Waste Management Outlook for Latin America and the Caribbean

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Waste Management Outlook for Latin America and the Caribbean

Foreword

Undoubtedly, sustainable development has become the pillar for long-term global development, in the quest to ensure the protection of the environment, as well as the social welfare and economic progress of nations.

However, current trends such as population growth, increased extraction of resources, and unsustainable consumption patterns, all based on a linear economy, have led to multiple environmental challenges at the global and regional levels, which include the proper management of waste, a central issue to be included in regional agendas.

In the case of Latin America and the Caribbean, the region generates approximately 10 percent of all generated global waste. Although waste collection and management systems have progressively improved in recent decades, it is alarming that more than 40 million people still lack access to a basic collection service, and that about a third of all waste generated, about 145,000 tonnes per day, ends up in open dumps, thusly causing serious impacts on health and the environment. On the other hand, it is estimated that only 10% of the waste generated is recovered, so that a large amount of valuable material and energy resources are wasted.

The countries of the region have developed new normative instruments and invested in the improvement of management models to deal with this situation. However, there are still weaknesses in the capacity of national and local governments to implement policies and regulatory frameworks, favor investments and the sector's economic sustainability, and promote the development of information and participation systems, all of which, in turn, contribute to the process of effective decision making.

Based on these realities, the Outlook for Waste Management in Latin America and the Caribbean has responded to the request of the countries in the framework of the Forum of Ministers of Environment of Latin America and the Caribbean as well as the Assembly of the United Nations for the Environment to have a guide for the design of possible policies and programs. The document, which has received valuable contributions from numerous governments and experts from the region, analyzes the current trends and proposes a set of actions around an efficient waste management that enables the transition towards a circular economy model.

In summary, it constitutes an invitation to the actors involved to work together in favor of the Region's prosperity, through the development of strategies to reduce the consumption of resources, guarantee a healthy environment, and therefore, contribute to the achievement of the commitments established in the 2030 Agenda and the Sustainable Development Goals in a comprehensive manner.

Leo Heileman
Director and Regional Representative
Latin America and the Caribbean Office

Key Facts

1 kg/day

of waste generated on average
by each inhabitant in the region

541,000 tons/day

of municipal waste are generated in Latin America and the Caribbean, a figure that will increase at least

25% by the year 2050

40 Million

people lack access to waste collection

145,000 tons/day

of waste are still disposed in open dumpsites, including

17,000 tons/day

of **plastic waste.**

50%

of municipal waste is organic

90%

of waste are not utilized

Key Messages

1

Waste generation in Latin America and the Caribbean is steadily increasing

Based on the information gathered, it is estimated that in 2014 the generation of municipal waste in Latin America and the Caribbean was

541,000 tons/day.

Under the current generation rate **(regional average of 1.04 Kg/inhabitant-day),** by the year 2050, this figure could reach

671,000 tons/day.

Global phenomena such as population growth, the increasing trend towards urbanisation (80 % in Latin America and the Caribbean), economic growth, a significant amount of people lifting out of poverty and joining an emerging middle class, and clearly unsustainable consumption and production patterns linked to linear economics, are some of the drivers leading to the persistent increase of waste generation in the region.

The study also reveals the direct relation between per capita income and waste generation, which suggests that increase in the latter could be possibly higher.

A regular and reliable waste collection service for the entire population is required

2

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Countries in the region show a quantitative and qualitative improvement in the collection of generated waste, **covering 93 % of the population,** being the municipal direct service the most common modality of service**.** Coverage may significantly vary between countries in the region and according to the size of cities.

Nevertheless, on a regional level, over

35,000 tons per day

remain uncollected, which has an impact on more than

40 million **people (7 %).**

This affects the population in marginal areas –usually impoverished– and some rural areas.

To overcome these deficiencies, a 100% collection rate must be reached in all generated waste streams, both in rural and urban areas.

Open dumpsites is a practice that must be eliminated

3

Although proper final disposal of solid waste has significantly improved over the past decades in Latin America and the Caribbean, approximately

145,000 ton/day

end up in dumpsites, are burned or are otherwise inadequately disposed of. This is equivalent to

27%

of the regional population, or to the waste generated by

170 million people.

These practices create **serious health risks,** both for people who work at the dump sites, as well as the communities around them.

At the same time, this has resulted in **severe environmental impacts,** including water pollution, emission of toxic and greenhouse pollutants, as well as soil pollution, which in turn affect production activity, as well as the tourism industry.

For this reason, it is essential to progressively phase-out open dump sites, and replace them with effective management practices and final waste disposal methods.

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Organic waste: ranking first in generation, yet last in management

Organic waste represents, on average,

50%

of municipal waste in the countries of the region.

The lack of specific treatment options generates greenhouse gases and leachates, in addition to reducing the quality of recyclable products and making this process more difficult.

Therefore, source separation should be promoted, as well as separate collection systems for dry and organic wastes and their proper treatment. Simultaneously, a gradual ban of dumping biodegradable waste on sanitary landfills should be considered, while at the same time encouraging its utilization, for example, through composting.

Any strategy should firstly consider the options to **reducing the amount of food waste** that is currently being generated.

5

It is necessary to accelerate the transition towards a circular economy

Recycling rates in Latin America and the Caribbean are still low (between 1-20%), which means that approximately

90%

of municipal waste ends up in landfills.

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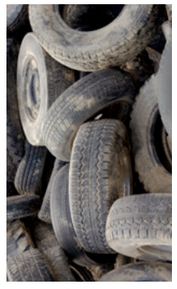
This situation contrasts with the widely accepted waste management hierarchy, which places prevention and recovery as top priorities.

Bridging the traditional "use and toss" scheme, inherited from linear economic systems, requires a paradigm shift towards a circular economy, based on replicating nature's biological mechanisms by introducing the idea of an industrial metabolism.

This must be based on thinking and designing products so that after one use they can be reused or become a secondary raw material for a new industrial process or a source of alternative energy, thus displacing fossil fuels.



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Special waste streams are not managed adequately

Some **waste streams** –particularly hazardous wastes, hospital waste, construction and demolition waste, food waste and electrical and electronic equipment waste– are not properly treated. In some cases, they are not even duly inventoried and characterized.

Some progress has been made in adopting specific legislation for these types of waste, but due to lack of control or absence of treatment plants, an undetermined fraction is not properly managed, which frequently ends up in dumpsites, with risky and improper handling processes.

It is therefore necessary to strengthen and ensure the enforcement of the legal framework, to establish specific programmes for these streams, and to encourage the installation of adequate treatment plants.

7

Coherent and effective governance models are required to ensure integrated waste management

Waste management governance implies having a system that aims at the **best possible management** for a given context. The system should also determine its rules or principles and the tools needed to achieve set objectives.

The countries in the region are known for their weak institutional operation, partly due to overlapping regulations that grant concurrent jurisdiction to different sections within the government and make environmental regulations hard to apply.

From a legislative perspective, an important step would be to clarify the concept of **circular economy** as the backbone of legal systems.

The same criteria would include the **extended producer responsibility principle,** essential to the transition process into the new paradigm. This principle can already be observed in about one third of the countries in the region, yet much work is still to be done in order to effectively consolidate it in regulations and in its practical application.

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Progress is needed in the formalization and recognition of informal recycling

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The substantial presence of informal **waste pickers** across Latin America and the Caribbean region is worth noticing. Although official data is not available, it is acknowledged that the work of waste pickers increases recycling rates in the region significantly.

Despite having been recognized by the legal system in several countries in the region, professionalization and formalization of the informal sector is yet to take place. This would contribute to productivity, and especially, it would promote the protection of health and children, as well as the access to dignified employment.

9

Encourage effective communication and participation of individuals at all levels of society is a priority

Access to information and citizen participation in decision-making processes is still limited in the region, despite its increased legal recognition. Additionally, communication efforts have been generally isolated and are not backed by a robust information system.

Ensuring the success of waste management systems requires the engagement of different stakeholders, as well education and communication efforts that will encourage behavioral changes.

Therefore, it is necessary to **ensure the participation of all stakeholders** through public enquiries at national and local levels, to establish partnerships with strategic actors such as producers and service providers, to carry out efficient and sustained dissemination campaigns, and to articulate environmental education with waste management policies, among other measures.

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Promoting investment and economic sustainability in the sector is essential

Financing is vital for the sustainability of waste management schemes. This is one of the weaknesses that needs to be overcome, as municipalities in the region tend to ignore **direct and indirect management costs, investment is insufficient** and **service charging systems are flawed.**

Also, budget allocation for management must compete with other resource-consuming priorities (health, poverty alleviation, drinking water supply, infrastructure, etc.).

Furthermore, for an adequate economic balance, the cost of inaction in terms of health, environmental impact and development must also be considered, as it may range from five to ten times higher than the cost of sound waste management.

It is advisable to consider a set of tools and strategies, such as **regionalisation** in the provision of services, in order to create economies of scale, to establish **rates or fees** in accordance with the population's ability to pay, or to promote the establishment of **public-private partnerships.**

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Generating data and information to understand and improve waste management systems

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The lack of information in most countries in the region is of key importance.

Creating **systematic collection, processing and analysis of data** is crucial for supporting decision-making processes, as well as evaluation, control and improvement of waste management systems.

Information on generation and collection of municipal solid waste is generally available, but there are difficulties to integrate data between national and local levels, as well as between countries; this is due to the lack of harmonization of waste generation and management indicators.

This is particularly urgent in waste streams such as hazardous wastes, hospital waste, and construction and demolition waste, among others.

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The sound management of waste remains as one of the main sustainability challenges in Latin America and the Caribbean

Waste management policies and systems must answer to a complex reality, taking into account the urgent need to prevent impacts associated with poor management practices which dominate the region, while maximizing the benefits on health and the environment which result from a sound waste management model and the efficient use of resources.

To this end, it is necessary that governments in Latin America and the Caribbean give adequate political priority to this issue.

This political decision implies the design and implementation of sound public policies and strategies, the creation of institutional support with proper legal frameworks, the use of duly financed available technologies with social inclusion and participation, and the use of management indicators and education and dissemination plans which contribute to its integration and sustainability.

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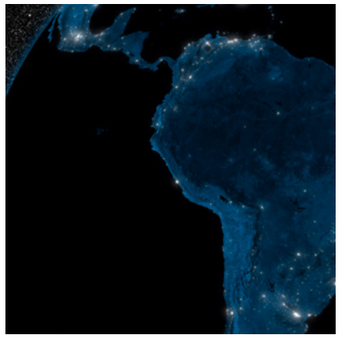

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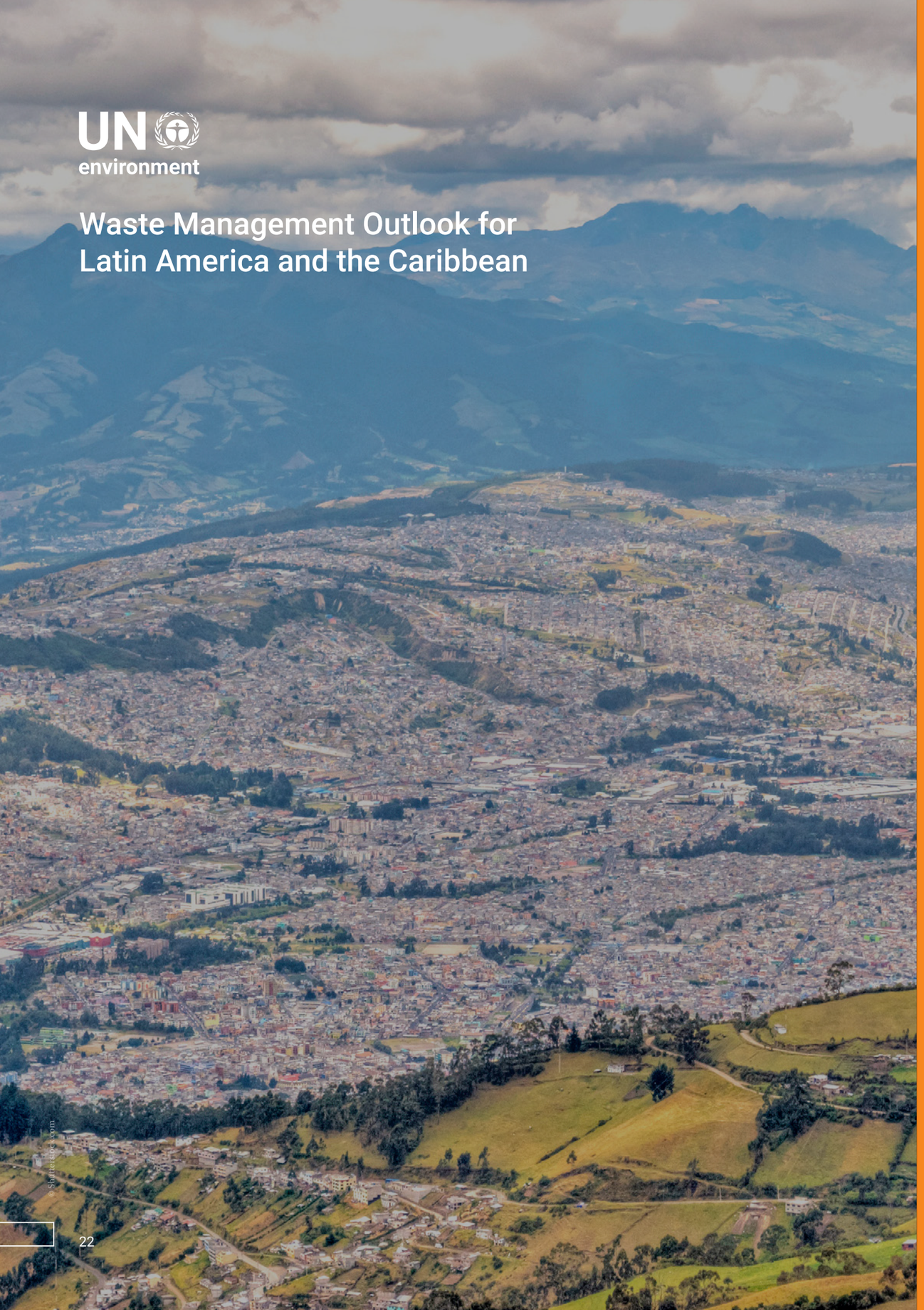

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Waste Management Outlook for Latin America and the Caribbean

1 Waste management as a political priority in the region

A real sustainable development agenda must necessarily include adequate waste management. It should consider the global characteristics and trends in the region and, therefore, the reasons that make such management a political priority as well as the inherent risks caused by inaction. (1.1). This process must be framed within a paradigm shift in which waste management plays a major role in the transition from a linear economy to a circular economy (1.2). The people of the world spoke through their leaders and, within the institutional framework of the United Nations, the sustainable development goals in the 2030 Agenda for Sustainable Development were established (1.3). A reader's guide is provided below (1.4).

1.1

The challenge of sustainable waste management

Global phenomena such as population growth, the increasing trend towards urbanization, economic growth, a significant number of people rising out of poverty to join the emerging middle class, clearly unsustainable patterns of production and consumption linked to a linear economy, have all resulted in a steady increase in waste generation (UNEP, 2016). These characteristics are present in the Latin America and the Caribbean region where approximately 80 per cent of the population lives in urban areas.

According to the studies conducted, the unavoidable consequence of the aforementioned characteristics is a projected exponential growth (more than 60 per cent by 2025) in the generation of waste in the region (The World Bank, 2012).

"A quantity grows exponentially when its increase is proportional to what is already there (...) When some factor experiences exponential growth, the amount of its increase rises from one period to the next; it depends on how much of the factor has already accumulated." (Meadows, Randers y Meadows, 2012, p. 66).

There is a projected exponential growth (more than 60 per cent by 2025) in the generation of waste in the region.

From the perspective of the economy, so far in the 21st century the region has experienced a cycle of sustained economic growth, which was only partially halted by the drop in the prices of commodities starting in 2015; this growth permitted the region's populations to enjoy higher per capita incomes and upward social mobility and, therefore, increased consumption.

Whereas the extraction of natural resources is the structural foundation of these economies, one consequence of this process is undoubtedly a greater strain on the reserves of such resources, which are also affected by the tourism industry, one of the main sources of income of the Caribbean countries. The direct correlation between higher individual economic income and per capita waste generation has influenced the incremental volume of waste.

Modern global society is characterized by a certain apprehension about consumerism, which makes consumption an end in itself, rather than being a means to meet a need. In tandem, and on the other side of the same coin, rapidly accelerating technological change has found quick acceptance and adoption amongst consumers **(FIGURE 1.1).**

An example of this is consumer electronics, the fastest growing waste stream of the past decade, largely owning to ever continuing innovation and obsolescence that are driven by trends and not by their intrinsic characteristics.

This is the reality that needs to be addressed by policies and waste management systems in the region.

An initial assessment is that they have not measured up to the economic and social progress achieved in other areas.

The most notable shortcomings are an insufficient (less than 100%) coverage of collection services in addition to an inadequate final disposal, leading to a large number of open dumpsites in many countries. Waste collection rates in the region are high, yet millions of people still do not have access to collection services.

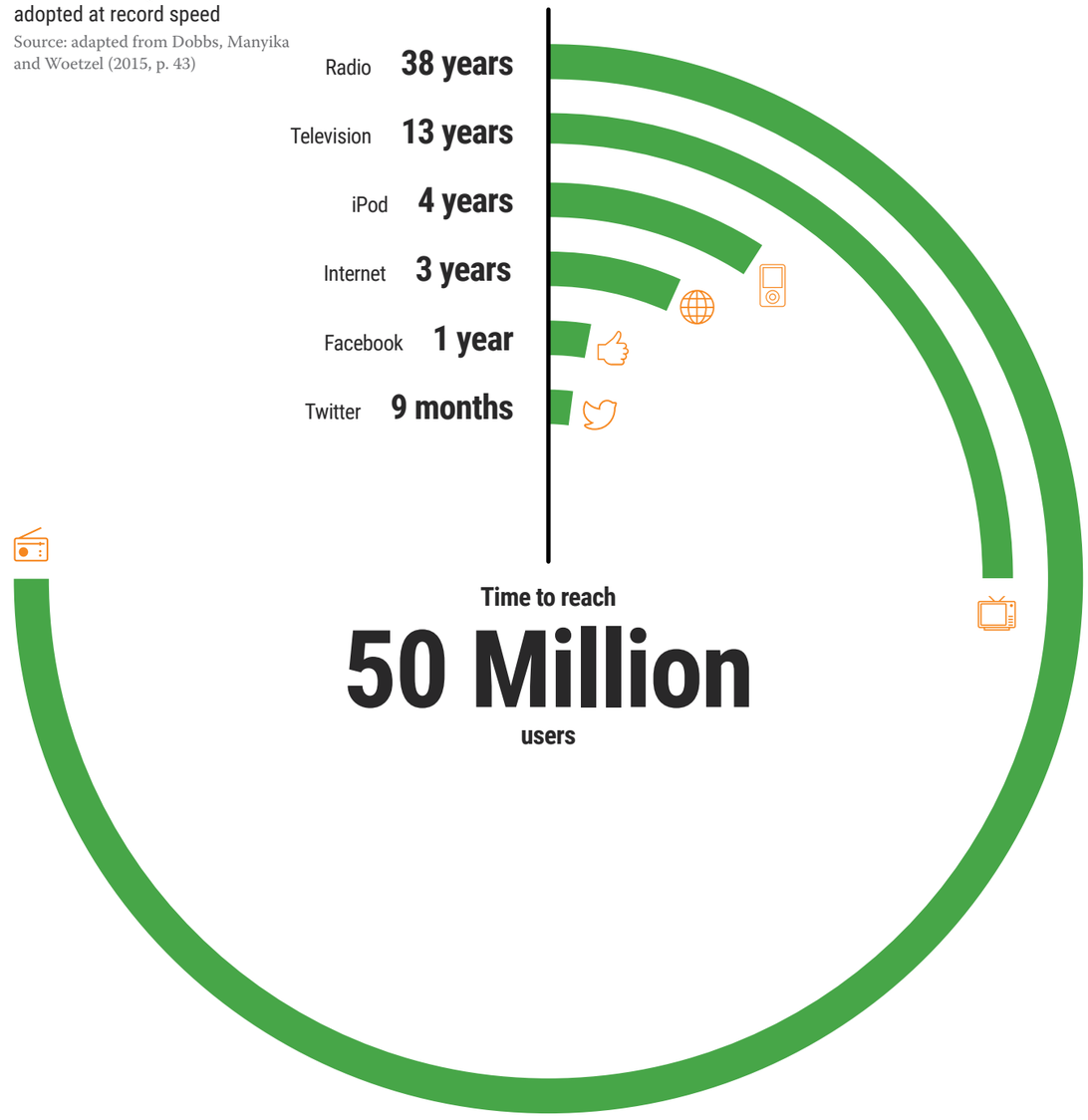
Even though society as a whole, the community, and the public and private sectors, have taken due note of the complexity of the problem and its members have become participatory actors in the search for solutions. It is clearly the responsibility of governments to give this issue the political priority it deserves.

This publication is intended as a call to action for such a political determination to contribute to the development of strategies, institutional support, regulatory frameworks, available technologies, social inclusion and participation, financing, management indicators, and forms of education and communication, that will aid in the integration of a sustainable waste management system.

FIGURE 1.1

Social technologies have been adopted at record speed

Source: adapted from Dobbs, Manyika and Woetzel (2015, p. 43)



Box 1.1

The impact of open dumps[1]

Uncontrolled final disposal, or, indeed, the lack thereof or inappropriate waste collection lead to open dumps. The most hazardous ones are those where waste is systematically and indiscriminately dumped on streams or abandoned areas or, without any control or protection, burned deliberately to reduce its volume or is subjected to spontaneous combustion, and left for vectors to spread the pollutant load. Informal recyclers, who usually live in the same site or go there every day, handling waste while searching for food, recoverable materials or anything that can be used for feeding animals in breeding establishments or pets. It is a humanitarian tragedy.

This becomes especially relevant because of institutional responsibility when this practise is part of the regular final disposal of waste in a certain municipality.

Disposed waste can weigh millions of tonnes and cover areas that are greater than 100 hectares.

It is not just the people who operate in the dump or go there routinely that are exposed to it, so are the people who live in the surrounding areas, usually within short distances.

The risks and impacts are caused by the pollutants or hazardous substances that are part of a certain waste stream, or those formed in the dumpsite itself through physicochemical interactions.

The routes of exposure can be inhalation, ingestion, or skin contact.

Of course, possible conditions are determined by:

- Type and quantity of waste deposited
- Type and size of the dose of the pollutant
- Exposure time
- Exposure frequency

Even though there is scientific evidence of the potential health risks, few attempts have been made to conduct long-term epidemiological studies that prove that fact in particular.

Environmental impacts can affect the water, soil or air.

Leachates consisting of biological and chemical compounds generated from the decomposition of waste which, combined with rainwater or surface waters, can seep into the soil, where they can reach groundwater sources. The pollutant load will depend on the degree of decomposition, type and quantity of waste.

The decomposition of waste also produces gases, principally methane and carbon dioxide, two of the main greenhouse gases responsible for climate change. Under anaerobic conditions, these each reach about 50% of produced gases.

Waste burning also causes concentrations of toxic gases, such as persistent organic pollutants (POP), nitrous oxide (N_2O), sulphur oxides (SOx), and heavy metals and black carbon in the air to rise.

Soil pollution is another consequence of the improper handling of waste. Waste can contain different metals which affect plants by altering their life cycle.

Additionally, dumping waste in watercourses causes marine pollution.

Significant economic activities, such as tourism, are also adversely affected by the consequences of improper management.

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According to the Global Waste Management Outlook (GWMO) (UNEP / ISWA, 2015), costs to society and the economy as a whole derived from the improper management of waste are 5 to 10 times the cost of implementing proper waste management in a middle- or low-income city.

Given that open dumps affect a myriad people, closing them should be considered as a global health emergency.

International financial assistance should be allocated towards the implementation of the plans necessary for complete elimination by local and national governments.[2]

For more information, see the publication "Waste Atlas –The World's 50 Biggest Dumpsites" (D-Waste, 2014) which lists several sites in the region, such as: El Milagro in Trujillo, Peru, La Chureca in Nicaragua, El Trebol in Guatemala City, amongst others.

1. Open dump: a land disposal site where the indiscriminate deposit of solid waste takes place with no or, at the best, very limited measures to control the operation and to protect the surrounding environment. ISWA Working Group on Landfill. Key Issue Paper: Closing of Open Dumps. 2006.

2. For more information see ISWA Scientific and Technical Committee (2015) and ISWA (2016).

1.2

Moving from waste management to resource management

> *"The physical limits to growth are limits to the ability of planetary sources to provide materials and energy and to the ability of planetary sinks to absorb the pollution and waste."*
>
> (Meadows, Randers y Meadows, 2012, p. 53).

The above quote summarizes the concern of many well-meaning environmentalists can be, which offers a warning about the consequences of a linear economy, which started with the first Industrial Revolution and can be synthesized with the "take-make-throw away" pattern.

Extracted natural resources are used in the production and distribution of goods whose waste must be disposed of. The result: a society that is geared towards producing waste.

The exponential industrial growth towards the end of the twentieth century began showing signs of natural resource scarcity due to their excessive use and the corresponding depletion of reserves.

The rationale presented above along with real-life data, lead to the firm conclusion that this economic model is clearly unsustainable for a world of 7.3 billion people all of whom aspire to a higher standard of living, even more so for the projected world population of 9 billion by 2050.

In 2015, the population of Latin America and the Caribbean was estimated at 630 million and the projection for 2025 is 691 million, of which eighty-two per cent (567 million) will live in cities (UNEP, 2016).

The solution, then, was to embrace a paradigm shift with one goal: a society geared towards generating resources.

This gives rise to the concept of a Circular Economy focused on replicating the biological mechanism in nature by incorporating the idea of an industrial metabolism based on devising and designing products that after their initial use they can be reused, or turned into a secondary raw material for a new industrial process, or used to generate alternative energy, replacing fossil fuels.

Thus, begins a transition in which the fundamental goal is to leave the idea of the final disposal of waste received from the linear economy behind in order to move towards an adequate management of waste, and even to a true management of resources as an integral part of a circular economy.

1.3

Waste management as an entry point for sustainable development

> *"Sustainable development: Development that meets the needs of the present, without compromising the ability of future generations to meet their own needs."*

Even though this definition of what "sustainable development" should be understood to mean does not specify the nature and extent of needs, it introduces a key element for overcoming the challenges faced by humans, which is the notion of intra- and intergenerational equity.

This somehow puts to rest the established generational tyranny through which current generations impose their decisions on future generations.

Development is change, it is progress. It mimics the atmosphere in that it is not a balanced framework. Rather it is somewhat unstable, with a particular equation concerning its components, but the conflicting reaction of those components means that it becomes "liveable", as if it were rigid and unchangeable there probably would be no life. A straight line on an EKG means the patient is dead.

It involves a generative dynamic which no longer allows the unbridled exploitation of resources and endless production of uncontrollable waste.

The notion of putting human beings at the centre of this development involves continuously striving to improve their quality of life. Continuous change must be based on the adequate use of our natural resources and the possibility that new generations can have the same opportunities to use the goods of the Earth that ours has had.

This undoubtedly requires a paradigm shift from trying to make waste disappear, to considering it as a resource for improving the system as a whole.

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Such a system geared towards sustainable development, must take the following domains into account:

Environmental – waste and climate change. The local impact of an improper management of waste have already been emphasized. Globally, the waste sector contributes to the generation of greenhouse gases (GHG), thus favouring climate change.

While the gas generated by waste transport is not quantified in this sector, the largest contribution comes from sanitary landfills due to the anaerobic decomposition of waste. A trend towards replacing open dumps with sanitary landfills can be observed. This trend, together with population growth and the increase in the amount of waste, will inevitably lead to an increase in GHG emissions.

This can only be avoided through policies conducive to a comprehensive management of waste, wherein the notions of minimization, reuse and recycling become relevant. In addition, sanitary landfills must incorporate those technologies that enable an active collection of biogas that is then flared or used for energy generation.

Governance and social aspects. An adequate management of waste also requires the support from the creation of institutions responsible for managing them at the local level, generating a suitable body of law with feasible and effective regulations that are easy to apply, avoiding overlaps between different agencies, professionalizing the sector through appropriate training and creating information systems designed not only for statistical purposes but also for the decision-making process.

This must necessarily be complemented with the identification and involvement of all public and private actors, and the integration of the informal sector.

A communications system, which includes formal and informal education conducive to the necessary change of consumption habits and participatory engagement, must also be developed.

Economic. The success of development policies depends on effective budget allocations at the level of the public sector, the creation of a reasonable business environment at the private level, and social support.

Appropriate financing requires the identification of costs, appropriate investment decisions, the creation of revenue systems based on taxpayer's ability to pay, access to credit markets, economic incentives, state policies that encourage the purchase of recycled products.

Box 1.2

The benefits of proper waste management

A proper management of waste will not only play a leading role in the preparation of a real agenda for development, it will also provide a number of co-benefits.

Environmental benefits

The application of tested, available technologies will reduce the generation of greenhouse gases, thus combating climate change.

The eradication of open dumps will reduce pollution and environmental degradation

Reuse and recycling will generate secondary raw materials to be introduced into the production process, consequently saving virgin raw materials as well as the energy necessary for obtaining them.

The generation of energy from the treatment of waste will contribute to the improvement of the energy mix by increasing the share of renewable energies.

The preservation and improvement of landscapes will allow for the environment as a whole to play another role, which is the enjoyment of nature.

More liveable cities.

Social benefits

Improvement of the sanitary conditions and public health.

The construction and operation of new facilities will contribute to job creation and employment.

The education and training of workers will improve human resources, especially in local communities.

It will enable social inclusion and, consequently, fighting poverty.

Improvement of institutions.

Economic benefits

Job creation.

Increased investments.

Adoption of new technologies.

Improved competitiveness, which makes it possible to deal with para-tariff barriers.

Reduction of health costs

Guarantee and protection of touristic activities.

Access to international financing through multilateral lending organizations.*

Exchange of experience for processing the technological change.

* Access to funding created as a result of the United Nations Framework Convention on Climate Change negotiations (Green Climate Fund, Nationally Appropriate Mitigation Actions – NAMAs).

Box 1.3

The Sustainable Development Goals

On September 25, 2015, world leaders adopted a set of global goals to eradicate poverty, protect the planet and ensure prosperity for everyone as part of the 2030 Agenda for Sustainable Development. 17 goals were set, each with specific targets to be achieved over the next 15 years.

An adequate waste management is included either explicitly or implicitly in more than half of the 17 goals.

It is, therefore, strategically important, to implement actions conducive to improving said management and to generating the information needed for monitoring the achievement of goals.

Global waste management goals		Related SDGs
Ensure by 2020	W.1 Ensure access for all to adequate, safe and affordable solid waste collection services	3 Healthy lives for all 11 Safe cities
	W. 2 Eliminate uncontrolled dumping and open burning	3 Healthy lives for all 6 Clean water and sanitation 11 Safe cities 12 Responsible consumption and production 14 Marine resources 15 Terrestrial ecosystems
Ensure by 2030	W.3 Ensure the sustainable and environmentally sound management of all waste, particularly hazardous wastes	7 Access to energy 12.4 Managing all waste 13 Climate change
	W.4 Substantially reduce waste generation through prevention and the 3Rs (reduce, reuse, recycle) and thereby create green jobs	12.5 The 3Rs 8 Growth and employment 1 End poverty 9 Sustainable industry
	W.5 Halve global per capita food waste at the retail and consumer levels and reduce food losses in the supply chain	12.3 Food waste 2 End hunger; achieve food security

TABLE 1.1

The Global Waste Management Goals and their relation to the Sustainable Development Goals (SDG)

Source: UNEP-ISWA (2015)

1.4

Guide to the Waste Management Outlook for Latin America and the Caribbean

The report is organized into the following chapters:

Chapter 1

Waste management as a political priority in the region

Chapter 2

Introduction: background, definitions, concepts and indicators

chapter 3

Waste management: regional status

Waste generation and management in the region.

Chapter 4

Waste management governance

Regulatory and policy instruments, institutional framework and stakeholder inclusivity,

Chapter 5

Waste management financing

Financing models.

Chapter 6

Waste management in the region: the way forward

Main results, conclusions and recommendations.

A series of Case Studies, as well as Boxes that further illustrate certain concepts or show a related example are also included throughout the document.

Box 1.4

Waste and climate change

According to the Intergovernmental Panel on Climate Change (IPCC)[3], in 2010 emissions from the waste and wastewater sector accounted for 3% of total GHG emissions from different sources. Therefore, the sector's contribution to global emissions is almost marginal. Climate change, however, can have a negative impact on the waste management system through its undeniable consequences, such as:

- Infrastructure and facilities can be affected by floods or extreme events.
- Increased temperatures or rainfall may influence the system degradation or leachate generation processes.
- Collection and transport services can be disrupted and the accumulation of uncollected waste clearly poses a risk to the health of workers and the surrounding population, due to the increase in vectors and pathogens.

The main gases produced during the different waste management operations are listed below:

- The sector's contribution to GHG production is mostly (97 per cent) through *methane* (CH_4) emissions resulting from the anaerobic decomposition of waste in sanitary landfills. Methane is a GHG which is up to 28 times more potent as a pollutant than carbon dioxide (CO_2) and persists in the atmosphere for 12 years. While waste generation projections predict significant growth in the coming years, its immediate effect is an increase in methane generation if mitigation actions are not taken.
- The sector also emits *carbon dioxide* (CO_2) in collection, transport and recycling activities (even though, due to a methodological decision they are not quantified in this sector, but rather in the transport sector), and also as a result of some treatments (composting, incineration, sanitary landfills) or burning in dumps.
- *Nitrous oxide* is also emitted during the composting and incineration processes.
- Indiscriminate burning of waste generates *black carbon,* which is also produced by the combustion that moves the waste transport and operation equipment, as well as the equipment used in recycling.

The economic process as it transitions to a circular economy can be summarized as shown in **FIGURE 1.2,** which highlights the sources of gas emissions in different stages of the economy.

Natural resources are turned into raw materials used in the production of goods that are distributed and consumed by public and private actors, generating waste which is collected, treated, recycled and finally disposed of.

Waste recycling and treatment produce new inputs which, in turn, are fed back into the process as new raw materials, soil improvers or for the generation of power or heat.

The anthropogenic activities described are sources of GHG emissions (in red), but in some cases, production can be avoided (in green) and, in other cases, directly eliminated.

Continuing and expanding positive actions will enable the solid waste sector to move from being a marginal contributor of GHG to being a net saver of emissions.

3. [http://www.ipcc.ch/home_languages_main_spanish.shtml].

The Paris Agreement

On December 12, 2015, the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC), held in France, adopted the Paris Agreement (PA). It has laid the foundation for a long-term international climate governance system, primarily based on international cooperation, to deal with the demands presented by climate change on the international community and, simultaneously, national societies.

It is clearly focused on implementation: all countries have committed to undertaking actions to reduce greenhouse gas emissions (mitigation) and to improving the resilience of national societies (adaptation) by submitting Nationally Determined Contributions (NDCs) in the future, every five years.

The Intended Nationally Determined Contributions (INDCs) which have already been submitted are the formal expression of national plans and/or the specification of policies which, as pertains to mitigation, outline the approach each country is to adopt in order to reduce emissions and thusly contribute towards the collective goal explicitly stated in the Agreement of "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels."

Therefore, this new implementation stage also poses new –almost unprecedented– challenges for the countries that comprise Latin America and the Caribbean. These countries also must examine, at the national level, the challenges connected to the implementation of the public policies required by the Agreement, decisions about the allocation of resources, the criteria for determining priorities, current incentive structures, the reform thereof and the introduction of new incentive mechanisms, the valuation of mitigation actions' co-benefits, as well as, amongst others, the menu of policy instruments that can be put into effect to organize, stimulate and monitor the actions.

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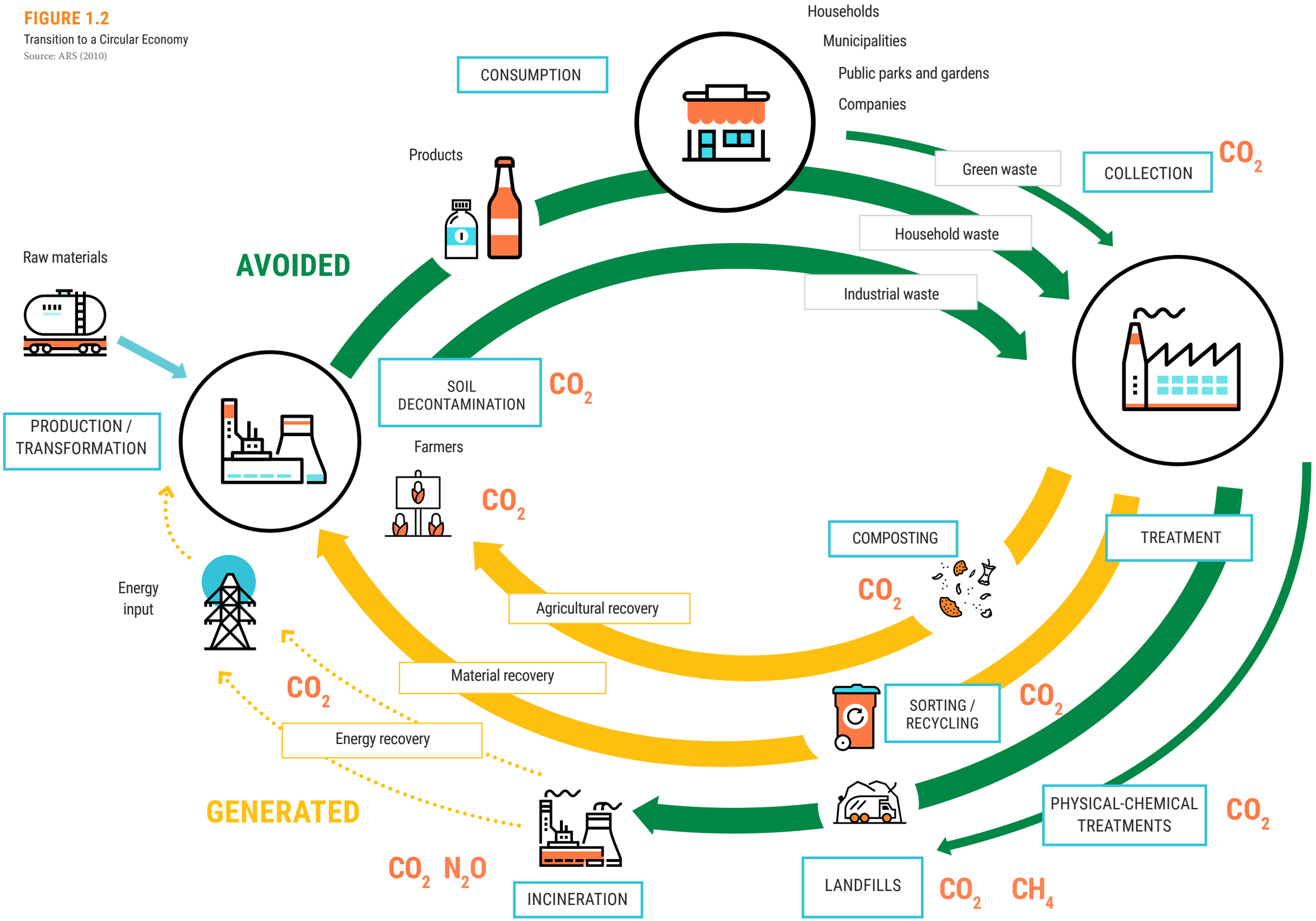
Eiffel Tower during COP21. Paris, France. 2015.

These transformation processes will certainly include the waste management sector, in which mitigation actions are inherently associated to improvements in the landscape conditions, the reduction of the impacts on health and on the cost of health care interventions, the improvement of the environment and the reduction of pollution, aside from the potential to create economic benefits by generating energy, reducing the demand for productive supplies and decreasing the pressure on natural resources. The sector undoubtedly shows some of the most significant transformative qualities when determining the priorities for preparing response strategies, nationally appropriate mitigation actions and, most notably, the effective implementation of nationally determined contributions, which will be the backbone of national efforts for international cooperation aimed at facing climate change.

FIGURE 1.2

Transition to a Circular Economy

Source: ARS (2010)



WASTE SECTOR:

3%

of GHG emissions at the global level

Case Study 1

Environmental Complex Norte III in Buenos Aires, Argentina

Buenos Aires, Argentina

The Environmental Complex (Complejo Ambiental) Norte III produces energy from waste. The affected population amounts to 14 million and the reduction in CO2 emissions in 2016 amounted to 323,674 tonnes of CO2 equivalent. The Complex is an environmental facility owned by a publicly-owned company, CEAMSE, and is operated by a private company.

Located in the metropolitan area of Buenos Aires, it receives 16,000 tonnes of urban solid waste (USW) generated in the city of Buenos Aires and 31 other municipalities in the province every day, accounting for 90 per cent of the waste generated in the Greater Buenos Aires.

The facility consists of:

- 12 Social manual sorting plants for USW, created to promote the social inclusion of recyclers
- 1 Tyre recycling plant that processes 700 tonnes/month
- 1 Composting plant that receives 800 tonnes of green waste/month
- 1 Mechanical Biological Treatment plant that receives 1,100 tonnes/day
- 2 Degasification plants with flares
- 2 Degasification plants that generate 15 MWh of energy

The biogas produced in the sanitary landfill Norte III is collected by an extraction plant consisting of a network of interconnecting wells and pipes that flow into blowers and then to flares or, otherwise, to the energy generation plant.

The four degasification plants are registered in the Clean Development Mechanism (CDM), an initiative that enables emission reduction projects in developing countries to obtain Certified Emission Reductions (CERs), each equivalent to one tonne of CO_2. Since they began operation in 20016 and until 2016, degasification plants have reduced a total of 6,028,198 tonnes of CO_2 equivalent.

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Environmental Complex Norte III. Buenos Aries, Argentina.

Benefits:

- The reduction of CO_2 is 1,048,068 tonnes/year.
- 15 MWh of energy are injected into the national electrical grid, which meets the daily electricity needs of approximately 25,000 homes.

Since current Argentinian legislation do not cover the combustion of sanitary landfills gases, this project contributes to the sustainable development of the area immediately surrounding the landfill in the Province of Buenos Aires. This includes:

- Reducing methane emissions from the sanitary landfill.
- Eliminating gas emissions and odours, thus benefitting the surrounding area. This not only mitigates the health problems these gases can cause to the local population, it also has a positive impact on the potential for development of the area.
- Safe extraction of biogas also significantly reduces the risk of fire and explosion in the sanitary landfill.
- The project positively impacts the local economy, by using local labour and local materials, whenever possible.

2

Introduction

Background, definitions, concepts and indicators

This chapter completes the introduction to the regional waste management outlook in Latin America and the Caribbean. It begins by setting out the mandate for its submission, its objectives, audience and outcomes, as well as its development process (2.1). It then explains what is understood by 'waste' in this report and the concept of waste as a resource, followed by an overview of its scope and coverage (2.2). The historical drivers for waste and resource management at the global level and in the region are also described (2.3). Finally, the principal analytical tools used in the report, including the concept of integrated sustainable waste management, lifecycle analysis and the waste management hierarchy, are briefly introduced (2.4), as is the importance of generating appropriate data and management indicators (2.5).

2.1 The Waste Management Outlook for Latin America and the Caribbean

During the XIX Meeting of the Forum of the Ministers of the Environment of Latin America and the Caribbean, the countries requested that UNEP "develop a regional outlook on the main challenges, trends and policies related to waste minimization and management, so that it can be used as guidance for the design and implementation of national policies, plans, Programs and projects." This request was renewed during the XX Meeting of the Forum of Ministers, held in Cartagena de Indias, Colombia, in March 2016. The context, as well as the connection with the Global Waste Management Outlook (GWMO), which was published in 2015, and whose structure and scope are the starting point for regional reports will also be presented. The global and regional outlooks respond also to the mandate of the United Nations Environment Assembly (UNEA) within the framework of Resolution 2/7.

2.1.1 Overall and specific objectives of the outlook report

The overall objective of the regional outlook is to take a holistic approach to propose a conceptual framework and the tools necessary for the integrated waste management system of the region to contribute to achieving sustainable development.

2.1.2 Specific objectives

- Make an urgent call for adequate waste management to be considered as a priority in the region.
- Move forward in the transition from waste management focused on the end of the process towards integrated sustainable waste and resource management, typical of a circular economy. This process will include the concepts of waste prevention and minimization, as well as those of resource efficiency, and sustainable consumption and production.
- Position proper waste management as a main player in meeting the Sustainable Development Goals set in the 2030 Agenda.
- Identify public policies and achieve institutional strengthening for the proper management of waste taking into account the varying economic, social and political situations between countries, as well as their needs and idiosyncrasies. Provide a critical overview of the instruments used to reach each goal and the circumstances under which they were used.
- Examine the different available approaches to system financing and set out an adequate framework for establishing a sustainable financing model in relation to each particular set of circumstances.
- Improve the availability and reliability of waste and resource management data, and systematize the collection of data for monitoring the performance of the different systems being used and comparing them.

2.1.3 Audience and expected outcomes

This report aims to be relevant to all countries in the region, regardless of their specificities and the current state of their systems, not to mention addressing issues that concern all the actors in the system. Even though the main message targets professionals in the sector, it includes an executive report for decision makers and a short summary aimed at the general public.

2.1.4 Development process

This document was prepared by a professional editorial team hired for such purpose, supported by a participatory process which included consultations with different stakeholders. Specifically, all governments of the region were invited to designate a point of contact, through which the countries received both the annotated index and the draft of the report for comments. These points of contact also forwarded a questionnaire for collecting information about the main sections of the study, which provided data from 16 countries of the region. Additionally, the process as also guided by a project Steering Committee, with government representatives and other stakeholders.

2.2 Defining the scope of the report

2.2.1 What this outlook means by waste

The terms "residuos" (waste), "desechos" (scrap) or "basura" (garbage) are typically used interchangeably as synonyms in Spanish-speaking countries to designate, under a common understanding, all of the products or materials that people decide to discard because they are no longer useful.

Because it is an all-encompassing and broad term for the purposes and objectives of this report, we will use the term "residuos" (waste) which, according to the dictionary of the Royal Spanish Academy, means *"things or materials from human activities which have been intentionally or unintentionally discarded because they have lost their value or usefulness, efficiency, effectiveness, or because of their overuse, destruction or decomposition caused by humans or nature."*

Under this definition, they can be in liquid, gaseous or solid state, and they will finally be received in the natural sinks: water, air and soil.

In order to be more precise and to make this internationally accepted, the definition of "waste" established by the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which has been ratified by 183 countries as of August 2015. Even though the official translation of the Basel Convention into Spanish uses the term "desecho", the term "residuos" is used in this outlook for the reasons presented above:

"'Wastes' are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law."

To narrow the context even further, this report will refer to solid waste generated as a result of human activities and/or nature, and the eventual consequences of its treatment or lack of treatment for soil, air or water quality, and land-use planning.

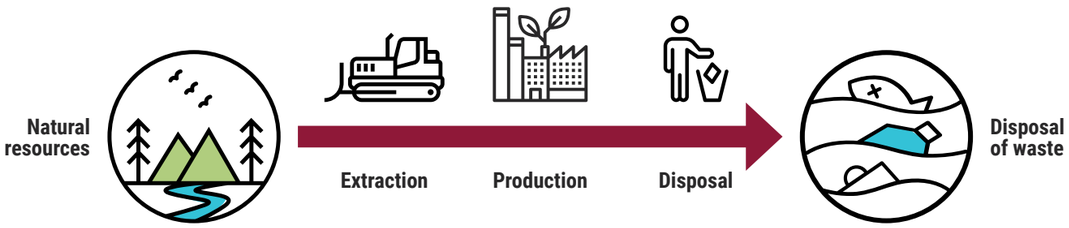
As the notion of circular economy is generically apprehended, and the products designed accordingly make a more efficient use of materials and energy, and are proven effective enough to be considered as resources, we should redefine the term "waste". At that point, waste will probably be considered as such at the end of the life of a resource.

2.2.2 Waste as a resource

In alignment with the GWMO and the mandate of this outlook, the approach adopted starts with waste prevention, minimization and management. In other words, the report is about waste and resource management, from a perspective that looks at waste prevention and at each of the components of a circular economy, as well as at

1 Where we are coming from: The linear economy and waste management

FIGURE 2.1
Moving from waste management to resource management within a circular economy
Source: Ellen MacArthur Foundation (s.f.)



the waste management after they have been discarded. The main goal of the circular economy is to use resources to the greatest extent possible, for as long as possible. Products are designed with waste prevention in mind.

The conceptual basis for the circular economy is the design of products and processes in a way that mimics the cycles of nature in order to recreate their metabolism and emulate their eco-effectiveness.

2 Where we need to get to: Resource management within a circular economy

Principle 1

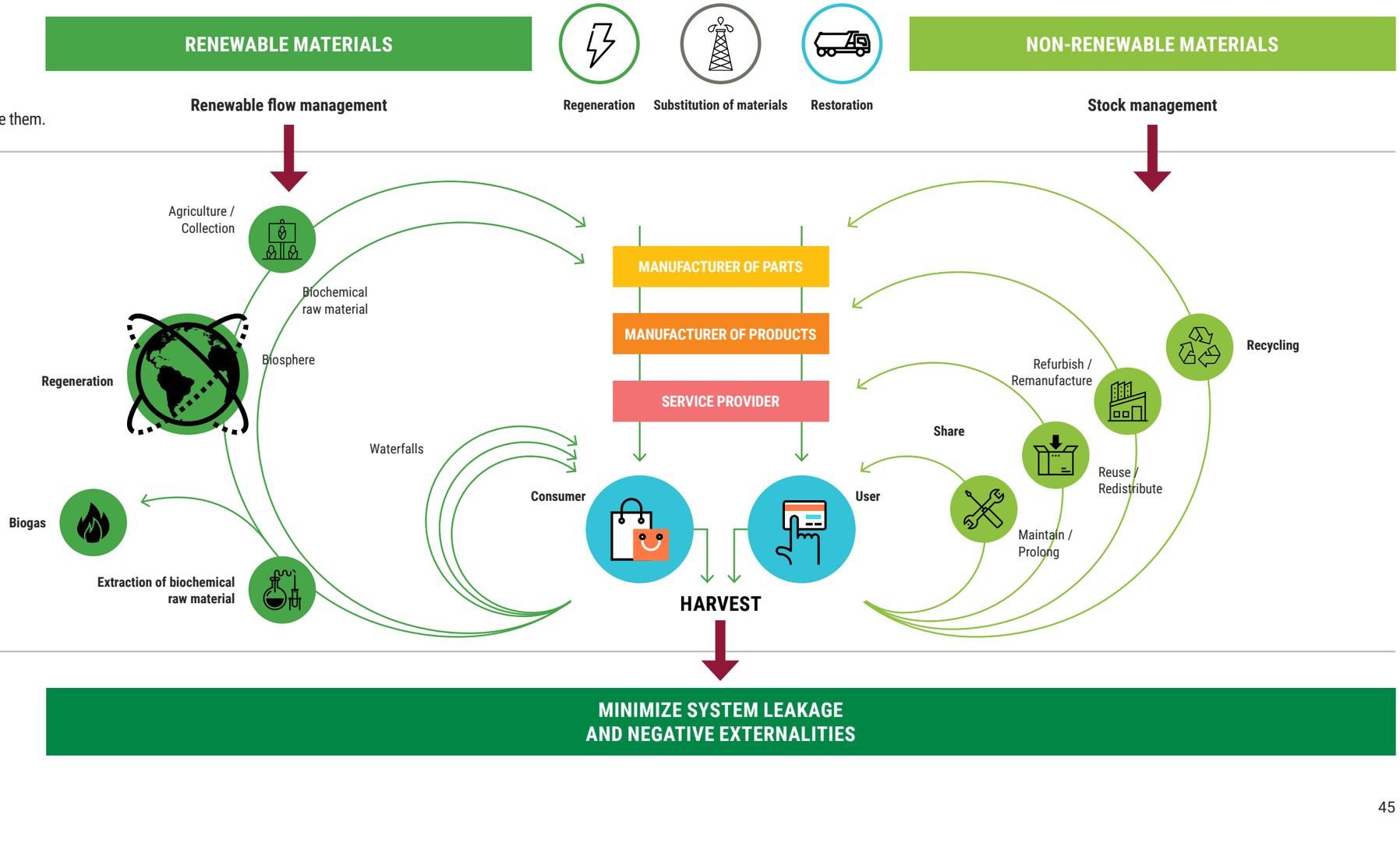
Preserve and improve natural capital by controlling finite stocks and balancing the flow of renewable resources to regenerate and exchange them.

Principle 2

Optimize resource performance through the circulation of products, components and materials in use with maximum utility at all times in both technical and biological cycles. Regenerate, share, optimize.

Principle 3

Promote the effectiveness of the system by revealing and identifying negative externalities



"The main objective of the circular economy is to make maximum use of resources. The products must be designed in consideration for preventing waste generation and imitating the cycles of nature."

"Consider the cherry tree: thousands of blossoms create fruit for birds, humans, and other animals, in order that one pit might eventually fall onto the ground, take root, and grow. Who would look at the ground littered with cherry blossoms and complain, how inefficient and wasteful! The tree makes copious blossoms and fruit without depleting its environment. Once they fall on the ground, their materials decompose and break down into nutrients that nourish microorganisms, insects, plants, animals, and soil. Although the tree actually makes more of its product than it needs for its own success in an ecosystem, this abundance has evolved (through millions of years of success and failure or, in business terms, R&D), to serve rich and varied purposes. In fact, the tree's fecundity nourishes just about everything around it."

(McDonough y Braungart, 2002, p. 72).

In the circular economy, waste is a resource, and it resembles a nutrient. When a product returns to the production chain at the end of its useful life and its materials are used for manufacturing new, valuable products, it is nourishing the system in an effective manner. It emulates the function of the cherry tree.

The waste sector has an essential role transmitting knowledge about materials in waste streams, as well as in the design and production processes, beyond its contribution to recycling, which can make it a key actor in the circular economy.

When waste is reprocessed it can generate a new product, material or substance. It begins what is known as a cycle. How closed that cycle is or how many times it can take place depends on many factors which make obtaining a 100 per cent efficiency impossible.

2.2.3 The cascade model

The concept of resource cascading can be compared to a river flowing over a sequence of falls, where its quality decreases partially with each one. A repeated use of a resource over time makes its quality decrease.

FIGURE 2.3 shows the usefulness of leveraging a resource in a varied manner for different purposes. The example shows a practise that has been widespread in rural areas for centuries.

The food for the population is produced with the resources in the fields. The best quality waste from such food is used for feeding pets. The remainder is consumed by farm animals (chickens, pigs). The animals' manure is used as fertilizer. However, the fertilizer is not lost, with the help of solar energy, it is recirculated back into a new nutrient cascade. Thus, cascading becomes a cycle process.

Ultimately, closing reprocessing loops, as well as adequately assimilating and utilizing the differences in quality in a cascade model will lead to an efficient use of resources, without ignoring the fact that virgin raw materials will always be used due to the unavoidable losses inherent in recycling, and the fact that adequate sinks to guarantee final disposal are required.

FIGURE 2.2

Concept of cascading by repeated using of a resource at decreasing quality

Source: Sirkin and Houten (1994, p. 26)

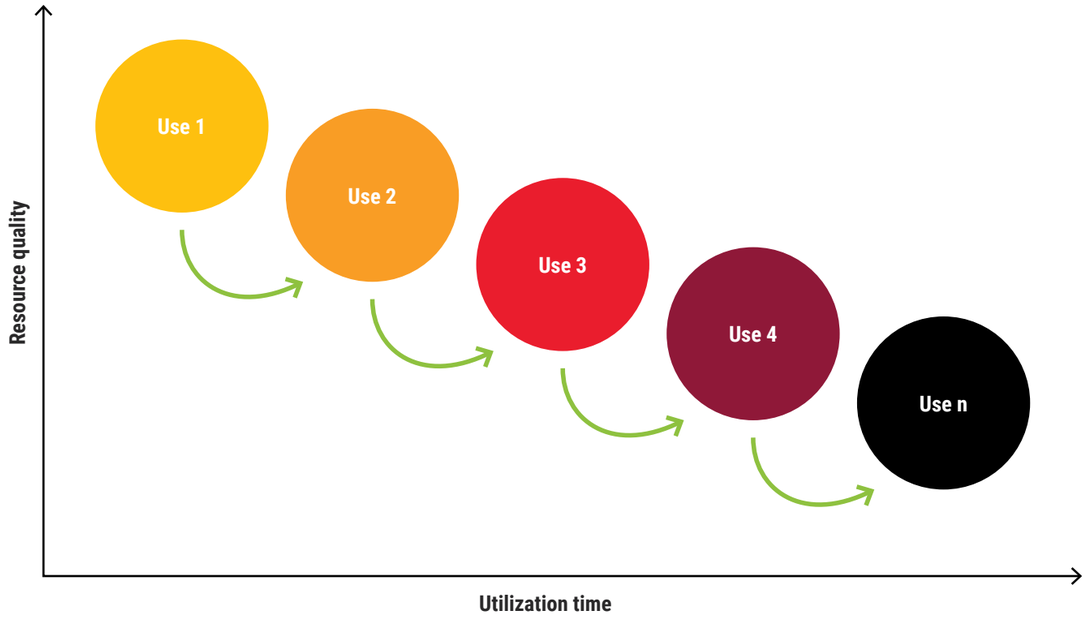
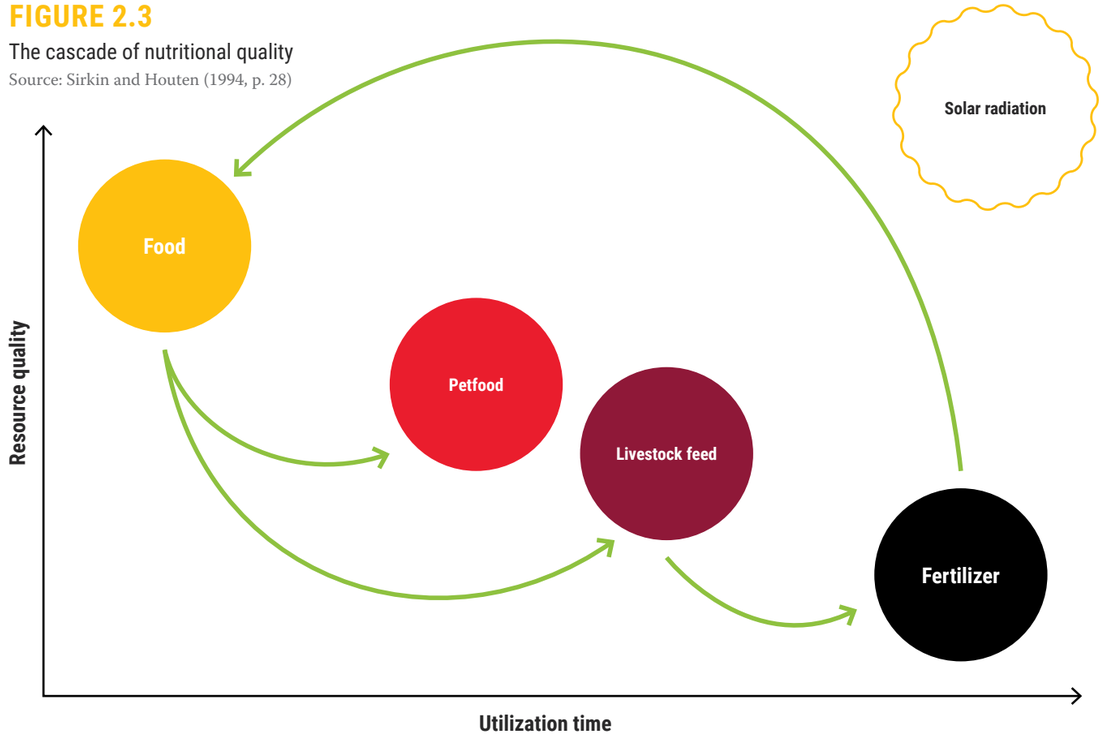
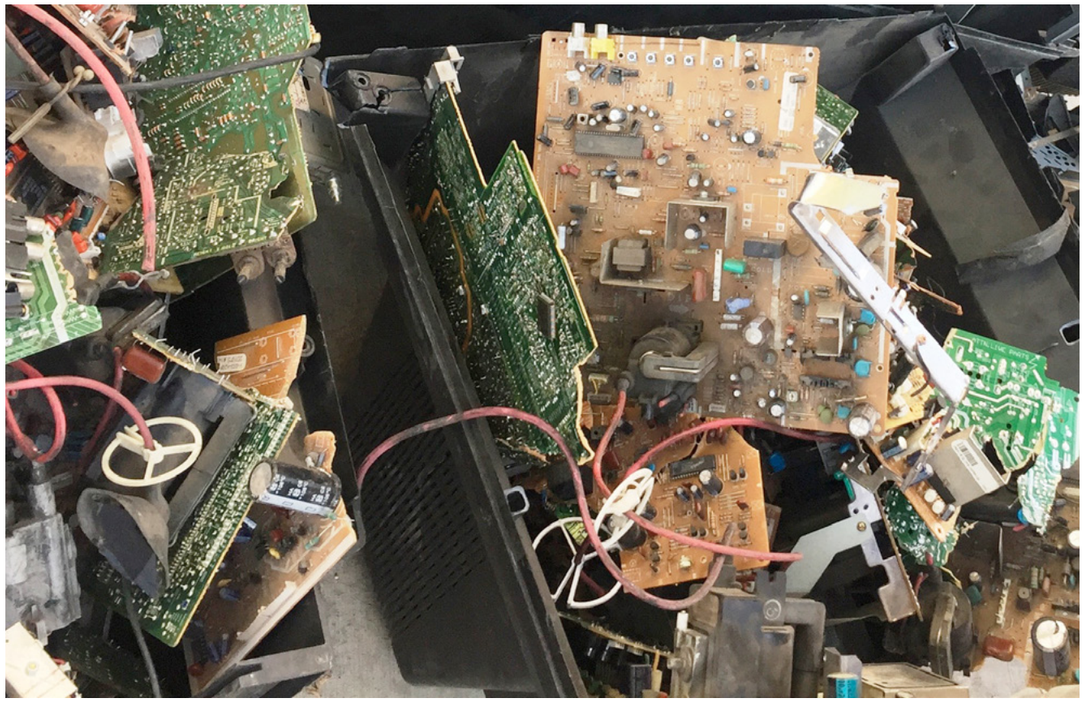


FIGURE 2.3

The cascade of nutritional quality

Source: Sirkin and Houten (1994, p. 28)





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Box 2.1

The limits of recycling

It is not entirely possible to constantly recycle and keep resources in a cycle.

In order to move towards a circular economy recycling is instrumental as it provides secondary raw materials to the production process. However, cycles are never perfect and leakages are a reality, one could say there are some thermodynamic limitations to recycling. It is worth remembering what the second law of thermodynamics states:

> *"Energy always flows from what is hot to what is cold, from larger concentrated to larger dispersion, from order to chaos. For example, if we burn a piece of coal, the total amount of energy remains the same but, some part of that energy will be released into the atmosphere as carbon dioxide, sulphur dioxide and other gases. Even though no energy was lost, the fact that it was dissipated prevents it from producing useful work. Physicists call this energy that can no longer be used 'entropy."*

There are material losses due to abrasion, wear and tear, corrosion. Significant amounts of copper are lost by corrosion.

Aluminium is commonly protected against oxidation by a thin layer of aluminium oxide. However, during the recycling process the metal is melted and at elevated temperatures a certain amount of metal is oxidized.

During paper recycling, the length and strength of cellulose fibres is reduced, which reduces the number of cycles.

In short, an inevitable decrease in terms of quantity and quality must be considered.

N.º	Category	Scope and approach in the report
1	**Impact the receiving media**	A holistic approach, but with a special focus on solid waste and waste derived from the treatment or lack of treatment of waste with a negative impact on the air, soil or water, or land-use planning
2	**Waste as a resource**	Prevention, minimization, reuse, recycling, energy generation, including the industrial sector
3	**Source of waste**	Municipal solid waste, waste from households and smaller businesses or institutions Commercial and industrial establishments, construction and demolition, larger generators
4	**Responsibility for generation**	
5	**Properties of waste**	Non-hazardous waste Hazardous wastes, including those generated by health-care facilities and households
6	**Specific types of waste**	From the production or consumption of food, electrical and electronic devices, packaging, generated by disasters, marine litter, emerging waste
7	**Public and private sectors**	Waste generated in operation by both sectors. Includes importers, producers, distributors, recyclers
8	**Formal and informal sectors**	Generated in operation and recycling by both sectors.
9	**Geographical scope**	Urban solid waste Considering local, national and regional levels. Emphasis on national policy

TABLE 2.1
Scope and approach of the report
Source: UNEP-ISWA (2015)

2.2.4 Scope of the outlook

Following the criteria set out in the GWMO and recognizing that the generation of all kinds of waste affects the normal development of cities, this outlook will focus on waste resulting from urban economic activities that, due to their treatment or lack thereof, have an impact on natural sinks or land-use planning, waste from disasters or that, when inadequately managed, have global consequences, such as significant marine contamination.

Special attention will be paid to both public and private sectors, and the integration of the formal and informal sectors.

TABLE 2.1 broadly outlines the wastes included in this outlook by category.

2.2.5 Geographical scope

This outlook focuses on the development of national policies to be implemented at the local and regional levels, according to their specific characteristics. The scope of this report includes the 33 countries in the Latin America and the Caribbean region[4].

4. Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela.

2.3 Drivers for waste and resource management

2.3.1 Historical drivers

Prehistoric hunters and gatherers had a close connection with the waste they produced. They wandered looking for food, which was a scarce resource. The use value of everything was extreme, and since technology was primitive, as were skills, reuse and recycling were common. They were constantly moving around, which made it difficult to accumulate goods, due to the difficulties for transporting them or their fast decomposition. What was left behind would nourish the biological metabolism. They personally controlled the lifecycle of the materials they consumed.

The sedentary lifestyle, together with the increasing social and cultural relations, gave rise to cities and, with them, waste and its consequences. Ancient cities employed three basic methods for disposing of waste:

1. Initially, the most prevalent method was to leave it on the floor of the houses, where people lived with domestic animals, or thrown to the streets, which in time elevated them, or threw them into watercourses nearby.

Microscopic analysis of sediments from Çatalhöyük (Turkey), which by 6500 BC had perhaps 3,000 residents, shows that people simply dumped garbage and night soil in stinking heaps between houses. The filth would have appalled hunter-gatherers but surely delighted rats, flies and fleas. We can see from tiny pieces of excrement trodden into the dirt floors that villagers also stabled domestic animals in their homes. (Morris, 2010)

2. The second method consisted of collecting waste and transporting it outside of the city. In Knossos, Crete, land of the mythical Minotaur, in about 3,000 BC, waste was placed in large pits that were covered, at intervals, with dirt or debris to control smells and vectors. (The Economist, 2009)

In 500 BC Athens, a law was passed which required waste generated by the population be taken at least one mile away from the city.

In the Aztec capital of pre-Hispanic Mexico, in the 16th century, throwing garbage on the streets was not allowed, there were people in charge of sweeping the streets and violators of the regulation were penalized. (Medina, 1999)

3. The third method is to take advantage of the market value of waste and, therefore, recycle it.

Collecting human excrement and selling it for use as a fertilizer, and urine for use as a fabric dye or for washing tunics was common in ancient times (Rome, 1st century) (Emperor Vespasian imposed a tax on the trade of urine). (Medina, 1999)

Between the 11th and 18th centuries in Europe, a large number of people worked recovering rags, especially linen and cotton, which were then used to manufacture paper.

King Philip II of Spain issued the Regulations for the Free Trade of the Indies in 1779 which, amongst other things, encouraged the recovery of rags in New Spain (Mexico) to be exported to Spain.

A really interesting experience is what happened in London between the end of the 18th century and the middle of the 19th century. Parishes contracted, in a semi-formal manner, a group of people who were in charge of removing household waste and sweeping the streets, who then transported it to dust-yards, facilities where waste was separated and then marketed . More than half of what was separated was coal ash, aside from wood ash, charcoal, dirt and excrements. The last two streams were sold as manure and the first two to brick makers. (Velis, Wilson y Cheeseman, s.f., p. 253)

The Industrial Revolution and its urbanization process required great amounts of bricks for building homes, as well as public and private buildings. Not only was there a closed circle for making use of waste, but a significant institutional shift took place as well.

Another remarkable event was the passing of what was called the Westminster Pavement Act, in 1762, which transferred the responsibility of sweeping, fixing pavements and public lighting from homeowners to the municipal authorities. This encouraged authorities to enter into the corresponding contracts. The drop in demand and subsequent drop in recycled materials gave rise to a stronger driver for the organization of a waste management system, that is, the institutional defence of public health.

The common belief was that the accumulation of waste in the streets was the cause of diseases and deadly epidemics, such as cholera. The scientific rationale used was wrong (microorganisms had not been discovered yet) because it was believed that the foul smell emanating from the decomposition of organic waste caused diseases. The first report of a Health Commission emphasized the connection between poor sanitary conditions and the occurrence of diseases. This resulted in the passing, in 1848, of the Public Health Act, which conferred the power and duty of providing waste collection services to all local authorities.

Similar bodies of law aimed at protecting public health were developed in the other countries (including in Latin America and the Caribbean), and this enabled the organization of a waste management system based on municipal responsibility.

2.3.2 Current drivers at the world level and in LAC

From the end of the 19th century to the end of the 1960s, the biggest concern was how to make waste disappear from the sight of the population. Services were called Waste Collection and Urban Cleaning and institutions, at the national level, were under the lower levels of Health Ministries, along with the treatment of excreta. The most common practise was uncontrolled disposal and burning.

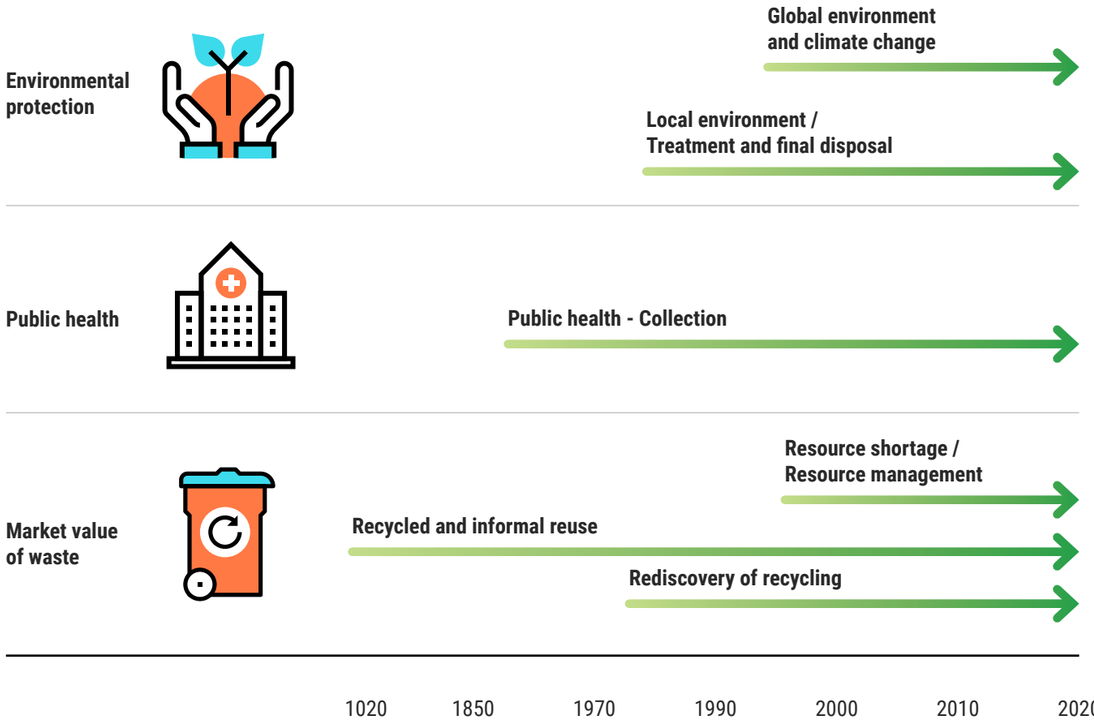
The environmentalist movement that became public in the 1970s and which started drawing attention to the pollution levels of the different natural receiving media, and to the limits of an uncontrolled economic growth (the Club of Rome), and also noted the importance and the role of waste for sustainable development. A considerable body of law and institutions started to be built establishing obligations, controls and standards, especially in developed countries. The implementation of the same, the technological development and the understanding that all processes needed to be environmentally sound, socially accepted and economically viable, started to bring the system to its current complexity.

The countries in the region started on a similar path, although with some setbacks, especially from 1992 when the Agenda 21 was adopted at the so-called Earth Summit in Rio de Janeiro, Brazil, with enormous international support. It should be noted that Chapter 21 of said Agenda is dedicated to laying the strategic foundations of a sound waste management system. Coincidentally, the United Nations Convention on Climate Change was a result of that meeting. The sector's contribution in terms of adaptation and mitigation was highlighted above, therefore, recognizing climate change as a undeniably significant driver.

FIGURE 2.4

Evolution of the primary drivers over time in developed and developing countries

Source: UNEP-ISWA (2015)

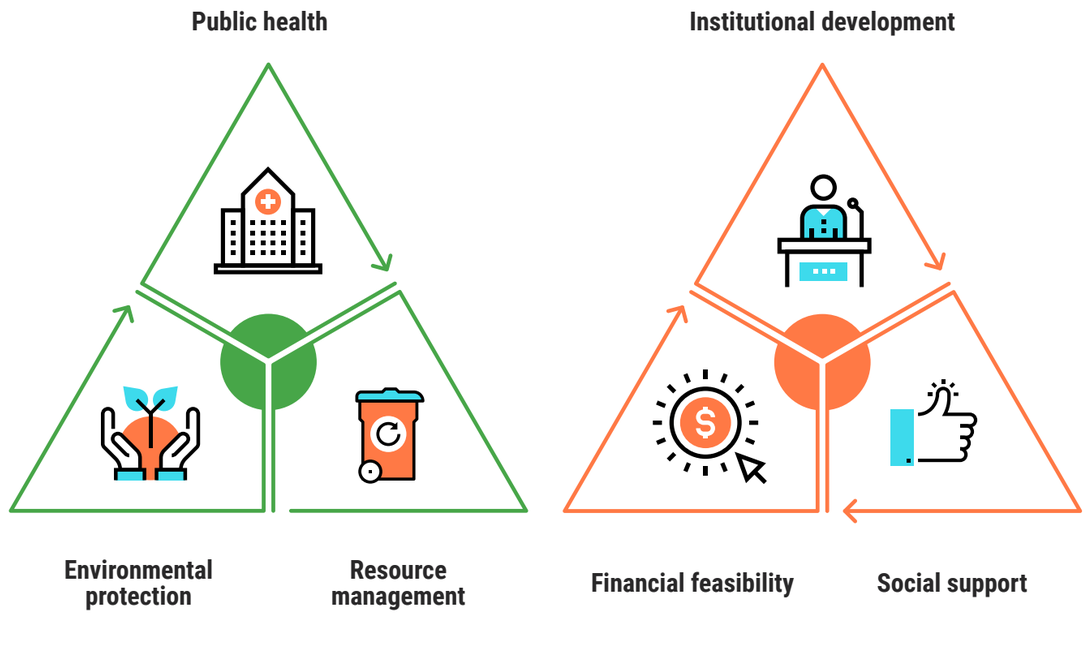


In short, the initial drivers, both in developed and developed countries, started recovering the value of some wastes and evolved due to public health concerns and, after the 1970s to the protection and care of the local environment up to its global impact, complementing the transition from one waste management system to a resource management system. This is conveyed in **FIGURE 2.4.**

FIGURE 2.5

Hard and soft elements of an ISWMS

Source: ISWA-Abrelpe (2012)



2.4

An analytical framework for the regional outlook

2.4.1 Integrated sustainable waste management

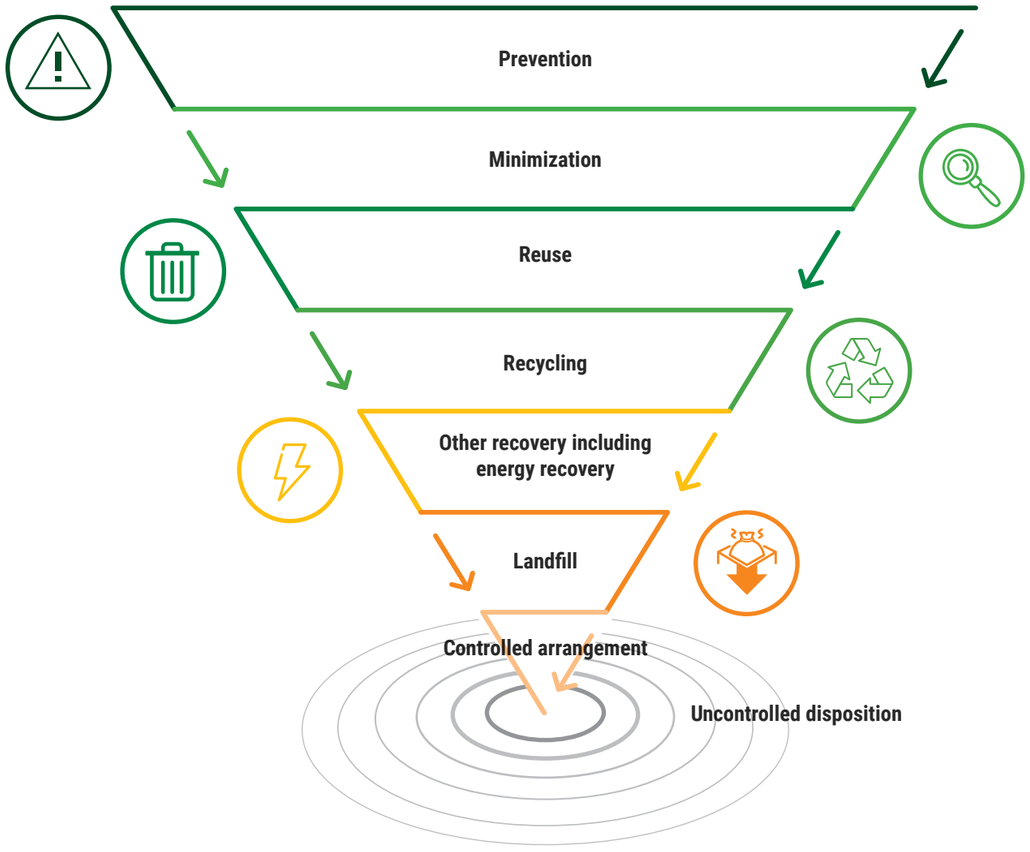
An integrated sustainable waste management system is fundamentally complex insofar as the interconnectedness between its components generates specific properties, which are different from those that would result from the sum of all of them. Therefore, each system has an essential individuality that reflects the different combinations resulting from its own social, environmental and economic characteristics.

Simply put, an Integrated Solid Waste Management System (ISWMS) can be represented with two triangles: the physical elements involved in integrating public health, environmental protection and resource management, and the system's characteristics of governance. Figuratively, we could speak of the system's "hardware" and "software" (see **FIGURE 2.5).**

FIGURE 2.6

Integrated waste management hierarchy

Source: UNEP-ISWA (2015)



The first triangle comprises the three primary physical elements which must be taken into account for any system that needs to operate in a sustainable manner over time:

- Public health: ensure public health in cities.
- Environmental protection: at the local and global levels.
- Resource management: "closing the loop" by returning materials and nutrients to the production process, with the contribution of waste prevention, minimization, reuse and recycling.

The second triangle focuses on the system's governance (strategies, policies, regulations) to ensure it functions properly. The system needs:

- To be inclusive, by providing spaces of transparency for stakeholders to participate, act as users, providers or facilitators (social support).
- To be financially sustainable, which means being cost-effective and affordable (financial viability).
- To lean on a foundation of sound institutions and proactive policies (institutional development).

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The performance of the system is a consequence of the holistic behavior of the hardware with the appropriate software. Besides, not every software is appropriate for every hardware, and not every hardware can run a particular software program. The system must also be part of a real sustainable development agenda and contribute to the achievement of its goal, with the resulting benefits.

2.4.2 Life-cycle analysis and other assessment tools

The concept of the lifecycle of a product refers to the ability of determining the economic, social and environmental impacts caused as a consequence of its existence. The Life-Cycle Analysis is a set of tools intended to measure, compare and understand these impacts. It was traditionally used within the "cradle to grave" vision of the linear economy.

The technique looks at each state in the cycle, from the acquisition of raw materials, manufacturing, distribution, use, possible reuse or recycling and, in the end, final disposal. Inputs (raw materials, resources, energy) and outputs to the environment (gas, liquid or solid emissions) are analysed, calculated and assessed, for each operation and in every state. Recently, there has been a push to incorporate this analysis tool into the new resource management paradigm. The life-cycle analysis is

also useful for learning whether the hierarchy options established in the international literature, as well as in some legislations, have been followed. **FIGURE 2.6** shows the version adapted by the parties to the Basel Convention who, in the tenth meeting of the Conference of the Parties to the Basel Convention (2011) stated that said hierarchy encourages treatment options that deliver the best overall environmental outcome, taking into account life-cycle thinking.

The notion of hierarchy is important for recognizing a strategic path which points to an ideal combination of options. To acknowledge its significance does not mean that its limitations, which are very real, have not been recognized. Because it only refers to the environmental aspects, it leaves out fundamental aspects of a waste management system that would make it more appropriate for comparisons, like social, public or occupational health, economic and financial aspects, as well as its contribution to a better waste management.

In developed countries, many years of ongoing and adequately implemented public policies have contributed to integrating management systems where sanitary landfills account for a minimal percentage in relation to other treatment tools, and where recycling rates are rising. It is also true that not every current member country of the European Union obtains the same results despite having a unitary legislation. Sanitary landfills are still the most used instrument in many of them. Presently, in Latin American and Caribbean countries, as in other regions of the world, a large portion of the waste generated is disposed of in open dumps, which in turn has a negative impact on the health and the environment.

The hierarchy could therefore be looked at as a kind of ladder wherein climbing to more desirable options is not at the expense of the two top goals of a waste management system, that is, the protection of health and the environment. To simply adopt the notion of hierarchy, without the corresponding clarifications, would result in the paradox of using the least desirable instrument the most.

Sanitary landfills, built and operated under the highest state-of-the-art standards, will be as necessary as the other technologies, prevention and recycling in order to achieve the much-needed improvement of current systems. Thus, each city, region or country will be able to face the great present challenge of having integrated sustainable waste management systems, with an open approach, free of preconceived ideas and with the participation of the appropriate actors, clearly stating the goals and combining the available instruments that have the environmental, social and economic legitimacy.

2.5

Waste related data and indicators

2.5.1 Introducción

> *"Data are the lifeblood of decision-making and the raw material for accountability. Without high-quality data providing the right information on the right things at the right time, designing, monitoring and evaluating effective policies becomes almost impossible."*[5]

It is necessary to distinguish between some related terms:

- Environmental data: These can then be processed and structured to produce information as statistics, using an agreed set of statistical methods and procedures.

- Environmental indicators: used to synthesize and present complex statistics in a way designed to summarize, simplify and communicate information and to turn that into knowledge.

In summary, statistics aim to convert raw data into useful information. Indicators, then, help to transform that information into knowledge, which can then be used to make right and wise decisions.

One of the key objectives of this regional outlook, in conjunction with the global outlook, is to assemble a set of performance indicators on waste management that allow the comparison of systems, facilitate an analysis of the state of each of them and the monitoring of their progress. The collection and provision of credible and updated data on waste and resources is essential in achieving this goal.

5. UN Secretary-General's independent expert advisory group on a data revolution for a sustainable development.

Goals	Indicators	Description
Protection of health	**Collection and sweeping coverage**	Percentage of citizens who have access to a reliable collection system
Protection of the environment	**Quality of the final disposal**	Percentage of the total waste disposed of in well-engineered landfills, a controlled disposal site or an open dumpsite
Financial sustainability	**Population using and paying for the service**	Percentage of total citizens both using and paying for waste collection and disposal
	Costs	Cost per tonne collected and per tonne disposed of
Improving the governance of the system		
Actor inclusivity	**Degree of inclusivity**	Laws or regulations at local or national level that require consultation and participation of different actors outside the bureaucratic structure Degree of consumer satisfaction
Social inclusion	**Degree of inclusivity**	Recognition of the role of the informal sector and result of their participation in recycling
Institutional coherence	**Degree of institutional coherence**	Is there a clear national strategy? Is there an adequate policy and institutional framework for the planning and implementation of the tasks required by a sound management system? Are authorities allowed to levy charges and collect fines to fund the system?

TABLE 2.2
Benchmark indicators

2.5.2 Quality and availability of waste-related data

One of the barriers affecting the quality of data is that usually, the definition of waste and its streams vary, not only amongst countries but also in the different areas of each country. Even though it is hard to agree on common definitions at regional levels, international fora should make progress in a minimum number of definitions and indicators that facilitate comparing and analyzing systems. It is necessary to standardize definitions within each country and incorporate the basic data that allow a quick assessment of the system into the national statistical systems.

One of the main difficulties is measuring per capita generation and weight in a recognized an accepted unit of measure (Kg, Tn). The usual manner consists of reporting the weight of the waste that enters transfer facilities or final disposal sites, so the "generation" data refers, more precisely, to collected waste. Per capita generation can be estimated by dividing the weight accumulated in the month by the number of days in which the service is operating, by the number of people covered by said service, according to the last official census.

Applying this procedure on an annual basis is recommended in order to avoid seasonal variations. The waste streams or types of wastes being considered or taken into account at the time of weighing should be clearly specified. If an informal collection system comes between the place where the waste is generated, where it is put up for collection, and the place where it is weighed, naturally, the quantity and the composition of the waste will be altered.

In order to study the composition of waste, aside of the caveat cited above, the size of the sample and the places where that sample will be collected must be officially stated for it to represent the different socioeconomic strata of generators, as well as the way in which seasonality is avoided. It would seem, pursuant to the various existing difficulties, that national governments have the responsibility of attempting to systematize processes that will allow for data searches, information generation and the development of reliable indicators, especially if the tendency is to prepare an adequate mass balance, which will allow for an analysis of system inputs and outputs.

2.5.3 Waste management indicators

Various intergovernmental organizations and international and national environmental agencies use environmental indicators to monitor waste management. In general, these indicators are related to waste generation, collection, final disposal, recovery and recycling, and energy recovery. (Munizaga, 2012) The United Nations Statistics Division added the following indicators to the above: Per capita waste generation, the amount treated using different methods, the number of treatment facilities, and its final disposal and their capacity, the amount of hazardous waste and non-hazardous industrial waste, and import or export of waste or hazardous waste. (United Nations Statistics Division, 2013)

When the purpose is to assess some of the main benchmarks of the system, indicators can be designed specifically for such a goal. (Wilson, Rodic, Schteinberg, Velis and Alabaster, 2012)

2.5.4 Resource management indicators

Resource management, as the central focus of the transition towards a circular economy, is an incipient issue in the region. It is, therefore, premature to try to evaluate it; however, in order to move forward in that direction it would be important to determine which information is important in order to develop the necessary benchmarks. Since the Sustainable Development Goals include goals for reducing waste generation through prevention and recycling, resource management indicators that allow the evaluation of the goals set.

In most of Asian countries, led by Japan and South Korea, where 3Rs (reduce, reuse, recycle) policies are common, the results of each of these practises are measured. In Europe, on the other hand, many countries have developed indicators for analysing progress in resource use efficiency. The most common ones are:

- Total waste per specific stream (plastic, cardboard, glass, paper, etc.)
- Share of renewable energy in the energy supply
- Share of raw materials consumed relative to Gross Domestic Product (European Environmental Agency, 2011)

A key indicator for determining the levels of recycling, and the loss of materials or substances during this process is the so-called Material Flow Analysis (MFA). (Costas and Brunner, 2013)

At the time, there are no relevant examples of its application in the region. The case of Japan, where the application of said analysis has shown positive results regarding the increase in resource productivity and the amount of cyclical use, is a good practical example. (UNEP-ISWA, 2015)

3

Waste management Regional status

Chapter 3 provides a regional overview of the management of various waste streams through figures and indicators relative to its generation and management.

After an introductory overview of different waste streams in section 3.2, section 3.3 especially focuses on the municipal solid waste stream, providing data on generation, composition and trends for this stream. Section 3.4 overviews the status of the collection and final disposal stages for municipal solid waste (MSW), and section 3.5 continues with this waste stream to deal with resource recovery and the different options available for material or energy recovery.

An overview of a wide variety of different waste streams, such as hazardous waste, e-waste, waste from health care facilities, transport, debris, tyres, etc., is then presented in section 3.6., while the last two sections discuss liquid discharges and emissions to the atmosphere, especially focusing on final disposal sites. Section 3.7 discusses the generation of leachates, and 3.8 reviews emissions to the atmosphere particularly emphasizing greenhouse pollutants and persistent organic pollutants.

The chapter also includes case studies which illustrate the specific conditions of some waste streams in certain countries.

3.1 Overview of regional waste generation

Providing a regional overview of the different waste streams in the region is a complex and difficult task. There is a large amount of relevant information regarding MSW for most of the countries, but when it comes to other streams such as hazardous waste, waste from health care facilities, construction and demolition, food, etc., information is scarce and it is hardly possible to say coverage is regional. For that reason, it is not possible to provide a comprehensive overview of the state of all waste streams on a regional scale. Comparatively, there is sufficient information on the OECD countries, so it is possible to estimate that the share of household waste in the total waste generated in these countries (commercial, industrial, construction and demolition, derived from energy production and water supply, sewage treatment, waste management and land remediation) is 24 per cent.

It is important to emphasize, however, that section 3.6 presents an individual broad overview of each waste stream in the LAC region that, in addition to municipal solid waste, must be addressed by virtue of their own characteristics, and the health and environmental risks they can pose. Despite this, it is advisable to make additional efforts for the countries in the region to have information related to other waste streams, aside from municipal solid waste.

3.2 Overview of municipal solid waste (MSW) generation

3.2.1 MSW generation

Even though information relative to the generation of MSW is available for the countries in the Latin America and the Caribbean region, data for each country often varies depending on the source used. Standardized methods are usually applied to the task of obtaining generation rates at the source, nevertheless, these rates are often obtained by indirect methods, for instance, from the records of the volume of waste received at a final disposal site. This reflects the volume of collected waste but not necessarily the volume generated at the source, creating a problem for the interpretation of data, since collection coverage rates can vary widely between the countries of the region, but also between the cities of one country, as well as between different sectors in the same city. Moreover, during transport between the source where waste is generated and the final disposal site, there can be a reduction due to the segregation of some materials.

Based on the information gathered for this study (see details in Annex 2), it can be estimated that the weight of the MSW generated in the 33 countries considered herein amounted to around 541,000 tonnes per day in 2014, a number slightly higher than the 436,000 tonnes reported in the regional study prepared by IDB-PAHO-AIDIS in 2010 (commonly referred to as “EVAL 2010”). (BID-AIDIS-OPS, 2011)

Generation rates and other indicators are usually related to the income level of a given country’s population. TABLE 3.1 shows the classification of the countries in the region according to income level as reported by the World Bank, indicator that is used in other sections of this report.

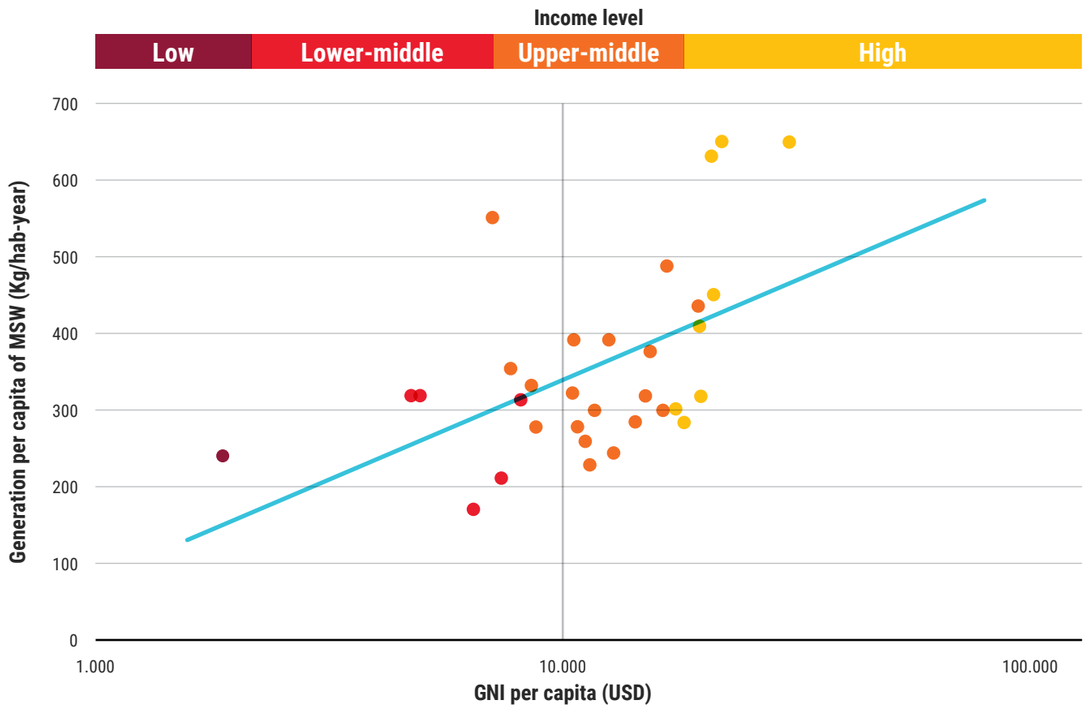
FIGURE 3.1, in turn, shows the relationship between per capita waste generation and per capita income level in the countries of the region. The data in the diagram show great dispersion, which does not establish an acceptable correlation between the parameters being analysed. This is due to the broad ranges of data obtained both for generation (from 65.7 to 620.5 kg/person-year) and for income level (365 to 31,970 USD/person).

Despite the above, the diagram shows that there are countries with higher waste generation rates in relation to higher income levels.

FIGURE 3.1

Waste generation versus income level by country

Source: Prepared by the authors with data from 33 countries.



Income level	Countries
Low	Haiti
Lower-middle	Bolivia, El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Paraguay
Upper-middle	Argentina, Belize, Brazil, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Grenada, Jamaica, Mexico, Panama, Peru, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Venezuela.
High	Antigua and Barbuda, Bahamas, Barbados, Chile, Saint Kitts and Nevis, Trinidad and Tobago, Uruguay.

TABLE 3.1

Per capita Gross National Income in LAC.

Source: World Bank. http://data.worldbank.org/indicator/NY.GDP.PCAP.CD. Accessed 19 February 2016, data for 2014, except for Argentina (2015).

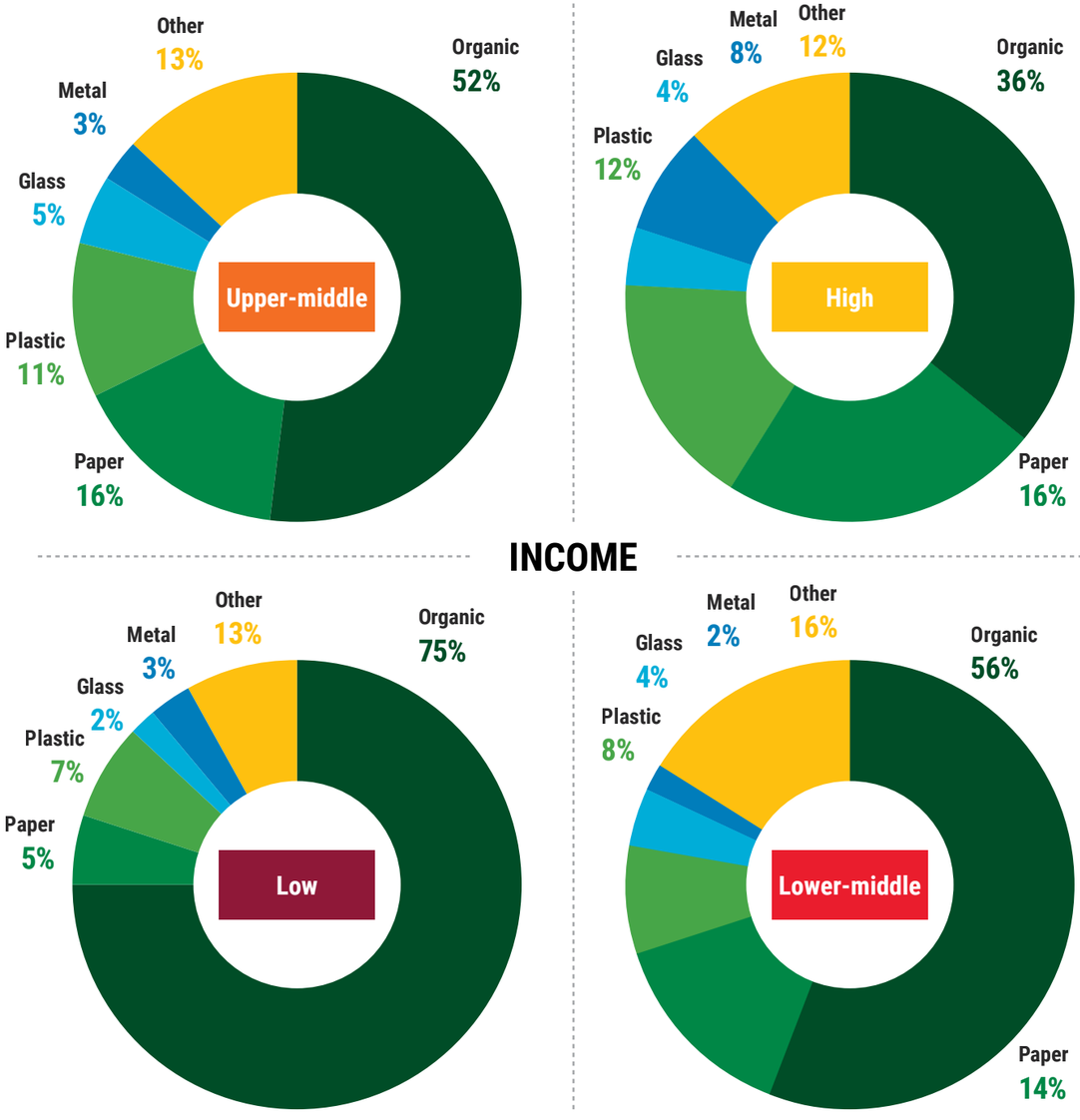


FIGURE 3.2

Variation in MSW composition grouped by country income levels

Source: Prepared by the authors with data from 22 countries.

3.2.2 MSW composition and properties

In a comparable manner to generation, MSW composition is a dynamic indicator that can vary considerably in time and space. It is influenced by such factors as the introduction of new materials in products and change in people's consumption habits, amongst others.

FIGURE 3.2, shows a comparison of MSW composition in the countries of the region grouped by per capita income levels. The organic fraction corresponds to what was expected, as may be observed, being higher in weight in lower-income countries, while in higher-income countries it is relatively smaller. It is worth pointing out that only one country in the region is classified as a low-income country, with the majority being middle-income countries.

Another indicator that is sensitive to the population's income level is the percentage of paper in the MSW composition. The behavior in the region is logical and consistent with the fact that higher-income countries report higher contents of paper in their waste. Thus, the percentage ranges from 5 per cent for countries with the lowest income level to 23 per cent for high-income countries, and 15 and 16 per cent for countries with lower-middle and upper-middle income levels.

The influence that the quality and availability of the data considered can have should be taken into account, as well as its comparability. Moreover, the composition of waste is expected to change over time, both qualitatively and quantitatively, which is to say that some fractions will become larger while others may decrease, and new materials will be added to the composition of the MSW stream, so a careful selection of technological options to provide adequate treatment solutions will be required.

3.2.3 Trends in MSW generation

The proportion of the world population currently living in cities amounts to 50%, and this is expected to rise to around 70 per cent in 2050. (The Secretariat of the Basel Convention, 2012) In the region, the urban population increased by 35 million people between 2010 and 2015, and it is expected to reach 567 million by the year 2025. This variable is highest in the sub-region of South America, with an estimated 346 million people (83 per cent of the population) living in urban areas in 2015, whereas the highest rate of urbanization in the region is in the Caribbean, where 62 per cent of the population resided in urban areas at the start of this century, increasing to 70 per cent in 2015 and projected to reach 75 per cent in 2025. (UNEP, 2016) FIGURE 3.3 presents the projected regional population up to the year 2100, which shows the upward trend stabilizing around the year 2060.

The estimation of the waste volumes to be generated in the middle and long-term starts with the data obtained in section 3.2.1 that correspond to the current volume of MSW generation in the region. The population growth rate shown in FIGURE 3.3 is applied to this number, and thus the MSW generation projection for the region up to the year 2070 are obtained, which is presented in FIGURE 3.4 that also shows that it is expected to grow from 541 thousand t/d in 2014 to 670 thousand t/d in 2050.

This projection has not considered an increase factor in the per capita MSW generation rate because there are no robust data available for the region. Moreover, the moderation in regional economic growth expectations in the recent years makes the definition of this variable even more difficult. As can be seen in the chart, the waste generation rate is expected to stabilize in the 2055-2060 period, as a result of the population growth stagnation in the same period.

FIGURE 3.3

Projected population in the LAC region and sub-regions

Source: UN - World Urbanization Prospects: The 2014 Revision

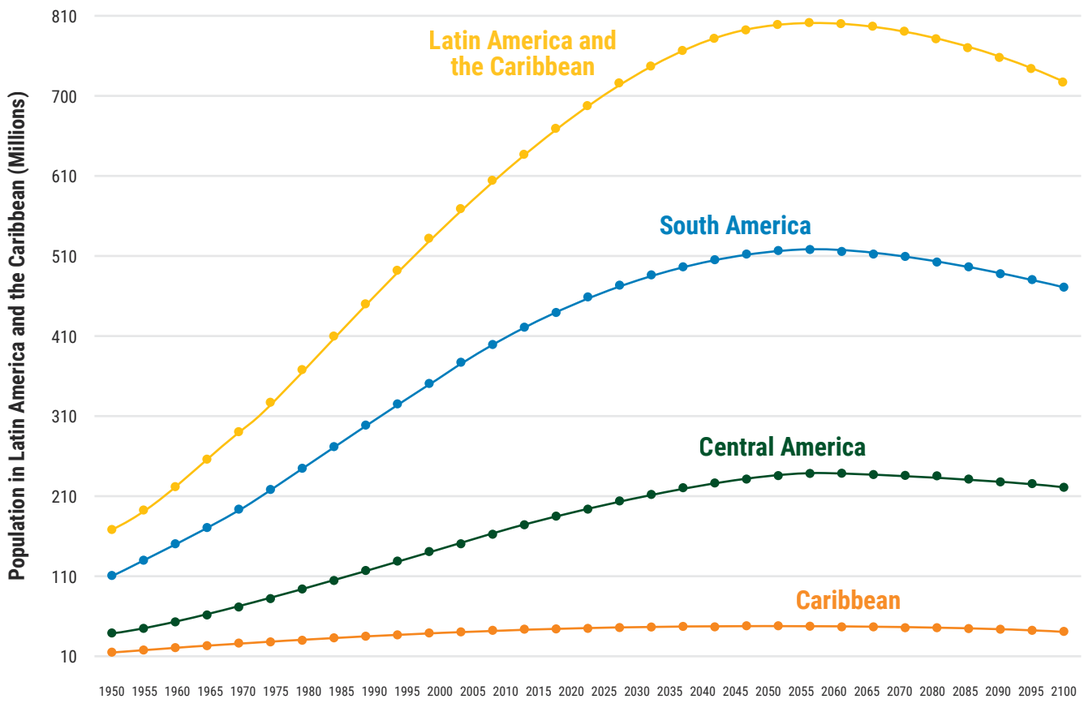
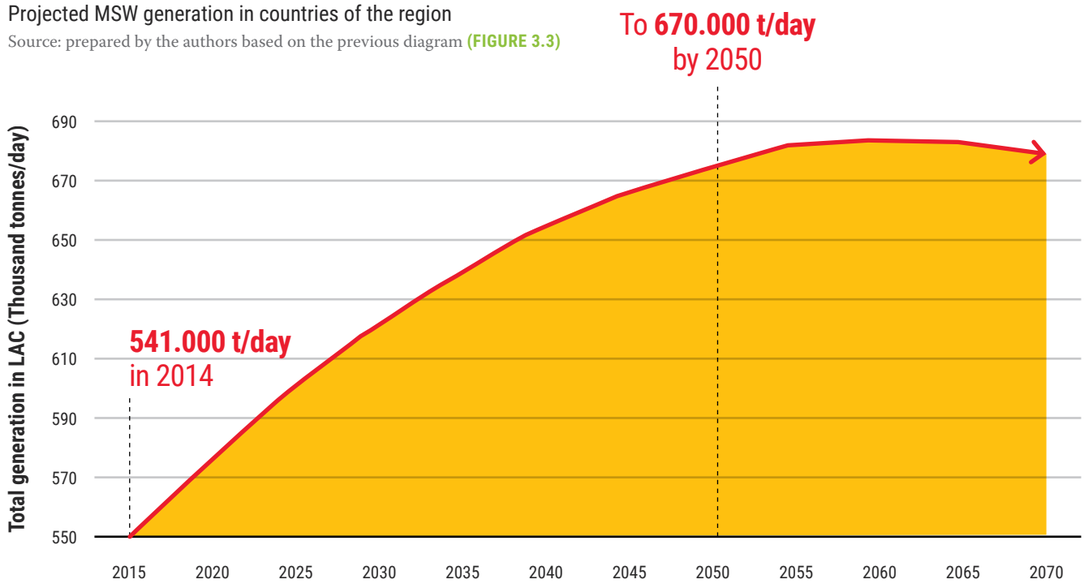


FIGURE 3.4

Projected MSW generation in countries of the region

Source: prepared by the authors based on the previous diagram **(FIGURE 3.3)**



3.3 General status of MSW management

This section examines the status of two significant steps in the provision of services in the region: firstly, MSW collection and then final disposal in places that may have different characteristics.

3.3.1 Collection coverage

MSW collection is a complex activity and, in economic terms, it is usually the most resource-intensive one of the urban cleaning systems in the countries of the region. Consequently, amongst other elements, it is of extreme importance that routes be adequately planned and designed in order to reach higher efficiency of collection rates, whilst simultaneously reducing unnecessary greenhouse gas (GHG) emissions. In general, and just as in nations in other parts of the globe, there has been an increase in both service coverage and quality.

Traditionally, the highest-income areas in a city, as well as the highest-income cities in a country, have high levels of collection coverage, which leaves marginal areas without an efficient service usually consisting of containers that are not looked after as often as necessary. **FIGURE 3.5** shows the collection coverage in relation to income level for a set of cities in the region.

As can be observed, collection coverage ranges from 70 to 100 per cent for the cities included in this chart. At country level, EVAL 2010 presents numbers comparable to the ones that characterize high-income countries, reporting a 93.4 per cent coverage average for the year 2010 for this indicator (this varies according to the size of the population and the income level, amongst other factors). (BID-AIDIS-OPS, 2011) This value is fitting, especially when compared to the data of other regions in the world reported by UNEP: Africa (25% to 70%); Asia (50% to 90%); Europe (80% to 100%) and North America (100%). (UNEP-ISWA, 2015)

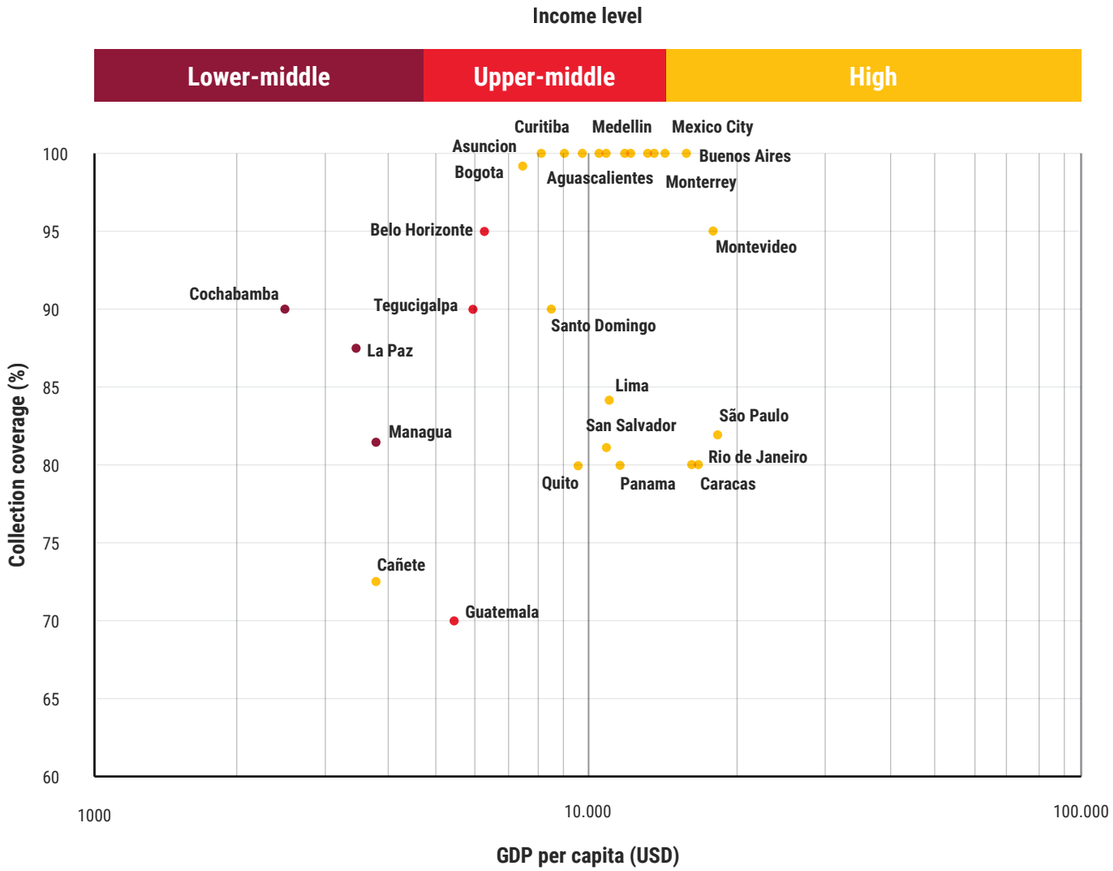
With regard to progress made, IDB reports a 10-point increase in the collection coverage percentage between 2002 and 2010 for the region. (BID-AIDIS-OPS, 2011) In terms of income and on a global scale, coverage percentages for this service reported in the GWMO from 125 countries were 36 per cent for low-income countries, 64 per cent for lower-middle income countries and 82 per cent for upper-middle income countries. For higher income countries, the value approaches 100 per cent. (UNEP-ISWA, 2015) There are, however, marginalized areas and neighborhoods in large cities, or municipalities located in rural areas with values below 70 percent. Even though the goal is to reach 100% coverage, approximately 41 million people lack the service, considering the average coverage value for the region. This is equivalent to approximately 35,000 tonnes are disposed of in idle lands, riverbeds, ravines and riverbanks, meaning that eventually part of this volume of waste reaches the sea.

As for the delivery method used for the provision of collection services, the most common one in the region is direct municipal service, which covers 50.6 per cent of the population, followed by the contracted services method, which covers 45.4 per cent of the population. (BID-AIDIS-OPS, 2011) Regarding collection equipment, the same source reports that there are, on average, 1.31 collection vehicles per 10,000 inhabitants, with 33 per cent of the fleet dating more than 10 years, while 58 per cent of vehicles have compacting equipment (with Chile and Costa Rica reporting values above 90 per cent for this mechanical feature).

FIGURE 3.5

Collection coverage for cities in the region by income level

Source: Prepared by the authors with data from 28 cities



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Waste collection in Panama City, Panama.

3.3.2 Controlled disposal

Final disposal of MSW has improved significantly in recent decades in the region, so much so that a significant share of the volume of waste collected is currently disposed of in sanitary landfills, especially in medium and large-sized cities. Unfortunately, countries still have the norm of disposing of at least a fraction of their waste in places that meet the conditions of a sanitary landfill only partially or not at all. This practise has led, in some countries in the region, to the use of the term "controlled landfill", a facility which generally consists of old dumpsites ("basurales" in Spanish, also called "botaderos", "tiraderos" or otherwise, depending on the country) in which some control measures such as fencing, signage, access control, scale (or some even more advanced measures, such as coverings and waste compaction, gas collection, amongst others), have been put in place in order to have better operating conditions. A standardization of this terminology and other MSW terms used for the concepts used in the waste sector in Spanish-speaking countries is desirable. Annex 1 includes a classification prepared by ISWA which sets out the characteristics that differentiate these different categories of final disposal sites for MSW.

The above-cited EVAL 2010, (BID-AIDIS-OPS, 2011) which reports the most recent information from the region in a comprehensive manner, grouped final disposal sites for MSW in three categories: sanitary landfill, controlled landfill and open dump. The evaluation reported that on average, by 2010, MSW generated by 54.4 per cent of the population in countries of LAC were disposed of in sanitary landfills, 18.5 per cent in controlled landfills and 27.1 per cent in open dumps, burned or disposed of using other inadequate practises (approximately 160,000 t/d for the three forms of disposal in the latter category).[6] In opposite extremes of the sanitary landfill as a final

6. Considering the total population in the region in accordance with the data reported by IDB in the cited source.

© Albina Ruiz

Controlled disposal of waste, Peru.

destination for waste, two countries reported values higher than 80 percent, while three reported a value of 0 per cent for this category. Within the same country, cities can likewise present different values regarding the final disposal method used.

Even though the World Bank reports that worldwide, the usual practise for most developing countries is still the final disposal through open dumping and open burning, (The World Bank, s.f.) the region has made significant progress in improving this. Data from the *Wasteaware* methodology reported in the GWMO suggest that, globally, some cities in middle-income countries have made significant progress in this area. (UNEP-ISWA, 2015) Whereas at country level, Colombia and Chile are the countries in the region with the highest sanitary landfill coverage rates (over 80 per cent), followed closely by El Salvador (78.2 per cent). Indeed, between 2002 and 2010, final disposal of MSW in sanitary landfills increased from 22.6 per cent to 54.4 per cent; while simultaneously, the use of open dumps for the final disposal of MSW decreased from 45.3 per cent to 23.3 per cent.

Despite significant progress, there still is a lot left to do, the waste of 27.1 per cent of the LAC population, pertaining to approximately 170 million people, is disposed of without any precautions, being burned or used as animal feed, (BID-AIDIS-OPS, 2011) with the health risks these practises entail. Nevertheless, it is important to note that while there still are a considerable number of dumpsites in operation in the region, several countries have made inroads in the energy valorization of MSW in some final disposal sites. This issue is further discussed in section 3.4.2.

3.4 Resource recovery

Accomplishing an efficient resource recovery from MSW depends critically on the previous steps of the local waste management system. It is particularly important to implement a Program for segregated at source and separate collection, both aspects which will allow for materials to reach valorization facilities with a better quality and at higher quantities, regardless of the methodology used.

3.4.1 The importance of segregation

The segregation of materials in waste is performed in different ways in different countries and, also, in different cities. The success of many valorization Programs depends more and more on good segregation at source, therefore, many countries in the region have implemented separate collection Programs (basically organic/inorganic fraction), with greater or lesser success, but which have laid the foundation for achieving higher recycling rates by providing less contaminated materials. In practically every country in the region, segregation is carried out in all stages of waste management: at the source, sweeping, collection, transfer and of course at final disposal sites, mainly by waste pickers (WP).

Determining the size of the population of waste pickers has always been a complex task due to the informal nature of the activity, amongst other factors. In an attempt to set an approximate value to this group, EVAL 2010 (BID-AIDIS-OPS, 2011) reported a conservative 500,000 WP in the region as estimated by PAHO in 2005, and reports a number of 3.8 million people in the upper limit, citing Martín Medina in *Supporting Community-Based Recycling Initiatives in Latin America and the Caribbean.* Said source gives an estimate of 8.57 WP per 10,000 inhabitants in the region, which adds up to slightly more than 400,000, which is a conservative estimate according to the same source (the range obtained by EVAL 2010 goes from 0.85 to 29.98 WP/10,000 inhabitants, in Chile and Colombia, respectively). The Regional Initiative for Inclusive Recycling (IRR) reported in 2013 that "The population of waste pickers in LAC aggregates around four million people". (IRR, 2013) The Red Latinoamericana de Recicladores (Latin American Recyclers Network) is also a source of information about inclusive recycling in the region.[7]

It is important to stress that the difference between waste sorting and recycling is often unclear, so it is necessary to note that the terms can refer, interchangeably, to: (i) the percentage of waste actually separated for being then reused, recycled or subject to another activity that extends its life cycle; (ii) the percentage of waste removed from the waste stream for possible recycling; (iii) the percentage of waste actually incorporated into recycling processes and (iv) a combination of all of the options mentioned.

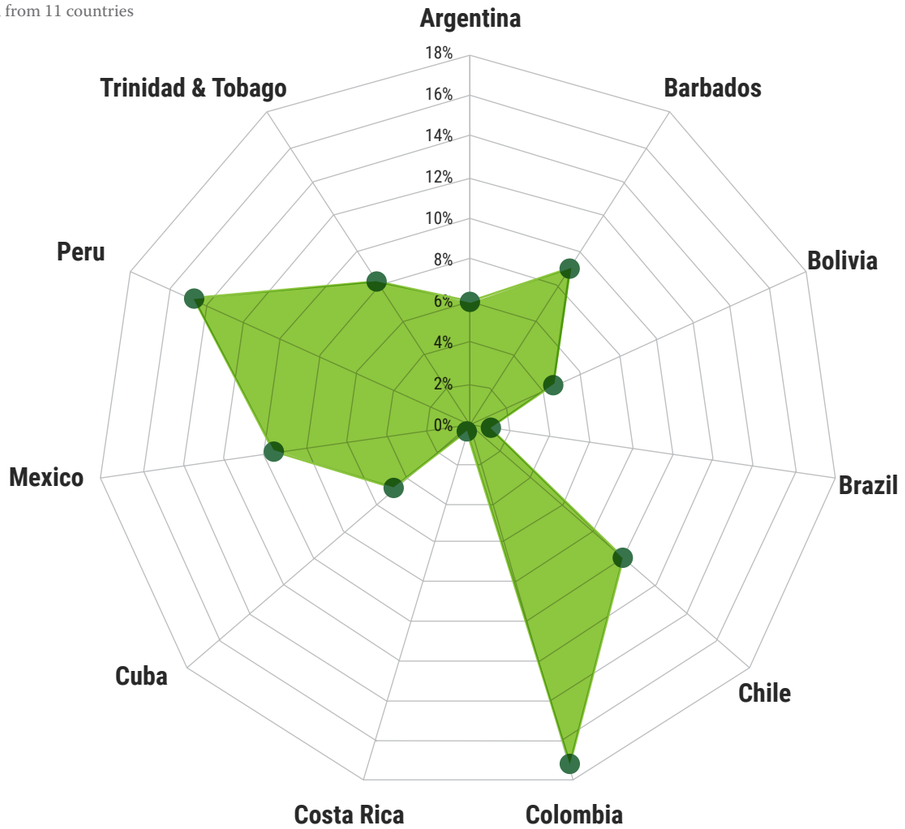
Although considerable efforts have been made in LAC for estimating the recycling rate at country level, the countries that have national

7. [www.redlacre.com].

FIGURE 3.6

Recycling rates in countries of the region

Source: Prepared by the authors with data from 11 countries



estimates for this indicator are still few, not forgetting how the terms sorting and recycling can be confused, nor the uncertainty and reliability of the information given the considerable presence of informal groups connected to recycling activities, together with the lack of consistent methodologies for reaching estimates regarding to MSW management and reporting information from local authorities to national authorities. Taking these concerns into account, FIGURE 3.6 shows the national average recycling rates for eleven countries representative of the region.

Selective or separate collection is a key step for providing continuity for the efforts of the generators who segregate the waste produced (segregation at source, or at the point of origin) so that they can go on through differentiated management, thus separating the waste which can be subjected to some treatment that will allow for valorization and/or recovery, from waste that has to be finally disposed of given its characteristics and/or lack of a market for them. There are different mechanisms for selective collection, with the following two being the most widespread:

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1. Setting certain days of the week for collection of different kinds of waste; the widespread practise is usually to separate MSW into two categories (organic and inorganic, or wet and dry fractions). This basic classification can be expanded to incorporate major components as the efficient implementation of separate collection schemes progresses.
2. Provision of equipment (vehicles) that enables the selective collection of the different fractions of waste separated at their point of origin, which entails purchasing or adapting collection units with different compartments.

Two cases from the region where there is separation at the source and selective collection are described below.

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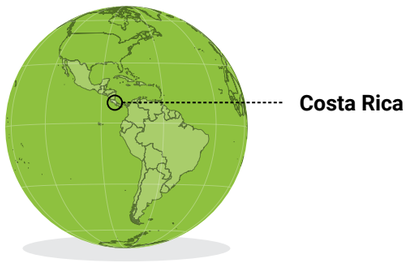
Case Study 2

Selective collection in a municipality in Costa Rica



The regular waste collection operational audit carried out in Costa Rica (Contraloría General de la República, 2016), reported that 39 of the 81 municipalities in the country provide selective collection at the source of origin, whether through the traditional system of collecting them individually from said sources, or by collecting them from common points determined by the citizens of the district, or with facilities available to some communities for disposing of their waste separately. Of the 42 local governments that do not provide selective collection services, 13 of those municipalities provide collection campaigns at specific points, for generators to bring their recoverable waste. However, this system has some shortcomings because it does not cover the entire district and it is easier for generators to give their waste to the conventional mixed collection system.

Despite the efforts made to encourage selective collection, only around 1 per cent of waste was recovered for valorization at the national level in 2014. The following are some of the leading constraints for promoting selective collection in this country:

- Lack of a market for the materials
- Lack of awareness amongst the population
- Shortage of economic and human resources
- Lack of political will and commitment
- Insufficient incentives
- Difficulty in the application of penalties
- Lack of institutional capacity
- Geographical extension and state of roads

As an example of this practise, the municipality of Alvarado, with a population of approximately 14,312 people (2011), started an ambitious plan in 2007 for recovering potentially valuable waste. They started to be collected and marketed as part of the recycling Program of the Clean and Healthy Alvarado Recycling Association (Asociación Recicladora Alvarado Limpio y Sano, ARLISA) (Gobierno de Costa Rica, 2011), created under the auspices of the municipal government itself, which provided the space for managing the recycling centre, as well as transport for the recyclable materials (Cantón de Alvarado, 2008).

Later, in 2010, the Department of Environmental Management started working and

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"The resulting recycling rate is estimated at 9.7% of total waste generated"

the Comprehensive Waste Management Law was passed, which created the obligation for municipal governments to provide accessible, regular and efficient selective waste collection services (Quirós, 2014). This gave way to an updated, new solid waste management plan, so there are 3 categories for differentiated collection. Organics are picked up on Mondays, regular waste on Tuesdays and recyclables on Wednesdays; scrap metals and non-conventional are picked up on the last Friday of every month. Potentially valuable waste is sent to a stockpiling centre managed by a local SME, with which the government has partnered for it to cover the packaging and market costs of the materials. In return, the enterprise sponsors agrochemical containers and collaborates in environmental education campaigns. The percentage of valorization obtained is estimated at 9.7 per cent of the total, which amounts to 166,440 tonnes of potentially valuable waste recovered in 2013 (Grupo Nación, 2014).

Case Study 3

Segregation at source and separate collection in Mexico City, Mexico

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Segregation at source. Mexico City, Mexico.

Mexico City, Mexico

"The programme made a change in society's attitude to continue separation at source possible"

Mexico City has a segregation at source and separate organic and inorganic collection Program. In the beginning, the separation Program strictly established certain days for collection of organics and others for inorganics. The program also includes a series of collection units with double compartments, which in 2014 amounted to 281 vehicles or around 12 per cent of all the collection units (2,460 units). In addition to that, the city has 2 semi-mechanical sorting facilities that receive 3,758 tonnes of MSW daily, where more than 20 recyclable materials such as metals, glass, paper and cardboard, plastics, amongst others, are recovered in this facility; less than 7 per cent of MSW received in each facility is recovered. There are seven small composting plants and a large one for recycling organic waste, altogether they receive close to 870 ton/day of organic matter (just one of them, the largest plant, receives around 98 per cent of the total, which amounts to 850 ton/day) (Secretaría de Medio Ambiente de la Ciudad de México, 2015).

The Program made a change in society's attitude to continue separation at source possible, which has increased the interest of collectors or waste pickers in waste, who are present throughout all waste management steps, except for final disposal: it is estimated that more than 12 per cent of what is recycled in the city is a result of informal activities. The presence of scrap metal dealers advertising the purchase of different materials, including ferrous metals, in the streets is an outstanding case. At the national level, out of 32 states, only 13 have selective collection, and although collection coverage is higher than 90 per cent, only 9 per cent is differentiated (Semarnat-INECC, 2012).

3.4.2 Technologies for material recovery

The technologies used for recovering materials from MSW have improved and diversified in recent years, so that currently there is a wide array of possibilities, although more so in developed countries. Experience has shown that these technologies are not always necessarily suitable for the region, yet mayors and authorities in general are often offered treatment systems which sometimes have not even been sufficiently tested in other regions. The lack of knowledge and qualified staff in municipalities has often favoured the acquisition of inappropriate –and almost always very expensive– technologies, which have resulted in failures, so it is advisable to raise awareness about the advantages and disadvantages of these technologies in order to avoid these mistakes at the local level.

In this respect, due to the lack of an adequate infrastructure for processing organic waste in the region, a high percentage of this waste is finally disposed of in sanitary landfills –at best– which contributes to considerable problems, such as the formation of leachates and GHG emissions, amongst others. Since the organic fraction is the most significant part of MSW, it is necessary to adopt technologies for its management, which need to take into account important variables, such as volume, moisture content, where it is generated, etc.

Additionally, elevated levels of urbanization and the space constraints of large cities, as well as the expiration of the useful life of current final disposal sites in the region, have attracted interest to the development and/or application of technologies that enable a paradigm shift about the notion of waste as trash to, instead, seeing waste as a new resource, both as a material and for generating energy. Even though the application of technologies to the recovery and treatment of waste on a large scale is still unusual, the fact that there is a great number of final disposal sites with a significant presence of organic matter, has promoted the use of biogas from sanitary landfills (when feasible), followed by composting (when organic matter is properly separated).

There are other important factors which have stimulated the search for alternatives, such as the energy sector. The primary growth rate for this sector in Latin America is 3.11 per cent a year, which means that it will require a 50 per cent increase in its installed capacity in this decade (UN Habitat, 2010). Moreover, there are commitments to reduce greenhouse gas emissions and, given the waste sector's considerable methane contribution, the search for alternatives to reduce methane emissions becomes more important, not only in the region but also globally.

Despite the above, most countries still lack the critical mass necessary to avoid the problem of isolated management in municipalities, which deprives them of certain benefits –such as access to technologies, financing and other advantages– that they could enjoy if they were organized in regional or inter-municipal entities.

Various examples of technologies used and operational in countries in the region aimed at generating energy or recovering materials from waste are described below.

Mechanical sorting

The most basic and simple technology for recovering resources is made up by material separation facilities, usually including a conveyor belt on rolling pins where the staff manually separates recyclable materials from MSW. This technology, used in several countries in the region, can be located in urban areas or at final disposal sites, and its dimensions and capacities range from a few to several thousand tonnes a day.

It is important to note, however, that several cities in the region already have modern facilities in which efficient technologies are used, including pneumatic, gravimetric, optical, magnetic separation equipment, etc.

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Energetic use of biogas in the La Perseverancia sanitary landfill. Morelos, Mexico.

Energy generation from biogas in sanitary landfills

Amongst the options considered in the CDM for reducing GHG emissions is the combustion of methane from the biogas generated in sanitary landfills (or in large decommissioned dumpsites), as well as its use as energy for producing heat or electricity. Aside from reducing GHG emissions, this option also allows for the displacement of fossil fuels, thus contributing to meeting the global commitments of countries in these important areas connected to climate change. There is also the added advantage of obtaining income through carbon markets and from the sale of electricity.

In order to take advantage of this, several cities in the region have developed energy recovery projects that have been granted registration in the CDM. However, despite the implicit advantages of these projects, the number still remains small. Experiences have been different in all countries, but a recurring problem is the overestimation of the projected volume of biogas expected to be generated during the life of the project. An additional factor is the volatility of prices in the market of carbon bonds, an instrument which was attractive at first but that has lost its appeal in recent years. Finally, the variation in electricity prices is another decisive factor for the viability of a project of this kind. Amongst other countries in the region, Argentina, Brazil, Ecuador, El Salvador, Colombia, Mexico, Peru and Uruguay have, altogether, around twenty sanitary landfills equipped with biogas recovery facilities.

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Anaerobic digester in Atlacomulco, Mexico.

Composting

This technology has been present in several countries in the region for a number of years, but it is yet to have the desired impact on MSW management. A study carried out by USAID (2013) lists different factors which explain the lack of success of a number of composting projects in LAC countries; amongst the most important are:

1. Poor planning due to lack of knowledge about actual local needs, including poor dimensioning of plants.
2. Lack of training and regulations, and of a compost certification body.
3. Poor or no budget and operational integration of plants into local cleaning services
4. Inappropriate location of plants, which are away from where waste is generated and from the possible market for the products, and close to populations who oppose these projects.
5. Difficulty marketing compost –even good quality compost– concurrently with a deficient or no prior market analysis
6. Doubts about the plant's profitability.

Despite this, there are success cases of composting facilities in the region, whether government-owned, public-private, private, community-owned or owned by neighbor associations in countries such as Argentina, Bolivia, Brazil, Chile, Costa Rica, Mexico and Panama, amongst others.

In Argentina, the above-mentioned CEAMSE built in 2001 the composting plant Environmental Complex Norte III with a treatment capacity for 1,200 to 2,000 ton/month of green waste (CEAMSE, s.f.). The compost produced is distributed to amongst CEAMSE facilities (where it is used as covering material in sanitary landfills), as well as municipalities, educational organizations, hospitals and NGOs when the quality allows. The city of Rosario also has the composting plant Bella Vista, with a design capacity of 200 tonnes per day, which employs 12 informal waste pickers that make up 30 per cent of the plant's staff (Rosario, s.f.).

In San José, Costa Rica, there is a successful project in the neighborhood of Hatillo for the valorization of waste which, thanks to the support of the Japan International Cooperation Agency (JICA), aside from providing training for waste separation, has implemented a composting centre in the school of Hatillo 3 which is operated by mothers. In view of the good results, the creation of a microenterprise for selling the resulting fertilizer is even being considered.

Anaerobic digestion (AD)

Anaerobic digestion is an alternative for the treatment of organic waste which has garnered interest in recent years in the region, although its use on a commercial scale is still budding and the process is being evaluated in some countries. Amongst the advantages of AD in comparision with composting is the shorter retention time, the possibility of generating thermal and/or electrical energy, as well as the production of a substrate that can potentially be marketed as a soil improver. The main disadvantage are the high capital and operating costs, as well as some technical requirements, such as the supply of a homogeneous stream of organic

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Compost production at the National Autonomous University of Mexico.

waste free from impurities. The GWMO reports additional comparative data on the characteristics of AD and composting.

AD has been used in the region for many years for treating agricultural waste, but it is still not widespread for the treatment of the organic fraction of MSW. The first anaerobic digestion plant in Mexico is located in Atlacomulco, state of Mexico, and has the capacity of processing 30 ton/day of organic waste, and an installed capacity of 200 kW for the generation of electricity (Clemente, 2015). On the other hand, a methanization plant with a treatment capacity of 1,500 tonnes / month is being built in Rio de Janeiro, with an expansion project for 15,000 tonnes / month.

Mechanical biological treatment (MBT)

MBT consists of a combination of mechanical processes with biological reactors, with the singularity that they are located in the same plant, and it can comprise several treatment technologies. The biological reactor can be biodrying, composting or AD (UNEP-ISWA, 2015).

Argentina has a plant in the Sanitary Landfill Norte III-CEAMSE for treating waste from the metropolitan area of Buenos Aires (CEAMSE, 2013). This plant has the capacity to treat 1,000 ton/day of MSW, of which up to 60 per cent, a volume consisting of about 420 tonnes of organic waste and about 180 tonnes of potentially recyclable waste (plastic, paper, glass and metals), can be recovered. The biological stage includes loading of food scraps/yard waste to bioreactors, where they are encapsulated and sealed for 21 days with a control of moisture. The product of this process is used as a coverage layers in the Sanitary Landfill Norte III.

Incineration

UN Habitat reported in 2010 that "many countries in Latin America, for the first time, are beginning to explore the use of waste-to-energy plants as part of their integrated solid waste management plans" (UN Habitat, 2010), *however, these are currently only used for the treatment of industrial and healthcare waste. Some islands in the Caribbean, on the other hand, have already implemented this technology for MSW, as is the case of Martinique, St. Barth and Bermuda, while Jamaica and Barbados have plans for developing it locally* (BID, 2013). *This is mostly due to the fact that island states naturally have limited space and to the need for energy supply.*

Energy generation (both thermal and electrical) is a condition that must be considered for this technology to be viable. The calorific value of waste must be at least 7 MJ/kg (UN Habitat, 2010), *which is often hard to meet given the high content of organic matter and moisture in the MSW in the region, a decisive factor to be taken into account in any initiative in connection with this technological alternative.*

The IDB has, for several years, been carrying out feasibility studies for this technology in municipalities in the region such as Buenos Aires, Argentina; Montevideo, Uruguay; Toluca, Mexico and Valparaiso, Chile. UNEP has also carried out studies in Haiti. In general, the conclusion reached is that high investment, operating and maintenance costs are a significant barrier to the development of this technology in the region, especially if they are in competition with the current costs of final disposal. [8, 9]

A considerable portion of the high investment costs corresponds to the need for the installation and operation of sophisticated equipment to filter emissions to the atmosphere, such as persistent organic pollutants and heavy metals, amongst others. Investors promoting MSW incineration can be faced with the difficulty municipalities face to pay rates that are commensurate with capital and operating costs, which can mean longer periods until return on investment in this kind of infrastructure. When addressing any project proposal to develop this technology, it is also essential to consider the engagement of stakeholders and local community in general, amongst other reasons, concerning how the potential impacts on environment and health will be prevented during the operational phase of the project.

On the other hand, the operation of these kinds of equipment requires a high level of specialization, therefore, this alternative will be economically viable with enough financial and governmental support (BID, 2013). An alternative to mass incineration is the recovery of recyclable materials in MBT facilities to produce refuse-derived fuel (RDF) following the removal of non-recyclable elements, so that only the latter goes to an incinerator.

8. See Annex 3.6 Costs of the management of solid waste per tonne or kilometre

9. Incineration projects which involves using external energy in order to dry the waste should not be taken into account.

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"When selecting a technology for the treatment of MSW, it is very important that technical, economic and social feasibility studies be carried out"

At the end of 2016 Mexico City reported that the *"specifications for the award of the contract for... the design, construction, commissioning, operation and maintenance of a plant for recovery of the calorific value of municipal solid waste... for the generation and delivery... of electricity... for up to 965,000 MWH a year"* (Gobierno de la Ciudad de México, 2016). The city has also made public the intention of installing an anaerobic digester with a capacity of 2,000 ton/day[10]. In the region an alternative variant of the energetic use of waste is widely represented by co-processing it in cement producing kilns, which uses various municipal and industrial hazardous, agricultural, and special handling waste streams.

For a description of the different MSW treatment technologies that are commercially available, as well as their main features, see the GWMO. In all cases, it is of the utmost importance that, at the time of selecting and implementing a certain technology, the necessary technical, economic, social, etc. feasibility are carried out, and also that attention be paid to technologies which have been sufficiently tested in other national or foreign municipalities.

10. La Jornada and El Universal journals. 18 October 2016

3.5 Other waste streams and emerging issues

3.5.1 Introduction

There are, aside from MSW, other waste streams –such as industrial toxic, explosive, reactive or other wastes, or those generated in health-care facilities– whose inclusion in this outlook was thought to be convenient for many reasons. Other streams –such as debris and tyres, amongst others– can represent large generation volumes, which makes their management considerably more difficult. There are also waste streams consisting of materials and products manufactured with substances that have recently entered the market. Some streams of liquid and gaseous waste, essentially made up by discharges from MSW management systems, such as leachate and emissions to the atmosphere.

In particular, sludge, slime or mud from wastewater treatment plants is not taken into account in this Outlook, basically due to the fact that they are usually included with the water and sewage sector in national or local Programs and plans. Notwithstanding, it is worth noting here that, as a consequence of the growth in wastewater collection and treatment in the countries in the region, it is imperative to pay attention to this waste stream in particular, to a large extent due to the significant potential for GHG mitigation in adequately handling it.

3.5.2 Hazardous waste (HW)

Even though countries can follow different methodologies for the classification of HW in their territories, this is frequently implemented taking into consideration the hazard characteristics which, in general, cause them to be classified as corrosive, reactive, explosive, toxic and flammable (independently from the classification of the Basel Convention). Additionally, there is usually the characteristic that makes waste infectious, a category which will be treated separately in the following section.

An ongoing study of the Basel Convention Coordinating Centre (BCCC) about HW in the region (Centro Coordinador del Convenio de Basilea, 2016) mentions that "It is noticed that some countries have made great progress in this area and have specific regulations for hazardous waste, appropriate technologies and management instruments that make an adequate follow up of the management of hazardous waste possible. However, this situation is not the norm in all of Latin America". And then adds: "Most of the countries do not have data on the amounts of hazardous waste generated and even less on the waste generation rate by industry". Along with these conditions, in some cases lack of monitoring and control on this waste stream means they are often mixed with other wastes and end up in unsuitable places, generally dumpsites and clandestine sites, ravines, riverbeds, etc.

There is, however, data which shows the generation volumes for the countries that have this information. **FIGURE 3.7** shows the generation of HW (categories Y1-Y45) of some countries in the region, based on the reports submitted to the Basel Convention in the years indicated for each country[11].

11. According to reports available up to 2016.

FIGURE 3.7

Hazardous waste generation in countries of the region

Source: National reports submitted to the Basel Convention. Available from: http://www.basel.int/Countries/NationalReporting/ReportingDatabase/tabid/1494/Default.aspx. Except for Brazil: Basel Convention Coordinating Centre (2016).

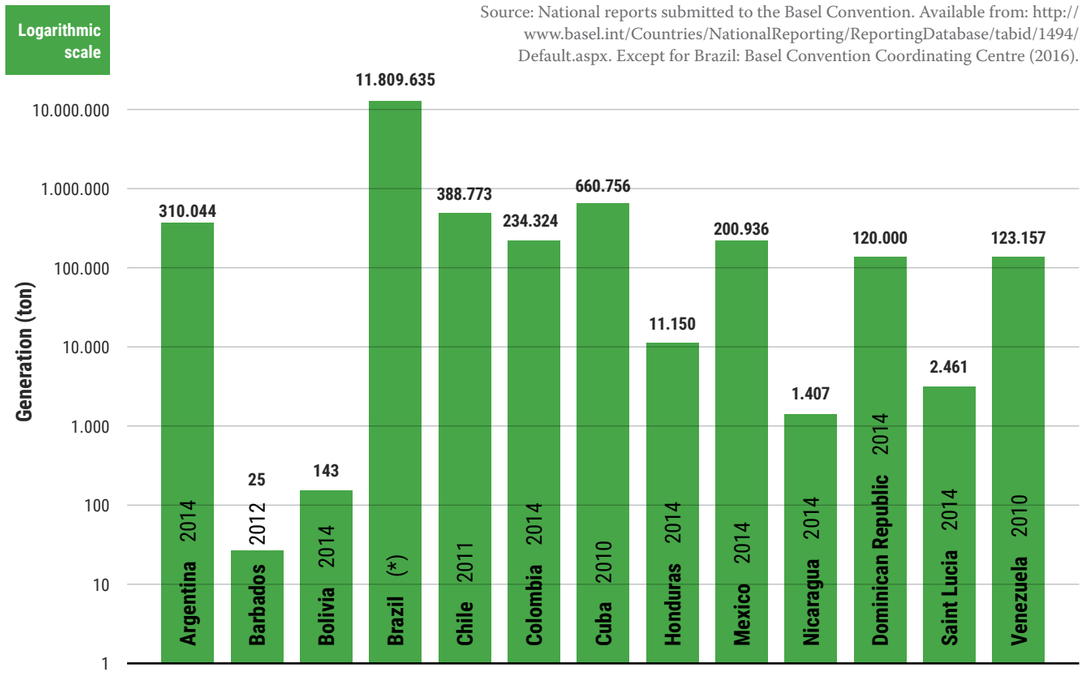
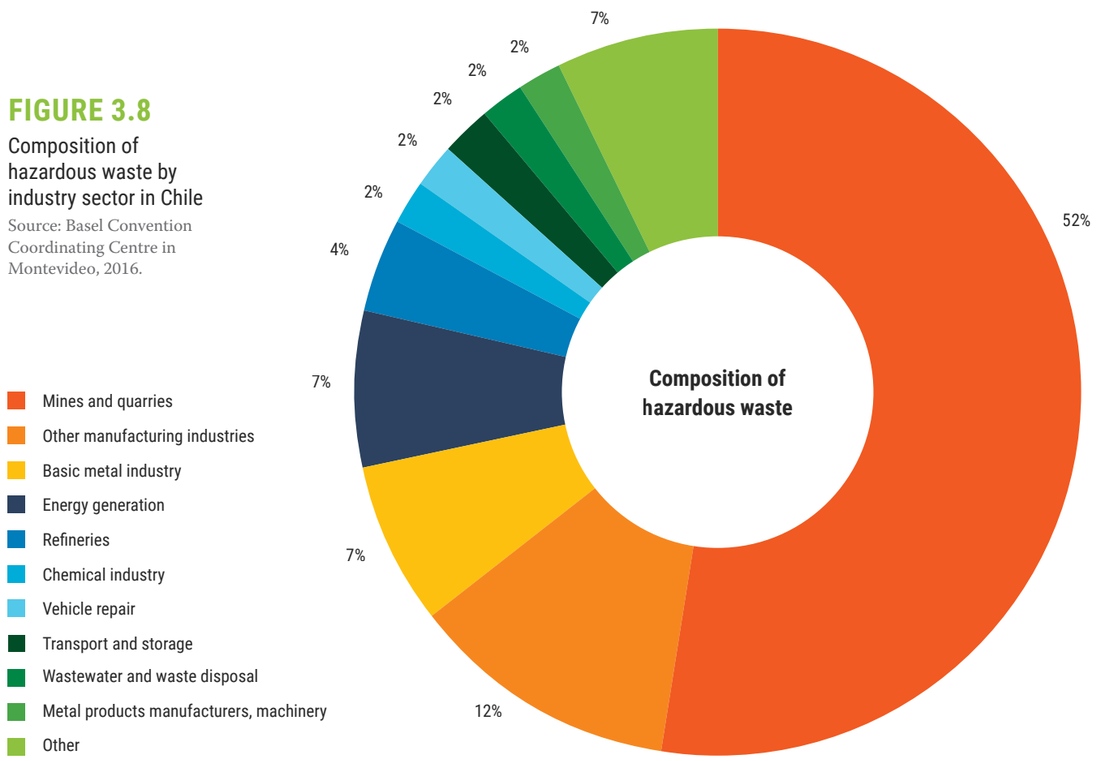


FIGURE 3.8

Composition of hazardous waste by industry sector in Chile

Source: Basel Convention Coordinating Centre in Montevideo, 2016.



The composition of this stream varies significantly from one country to the other, which is related to the differences in their economic and productive structures. By way of example, **FIGURE 3.8** shows the average composition of HW generated in Chile by industry sector.

Household hazardous waste

There is a small fraction in the MSW stream consisting of domestic or household hazardous waste (HHW), that can have a widely varying composition, depending on the location and size of the municipality, social class, etc. It is made up by a wide array of products at the end of their useful life and the degree of hazard varies depending on their chemical and physical characteristics. The consumer products found most frequently in the MSW stream that can potentially be HHW, are the following: detergents and whiteners, disinfectants, drain cleaners, oven cleaners, printer toner, motor oil, batteries, brake fluid, enamels, paints, pesticides, compact lamps, as well as those related to medical care, such as needles, cotton, gauze, etc., amongst others (City Hall of Bogotá, 2011).

When mixed with conventional MSW and managed together with that stream, they can pose a risk for operators of MSW management systems. Finally, this waste reaches treatment or final disposal sites where they can cause various problems, by becoming integrated into the composition of biogas and leachate from the site, thus increasing the risk of affecting the mediate and immediate environment.

The practise in developed countries is that citizens themselves bring their HHW to stockpiling centres to make sure they are adequately handled, and also so that the waste that has the possibility of being recycled is recovered. Part of the problem in the countries in the region is that the population is the widespread lack of awareness about the risks and how these wastes must be managed. And, on the other hand, the Programs and infrastructure available for stockpiling HHW are still incipient and, in general, there are no suitable facilities for adequately managing these wastes (Gaviria and Monsalve, 2012).

Some regional studies have been conducted for the purpose of determining the presence of HHW in MSW. A study carried out in 2015 (Universidad de Medellín, 2015) reported, for the city of Medellin, in Colombia, a high percentage of HHW of 1.16 per cent, with almost all of it being containers contaminated with paint and solvents. The value found for Mexico City was 0.35 per cent in 2002, with sampling undertaken in a housing unit. Later, in 2009, values of 2.83 per cent were reported for Ciudad Cuauhtémoc, in Chihuahua, and 4.58 per cent in Mexicali, Baja California (both in Mexico). A new sampling carried out in 2016 in Mexico City reported a value of 2.27 per cent (Otálora, 2016), and in Argentina, the values reported are 1 per cent (Altolaguirre, s.f.) and 0.4 per cent[12] for the year 2008 in the city of Buenos Aires.

As can be seen from these significant differences, this waste stream needs to be studied further, because aside from the shortcomings mentioned, HHW are likely to increase, and also, new substances are being incorporated into household consumer products (the composition of some personal care products, such as cosmetics, hygiene products and medications, amongst others, can include nano-materials or nanoparticles) (UNEP, 2015). The considerable range of variation in the values found can lead to the conclusion that it is necessary to continue investigating in this area, while adequate HHW stockpiling and management systems are implemented in the municipalities in the region.

12. [http://basuracero.org/sitio/base.php?sec=28].

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Health-care waste management in Mexico.

3.5.3 Waste from health-care facilities (hazardous)

Even though most of the wastes generated in hospitals and clinics have characteristics that mean they can be grouped with MSW, there are also wastes which can be classified as hazardous due to the infectious nature of their components (aside from waste which is hazardous due to its toxicity, corrosiveness, etc., generated during maintenance activities and in laboratories, or waste containing mercury). Inadequate management of this waste can pose significant risks for the environment and human health, first for the staff responsible for handling the waste internally, and then for the operators of the management systems for waste from health-care facilities. The risk is increased when this waste is mixed with MSW in places where there are informal waste pickers, who are exposed to possible injuries from needles, glass and other materials which could be infected and transmit diseases such as hepatitis, AIDS, etc.

The preparation of new legal instruments and a specific regulation for health-care waste (HCW) has facilitated advances in some countries of LAC in this area. An infrastructure has been developed in parallel to this for adequately managing this waste so that more and more municipalities in the region have treatment facilities ranging from autoclaves to incineration, to chemical treatments, microwaves, radio-waves, etc. As is the case for hazardous waste, this is not even throughout the region and conditions can even vary within the same country in relation to urban and rural areas, so that in countries with the lowest income levels, there are still weaknesses in the management of HCW both within sources of generation and outside them, resulting often in the combination of MSW and HCW in conventional final disposal sites.

One additional drawback in comparing indicators for this waste stream is that the classification and nomenclature of hazardous HCW can vary from one country to the other, consequently, the comparison of generation values by country should be taken with caution. Some countries report HCW indicators in domestic publications and, additionally, just like for hazardous waste, more and more countries are reporting to the Basel Convention the generation of waste classified as *Y1, Clinical wastes from medical care in hospitals, medical centres and clinics.* These two sources of information are the basis for a description of the status of HCW generation and management in some countries in the region.

Box 3.1

Examples of health-care waste management in the region

1

Brazil. In 2014, municipalities in Brazil collected a total 264,800 tonnes of HCW, an amount that was 5 per cent higher than the amount collected in 2013. The destination of this waste for treatment was incineration (44.5 per cent), autoclave (21.9 per cent) and microwaves (2.5 per cent). The rest –about 31.1 per cent– was finally disposed of in sanitary landfills, septic trenches and dumpsites (Abrelpe, 2014).

2

Colombia. In 2014, 24,470 tonnes of HCW were generated in this country (Basel Convention, s.f.). Another source (BID, 2012) mentions that in the year 2011, HCW generation accounted for 6.5 per cent of the nationwide generation of hazardous waste, being the third largest group for this category of waste. In that year, most HCW was treated in incineration facilities (IDEAM, 2012) and to a lesser degree through sterilization in autoclaves (and the treated waste was then disposed of in sanitary landfills).

3

Peru. In Peru, HCW is incorporated into the *Non-municipal waste* category. In 2014, 12,755 tonnes of hazardous solid waste were generated in this country in a total of 548 health-care facilities (Ministry of Environmente of Peru, 2016).

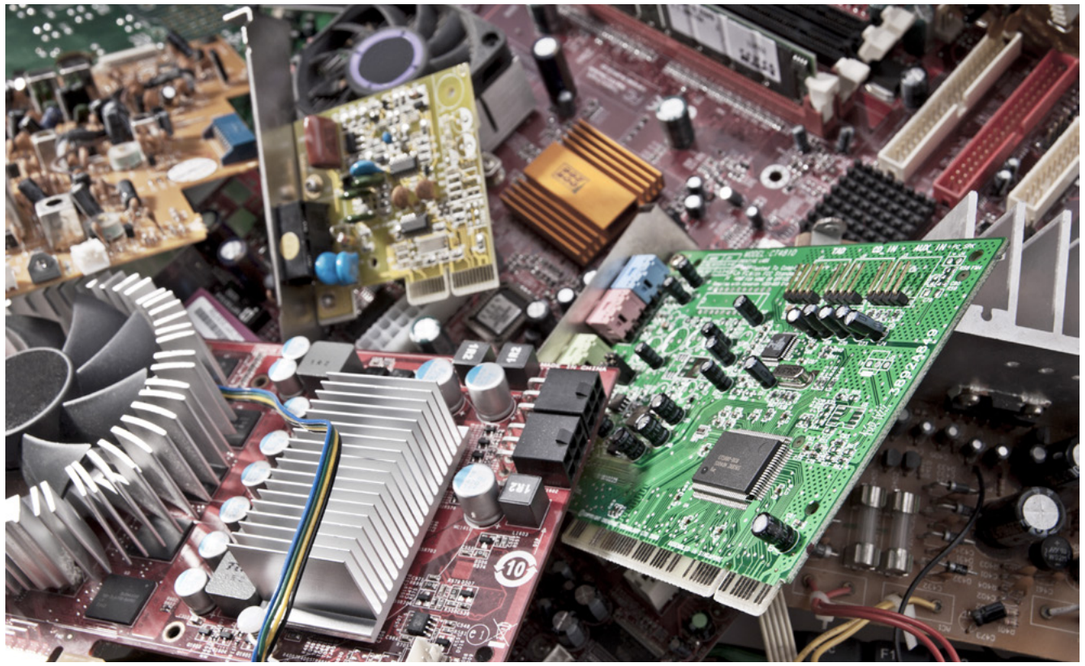
4

Uruguay. In 2005 Uruguay prepared the Solid Waste Management Plan for Montevideo and the Metropolitan Area (MMA), which included several significant streams of waste identified as special solid waste. Volume V of the Plan analysed the issues of *solid hospital waste* comprehensively (Republic of Uruguay. Planning and Budget Office. Division of Development Projects, 2005a). The study reports that MMA generated more than 1,800 tonnes of HCW in 2003, that is, 1.025 kg/person. The same study projected that the generation of this kind of waste for the year 2015 would be 1,892 tonnes.

5

In Saint Lucia, where generation amounted to 45 tonnes in 2014, HCW is treated in autoclaves and then disposed of in a sanitary landfill[13].

13. Information taken from each Country Questionnaire made for this document.



From the values obtained in the different countries it can be concluded that there is no consistent pattern in the generation of this kind of waste. Amongst other reasons, this could be due to the fact that different classifications are used in the region (biohazardous, hospital, biological infectious waste, etc.) It would be desirable to reach a standard definition in the region within a reasonable timeframe, in order to obtain more reliable data. Given the characteristics of this type of waste it is also advisable to set the necessary conditions for moving forward with adequate management, especially segregation at source, and to treat the waste as necessary to neutralize the hazard.

3.5.4 Waste electrical and electronic equipment (WEEE)

Just like in the rest of the world, the production, consumption and disposal of electronic and electrical devices have grown in the region, which has led to the generation of a growing volume of waste from these products at the end of their useful life. The progressive offer of equipment and new electronic devices, as well as intensive advertising campaigns and more convenient prices, coupled with a general improvement in purchasing power, have increased consumption of this types of products, making this the fastest-growing waste stream worldwide, due to the short lifespan of some of these products that are often not designed with their potential for recycling in mind (UNEP-ISWA, 2015).

The *Regional Latin American and Caribbean Platform for Electronic Waste* (RELAC, in Spanish), based in Santiago, Chile, combines the individual efforts of countries in order to consolidate information that is currently available in its online portal[14], an important media for raising awareness about the regional issues

14. [www.residuoselectronicos.net].

FIGURE 3.9

Composition of WEEE generation in the region (% by weight)

Source: UNU (2015)

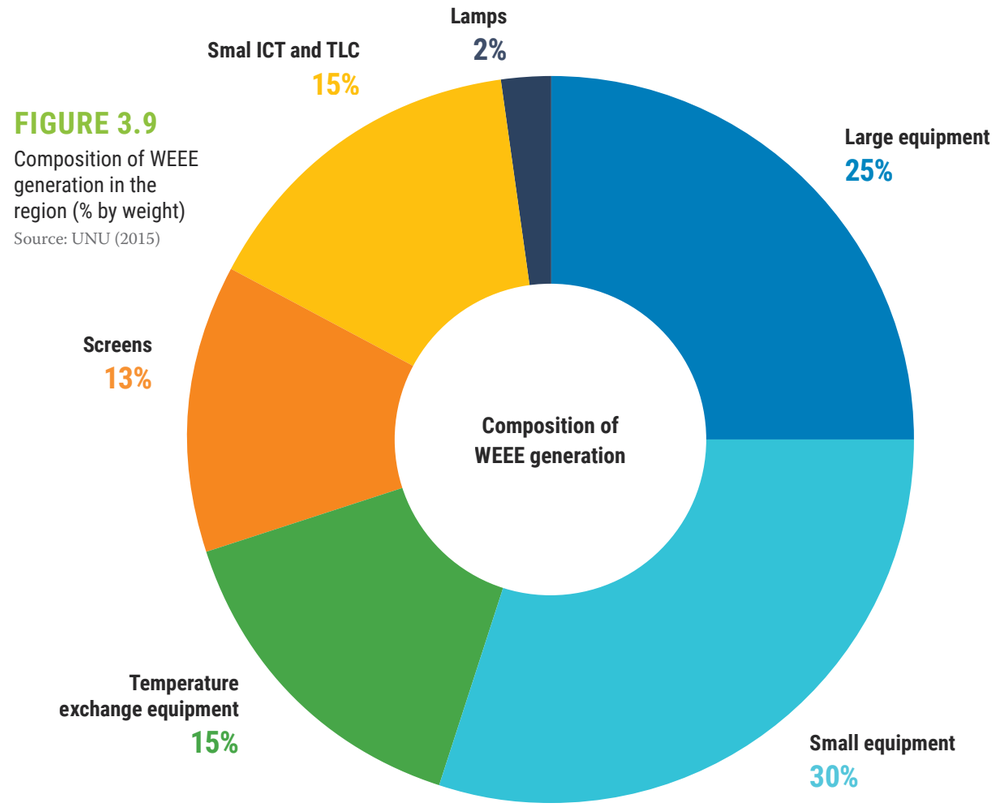


FIGURE 3.10

Electronic waste and mobile phones in LAC

Source: Adapted from UNU (2015)

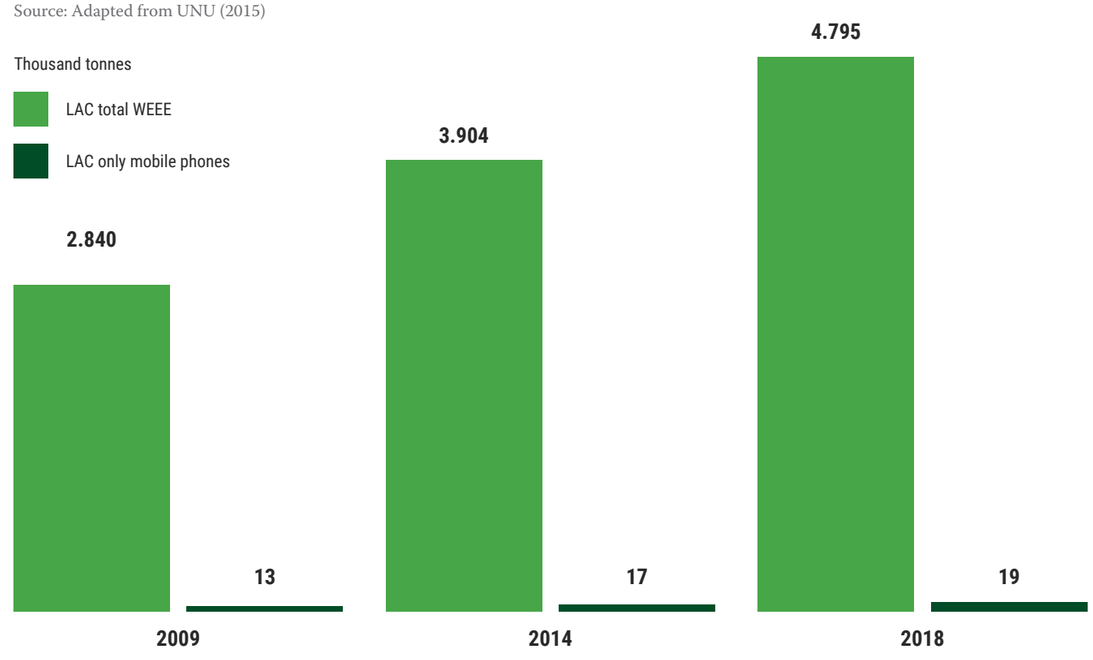
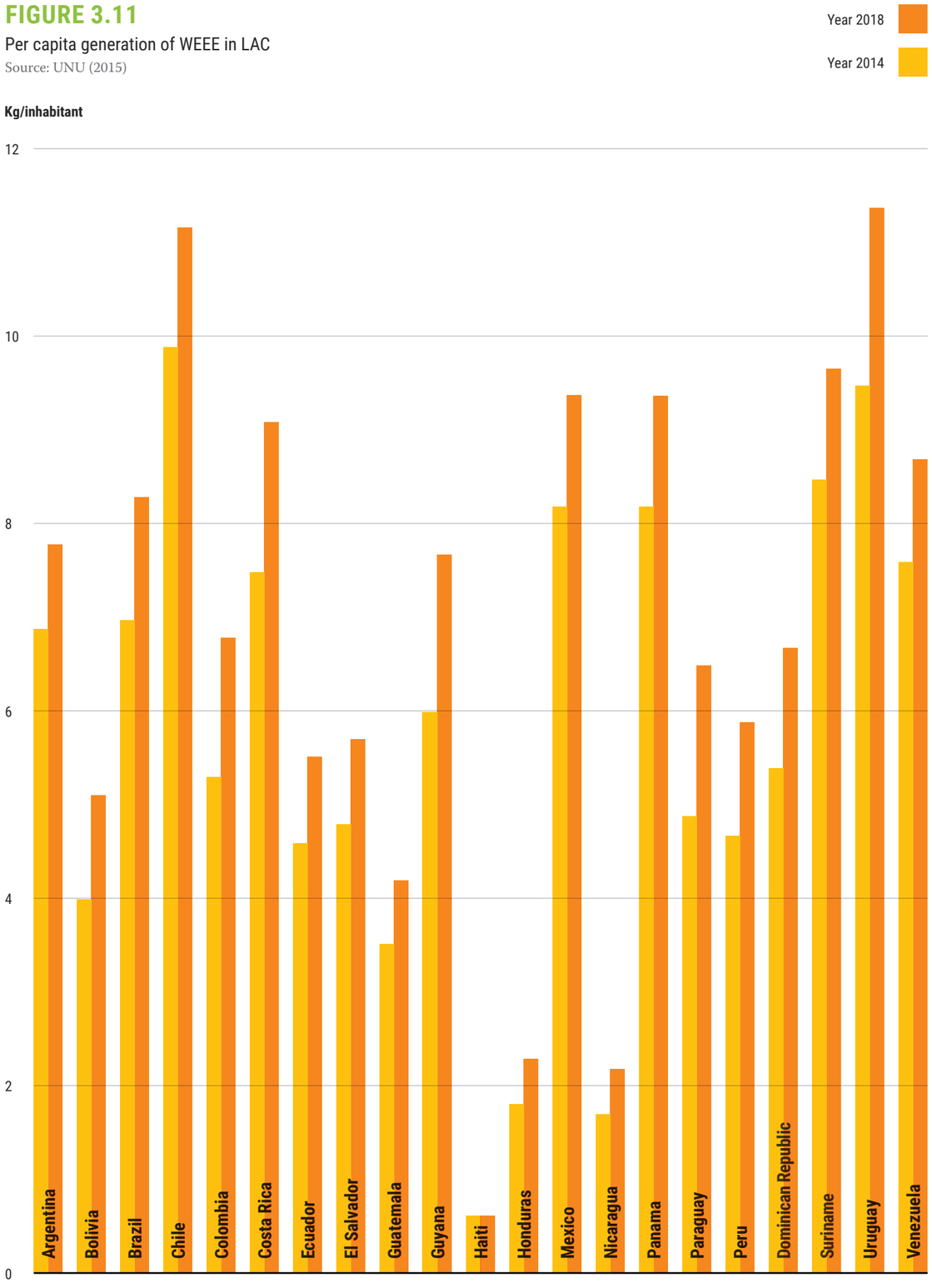


FIGURE 3.11

Per capita generation of WEEE in LAC

Source: UNU (2015)



in connection with this area. The United Nations University, in turn, has recently generated relevant information for the region that mostly relates to statistical indicators and public policy. The United Nations International Telecommunication Union (ITU) has also worked with an approach more geared towards sustainable management of WEEE in the region. It is anticipated that the growth of WEEE generation will be higher in the region than in the world, because the region is expected to grow 70 percent, compared to 2009, by 2018, whereas global generation will only increase by 55 per cent in the same period (UNU, 2015). The Secretariat of the Basel Convention estimates that the volume of waste from computers and mobile phones generated in developing countries is larger than the volume generated in developed countries . **FIGURE 3.9** shows the composition of WEEE in the region, based on the classification of the European Union (EU), which was taken by the United Nations University and applies it on an international scale (The Secretariat of the Basel Convention, 2012).

FIGURE 3.10, on the other hand, shows the increase in the generation of WEEE for the 2009-2014 period, and the estimation for 2018, even though the annual growth rate in the region is expected to go from 7 per cent in 2012, to 5 per cent in 2018 (UNU, 2015).

Per capita generation of WEEE is an interesting indicator, because despite the fact that Brazil and Mexico are the largest generators of this type of waste in the region, the countries with the highest rates, considering the volume generated per inhabitant, are Chile (9.9 kg/inhabitant) and Uruguay (9.5 kg/inhabitant) –the countries with the highest income levels in Latin America–, followed by smaller countries such as Suriname (8.5 kg/inhabitant) and Panama (8.2 kg/inhabitant), the latter with a value that matches the one reported by Mexico. **FIGURE 3.11** shows per capita generation of WEEE for the years 2014 and 2018.

The presence of heavy metals and rare earth metals in WEEE, as well as other compounds, such as flame retardants, make these wastes, which often end up in uncontrolled dumpsites (especially ICTs), hazardous, as they pose a significant environmental and health risk, because of the possibility that these compounds be released into groundwater through the subsoil, or to the atmosphere during occasional fires (UNU, 2015). Under these conditions, which are still common in the region, local burning is also frequent, so the damage goes beyond the local environment and can reach global dimensions through the emission of persistent organic and inorganic pollutants, such as dioxins and furans (chlorinated and brominated) in the first case and mercury vapour in the second. These practises, on the other hand, are a missed opportunity for the recovery of valuable materials.

The most significant challenges the region faces in order to achieve an adequate management of WEEE are (UNU, 2015):

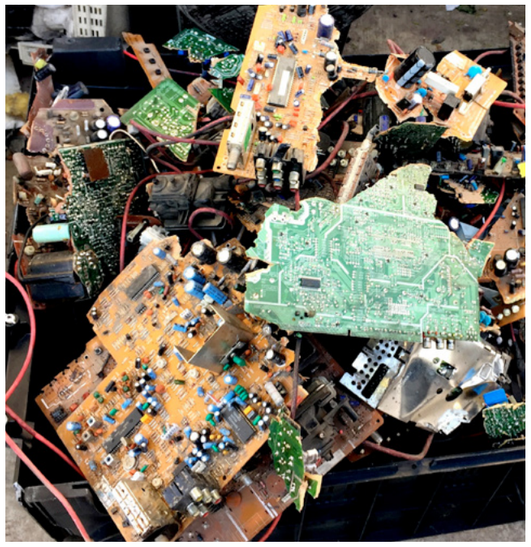
- Legal loopholes for WEEE management.
- Sustainable management throughout the life cycle of WEEE.
- Extended Producer Responsibility (EPR) as a State-level policy.
- Lack of awareness about WEEE management.
- Availability of recycling technologies and transference.
- Sustainable economic models that overcome financial difficulties.

Finally, it is important to emphasize that, even though the countries in the region have made significant progress in the development of legal instruments, as well as in the necessary infrastructure for adequately managing electronic waste, the same cannot be said for waste derived from electrical equipment, mainly consisting of household appliances and other types of equipment, such as beverage and food vending machines and air conditioners, amongst others.

Case Study 4

Waste management in the mobile industry in Mexico

Contribution from Gabriel Székely and Kathia García, National Telecommunications Association (ANATEL).



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Background

The number of mobile devices in the Mexican market has increased from 14 million in 2000 to 107 million until the first semester of 2016. This growth has raised concerns amongst mobile phone operators, device manufacturers and consumers for the adequate disposal of devices and accessories.

The initiative

In October 2013, mobile operators and device manufacturers made a formal commitment to promote the development of a budding environment protection culture in Mexico, through ANATEL's recycling Program, called "Programa Verde" (Green Program).

Amongst the main contributions of the mobile phone industry are: the provision of the physical infrastructure and logistics for the collection of devices and accessories in the 482 boxes distributed throughout the country; the coordination of social media campaigns during the post-Christmas season, in January, and during the first week of June, for the World Environment Day. The goal is to raise public awareness on the negative impacts caused by the incorrect disposal of electronic waste. Moreover, collaboration between government, companies and society is a decisive factor for the progress and continuity of the Program.

Eleven companies took part in this Program. Four out of ten searches in the online portal of ANATEL were looking for information related to recycling, with, remarkably, a majority of young users (ranging from 18 to 34 years old). In order to make sure that waste is treated according to the most stringent international standards, each of the members of the Program is committed to working with fully certified recyclers. ANATEL receives information about the materials that were segregated and their final destination, be it in Mexico or in other countries.

Year	Mobile phones (units)	Estimated weight of the devices (tonnes)
2013	347,715	52.16
2014	1,070,589	160.59
1st semester 2014	656,277	98.44
2015	388,518	58.27
1st semester 2015	246,708	37
1st semester 2016	92,228	13.83
Total	**1,899,044**	**284.85**

Mobile phone manufacturers usually follow Directive 2002/95/EC, that establishes the restrictions on the use of hazardous substances in electronic equipment for the European Union *("RoHS, Restriction of Hazardous Substances"),* including the maximum concentration of metals such as lead, mercury, cadmium, polybrominated biphenyls and brominated compounds.

Once the materials that make up a mobile phone have been segregated and recycled, they are reused in other industries. Plastics, for example, are used in construction, musical instruments and other various uses; glass and ceramic are fit to be used as raw materials; precious metals such as gold or platinum are recycled and subsequently used in the production of jewellery, coins, medals or even in vehicle catalytic converters, laboratory equipment and computer hard drives; copper goes to the construction, electronics and transport sectors; tin is turned into cans for food and drinks; batteries are processed and other materials are used for energy generation.

Since the Program was launched in the fall of 2013, 1.9 million phones and 583 tonnes of accessories (batteries, chargers, SIM cards and earphones) have been recycled. In general, 94 per cent of materials are processed outside of Mexico. The growth of the Program can promote construction of local recycling plants. The table shows that despite the campaigns carried out every six months in social media, the initial enthusiasm of consumers has dropped. A possible explanation is the surprisingly quick change from old devices to smartphones, which require higher investments and are, therefore, changed less frequently.

Lessons and the way forward

The efforts of the companies of the Mexican mobile industry will be reinforced as it receives government support in two areas: more exposure in the media and the introduction of citizen recycling actions in school curricula.

In the first case, the government has time available in radio and TV to spread messages of interest to the public, so it could devote some minutes a month to the promotion of recycling Programs such as this one. As for the role of schools, every child in Mexico receives textbooks made by education experts every year, so it would not be costly to include a section with citizen actions for recycling products containing harmful substances whose disposal requires special management.

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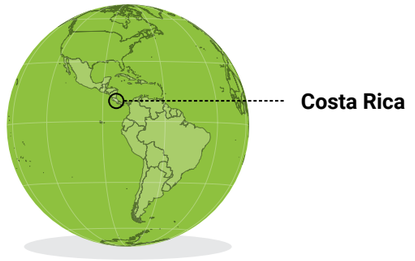
3.5.5 Construction and demolition waste

The construction sector is characterized as one of the most prominent in the economy of a country, because it is an important source of employment, it demands products and services, as well as the creation of infrastructure, so it can be deemed as an indicator of the development of a country or region. The region stands out as the most urbanized of the developing world, with 83 per cent of the population living in urban areas (UNEP, 2016), a share which is expected to continue growing in the future. This degree of urbanization is reflected in the fact that 32 per cent of the total population and 40 per cent of the urban population in the region live in cities with more than one million inhabitants. (Jofra *et al.*, 2016).

However, even though the construction sector brings tangibles and unobjectionable benefits, it also generates, as a consequence, a significant volume of waste classified as construction and demolition waste (CDW). As reported in the GWMO (UNEP-ISWA, 2015). frequently data relative to CDW are not routinely and consistently controlled and reported, which is true in the region, so the data available must be taken with caution since the classification of this category can also vary according to the country, as will be shown below. The state of the generation and management of these wastes in Costa Rica is reviewed below, as an illustration of how this stream is managed in the countries in the region.

Case Study 5

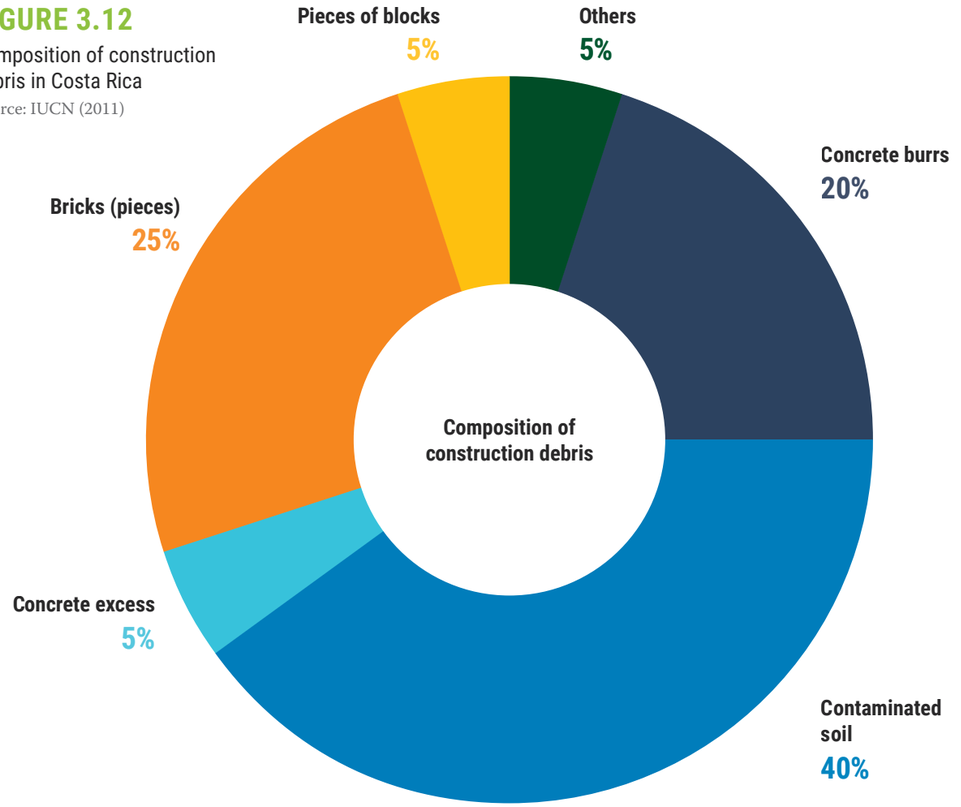
Debris management in Costa Rica



The *Guía de manejo de escombros y otros residuos de la construcción [Guide for the management of debris and other construction waste]* (IUCN. Regional Office for Mesoamerica and the Caribbean Initiative, 2011), was published in Costa Rica in 2011 as an instrument for achieving this goal. The guide reports 1,794 tonnes of CDW are generated every day in the country in 2007, with the composition shown in **FIGURE 3.12**.

The document reports that there is no separation at the point of origin, or it is inadequate, and they are generally disposed of in illegal dumpsites or wastelands in the surroundings of construction sites. An additional practise is disposal in sanitary landfills or dumpsites, although it is not widely accepted due to the volume this waste takes up.

FIGURE 3.12
Composition of construction debris in Costa Rica
Source: IUCN (2011)



3.5.6 Transport related waste streams (end-of-life vehicles, tyres, shipbreaking)

The transport of people and cargo brings with it the generation of various types of waste, which can range from the vehicle itself as a unit that is disposed of at the end of its useful life, to the different parts that make them up and which have a varying valorization potential. Amongst these wastes are some which, depending on the country, can be classified as hazardous.

Some countries in the region have made forays into Programs for the control of cars at the end of their useful life; in the case of tyres, there is a widespread practise of using them as a source of energy in cement kilns, even though the inappropriate disposal of tyres continues to be a common problem. Shipbreaking is less prominent in the region (unlike in Asia, for example, in Bangladesh, Pakistan and India). The state of each of the streams mentioned in the region is reviewed below.

End-of-life vehicles (ELVs)

The production and consumption of transport vehicles has increased significantly in the region, with some countries turning into important producers and exporters of this means of transport which, at the end of its useful life becomes waste that is hard to manage due to its volume but also due to the diversity of materials employed, including some hazardous materials. In general, there has been an increase in the vehicle fleet of the countries in the region, with most vehicles concentrated in the capital cities and large metropolitan areas.

Based on other numbers, it is interesting to note that the fleets of some cities in the region surpass the fleets of several countries. As for the manufacture of vehicles in the region, the main producers in 2015 were Brazil (2,429,463 units) and Mexico (3,565,469 units); yet there are other countries that produced smaller volumes of vehicles, as shown in FIGURE 3.13 (OICA, 2015).

The lifespan of vehicles can vary from one country to the next, generally being shorter in developed countries than in developing countries. By the end of this time period, automobiles are wastes comprising a wide variety of materials, such as various metals, plastics, glass, fluids, etc. Because of their design and manufacture, they also include hazardous waste, such as lead-acid batteries, lubricant oils, filters, explosive material from airbags, coolants, electronic circuits, etc.; therefore, it is very important to have suitable management schemes for this waste stream. ELVs have a high potential for recycling, because their average composition has the following general characteristics (Semarnat-IPN, 2009):

- 68% ferrous metals
- 9% plastics (some chlorinated or with brominated flame retardants)
- 8% non-ferrous metals
- 6% glass and rubber
- 9% other materials (textiles, batteries, fluids, electric components, etc.)

The instruments available in two countries in the region for providing adequate management for ELVs are described below.

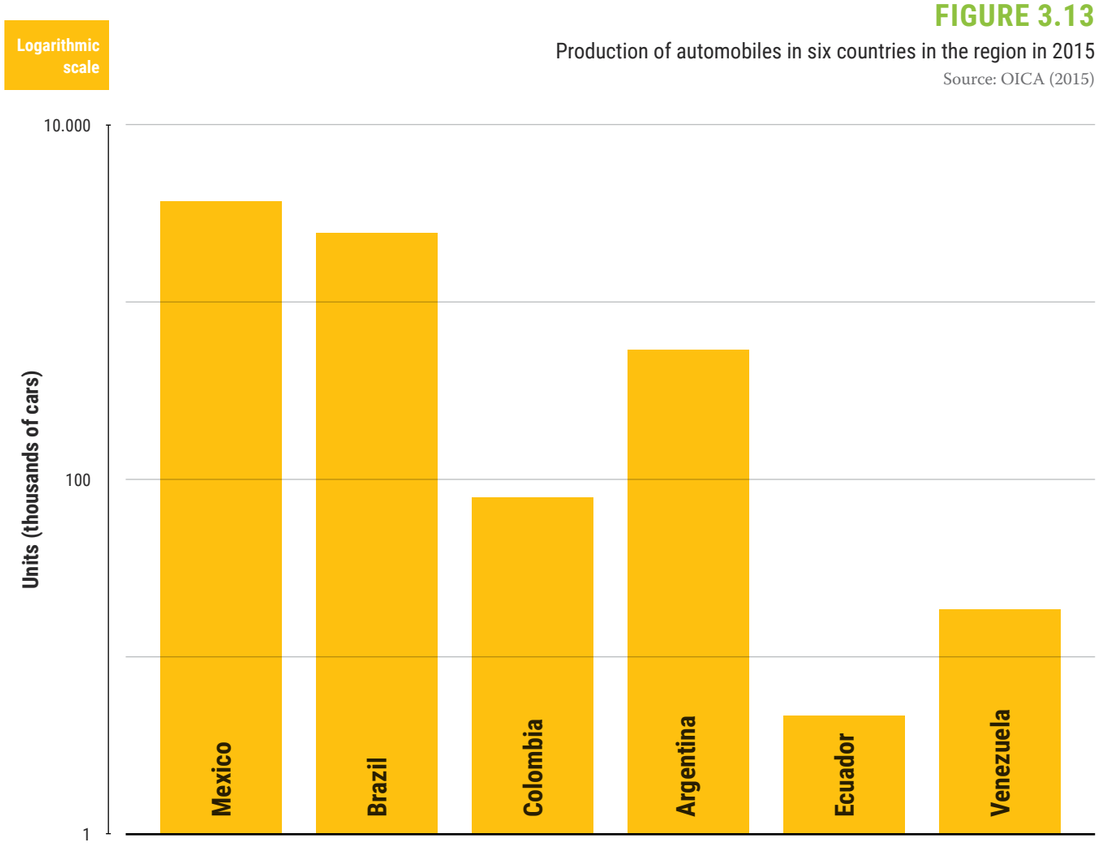
In 2012 Mexico published its Plan de Manejo de Vehículos al Final de su Vida Útil (Plan for the Management of Rnd-of-Life Vehicles) (Semarnat, 2012), which defines an ELVs as a vehicle that meets some of the following conditions: it has been destroyed in a collision; it is inoperable due to mechanical failures; its obsolescence makes it unaffordable to keep it working; or was abandoned in a public place. The Management Plan is only applicable to light vehicles (weighing under 3.5 tonnes), and its goals are:

- Avoiding environmental pollution generated by the inadequate management of this waste.
- Achieving the maximum recovery per vehicle
- Having a comprehensive management control system for ELVs, under the shared responsibility amongst stakeholders' scheme

FIGURE 3.13

Production of automobiles in six countries in the region in 2015

Source: OICA (2015)



The Plan reports the value of 837,000 vehicles for disposal for the year 2012. The ELVs generation mechanisms in Mexico involve a specific element due to the fact that it is next to the US, because, aside from the new domestically produced and imported vehicles, the country also legally receives a significant number of used automobiles (more than 10 years old) from the neighboring country, which in 2007 amounted to 1,221,144 units, and close to four million units between 2005 and 2010 (amongst the externalities inherent to this activity, it is estimated that "in the border cities of the state of Baja California, more than 85 per cent of CO emissions are attributable to imported used vehicles, whereas less than 15 per cent is attributable to national used vehicles") (Flamand y Rojas-Bracho, 2015). In addition to this are illegally imported used vehicles, for which no data are reported in the Management Plan. There are ten companies authorized to destroy ELVs in the country, and 27 reception sites.

In Uruguay, the Solid Waste Management Plan for Montevideo and the Metropolitan Area el Plan defines Out of Use Vehicles (OOSV) as "vehicles which no longer fulfil their purpose, which have been delivered to an authorized junkyard for its destruction and, therefore, have been deleted from the registry". It also includes abandoned vehicles and waste from the repair of vehicles (Republic of Uruguay. Planning and Budget Office. Division of Development Projects, 2005b). The Management Plan sets the following goals:

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- Find an environmentally sustainable system
- Ensure decontamination of OOSV in the short term in places authorized for such purpose, avoiding pollution of the soil and water
- Avoid abandonment of cars in public places
- Find the highest percentage possible of reuse and recycling for the components of OOSV
- Promote the design of vehicles that makes dismantling easy and further restrict the use of hazardous substances

The Plan estimated for the year 2015 that 33,200 OOSV would be generated in the entire country, considering all kinds of vehicles (automobiles, vans, trucks, buses and motorcycles). The projection that only included automobiles and vans was 18,000 units for 2015.

Tyres

Not being a hazardous waste per se, perhaps the most significant problem caused by the tyres used in the region is their potential for accumulating water, thus creating an environment favourable for the reproduction of vectors of diseases such as yellow fever, dengue fever, chikungunya and the Zika virus, which have surged in recent years. Because tyres are moved from one region to another, so are mosquitoes and, therefore, the diseases can be spread to places that are very far from the point of origin of the problem. The *Revised technical guidelines for the environmentally sound management of used and waste pneumatic tyres* (PNUMA, 2011) of the Basel Convention provide a detailed and thorough overview of the necessary aspects to be considered about tyres, from the point of view of the environment and human health.

As waste and lacking adequate management, tyres cause problems by accumulating in riverbeds and other places, interfering with the flow of streams and potentially causing floods. At final disposal sites for MSW, tyres pose operational problems, because they cannot be compacted, they rise to the surface, aside from occupying valuable space (mostly with air), and are not biodegradable. They represent a fire hazard in places where they are accumulated in great numbers and without control, and the combustion of tyres releases substances that are harmful to the environment and health, such as polycyclic aromatic hydrocarbons, dioxins, furans, hydrochloric acid, benzene, polychlorinated biphenyls, metals, etc. (PNUMA, 2011). Once discarded, used tyres can serve different purposes and applications. According to the above-mentioned *Technical Guidelines of the Basel Convention,* the following options for disposing of tyres are considered as environmentally sound:

- Retreading, that is, coating a worn tyre or rim with rubber again.
- Shredding of tyres at room or cryogenic temperature until a granulate is obtained, the result is a product for the industry or consumers, to be used as artificial turf, playground and sports ground surfaces, asphalt and bitumen in roads, conveyor belts, car mats, footwear, carpet underlay, roof tiles, flooring, activated carbon, etc.
- Devulcanization and reclaim, which use mechanical processes, thermal energy and chemical products to turn rubber into a state where it can be processed and vulcanized again.
- Civil engineering (in landfills, as lightweight fill and soil enforcement, for erosion control, thermal insulation, slope stabilization, etc.).
- Pyrolysis, co-processing (in industrial kilns, such as cement kilns) and co-incineration in plants for electric power generation.

Several countries in the region, such as Brazil, Chile, Colombia, Ecuador, Mexico and Uruguay have developed planes or Programs for the adequate management of this type of waste. The plan implemented in Mexico is briefly described below. In this country, the National Association of Tyre Suppliers and Renewing Plants (ANDELLAC, in Spanish), the National Association of Tyre Importers (ANILLAC, in Spanish) and the National Chamber of the Coal Industry (CNIH) published in 2013 the *Plan de manejo de neumáticos usados de desecho [Management plan for used waste tyres]* (Andellac-Anillac-CNIH, 2013), in accordance with the applicable Official Mexican Standard.

According to the above Plan, 28,900 million tyres are disposed of every year in Mexico. The Mexican tyre market is very peculiar in the region because of the proximity to the US and its close connection to the used automobile market. Aside from producing and importing new tyres, Mexico imports from the US used tyres to be placed in vehicles (1,065,000 units in 2012; 3.7 per cent of the national market), and it also imports used tyres for retreading (1,082,000 in 2012). Additionally, and as mentioned above, imported used vehicles from the US represent an uncontrolled input of tyres which very soon become waste, reaching 585,000 vehicles in 2012, which amounts to at least 2,340,000 additional tyres. This has led to the creation of joint Programs for tackling these and other types of waste on both sides of the 3,200-km border between the two countries. This two-country problem has resulted in joint workshops and seminars, as well as in the documents *Scrap Tires: Handbook on Recycling Applications and Management for the U.S. and Mexico* (USEPA, 2010), and in the so-called *Propuesta de Estrategia y Política Pública para el Manejo Integral de Llantas de Desecho en*

la Región Fronteriza [Strategy and Public Policy Proposal for the Comprehensive Management of Waste Tires in the Border Region] (COCEF, 2008).

As for the recovery and valorization of out-of-order tires in Mexico, in 2011, 2.6 per cent of energy consumption in the cement industry came from using tires as replacement for conventional fuel, which represents close to 8,360,000 tires used every year (Andellac-Anillac-CNIH, 2013). A study of GIZ estimates that the technology available in Mexico makes it possible to reach maximum theoretical levels of 40 per cent replacement of traditional fuels with used tires, which amounts to a theoretical potential for co-processing of used tires of 1,100,000 ton/year (GIZ, 2016).

Shipbreaking

A potential stream of waste in the region is represented by deep-draught ships (for cargo, containers, tanks, passengers, etc.) at the end of their useful life, which is estimated to range from 20 to 30 years (NGO, 2014). Approximately 90 per cent of the world's trade is conducted by sea (The Secretariat of the Basel Convention, s.f.b), and a significant number of ships is destined every year for disassembling or breaking, which varies depending on the demand for maritime transportation: whereas the historical average was 700 to 800 ships per year, the number decreased in the 2004 to 2008 period due to the high demand for the service (from 200 to 400 ships per year). On the other hand, due to the economic recession in 2008, there was a peak with 1,200 ships being sent for breaking up in 2009 due to the drop in the demand for maritime transport (The Secretariat of the Basel Convention, s.f.a).

The potential for recycling for a ship is higher than 95 per cent, mostly due to the high content of steel that can be used in construction and for other purposes (The Secretariat of the Basel Convention, 2012). Nevertheless, ships contain various toxic materials, such as polychlorinated biphenyls, asbestos, heavy metals, used lubricants, fuel, etc., so that the risks they pose for the environment and health are elevated when they are not dismantled under suitable conditions (The Secretariat of the Basel Convention, s.f.b).

In 2015, the number of deep-draught merchant ships dismantled around the world was 768 units. None of the countries in the region is in the list of countries where ships are dismantled, even though there are indications that this activity is carried out in the Dominican Republic, Cuba and Panama. The NGO *Shipbreaking Platform* reports in its list of ships dismantled in 2015 that a ship built in 1964 was sent to Santo Domingo. There are also newspaper articles reporting on the issue, and at least one company markets its dismantling services in Cuba and the Dominican Republic. On the other hand, there are several countries that provide ships for dismantling, with Brazil and Venezuela being the most outstanding countries[15].

3.5.7 Emerging wastes (nano-waste, biopolymers, composite materials, wind turbine generators)

Technological development and the inclusion of new materials and chemical substances used in the manufacture of various products provide them with new properties and features, which directly affects their condition as wastes when they reach the end of their useful life. Thus, the importance of considering these new waste streams so that they can be adequately managed in the region.

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Nanomaterials are an important category within new materials and products, and they are defined simply as materials containing particles with external dimensions between 1 and 100 nm (EU OSHA, s.f.). Part of the nanomaterials used in productive processes are incorporated into the waste stream as *nano-waste,* which are the *by-products, emissions or contaminants associated with nanomaterial manufacturing, use of nano-products or end-of-life components containing nanomaterials* (UNITAR, 2012). The flows of these are determined by those of conventional wastes in the activities of collection, transport, recycling, final disposal, etc.; for example, nanomaterials present in paint or concrete, insulation materials, etc., can be released especially during recycling activities or during the final disposal of CDW (EMPA, Swiss Laboratories for Materials Science and Technology, 2015).

15. Shipbreaking Platform: [www.shipbreakingplatform.org, http://www.grida.no/graphicslib/detail/shipbreaking-in-2014_8f7d].

Sanitary landfills are likely to be the final destination of nano-waste (Mueller, Nowack, Wang, Ulrich and Buha, 2012), and there still needs to be an in-depth analysis of the behavior of this stream in conventional waste management and treatment facilities (incineration, recycling, final disposal, etc.), as well as the effects on microbial degradation (composting or biogas), or their potential for penetrating watertight barriers in sanitary landfills or for entering the biogas, as well as the health and environmental risks associated to the management of this type of waste (Mueller *et al.*, 2012). It is desirable for countries to gradually incorporate into their waste management Programs those from this specific stream, for the purpose of avoiding environmental risks and, in particular, risks to the human health.

An additional, relatively recent material is made up by *bio-polymers;* which are polymers produced by a living being (such as cellulose), or synthesized in a laboratory from biogenic materials, not from hydrocarbons (petroleum or gas). Some of them have been manufactured for the purpose of replacing certain kinds of plastics, such as polyethylene, polypropylene, PET, etc., and other synthetic bioplastics such as PLA, polyamide, etc., manufactured from vegetable materials such as corn starch, soybean oil, etc. They are used in the manufacture of disposable products such as plates, cups, etc. (Chen and Patel, 2012), and in non-disposable products such as mobile phone cases, automobile parts, etc. (Suszkiw, 2005). The most advertised advantage of these materials is their capacity to biodegrade and being compostable materials ; the disadvantage is that they are more expensive. It is important to note that not all bioplastics are biodegradable, a UNEP article reports that PLAs are degradable only when subjected to high temperatures in industrial settings (UNEP, 2015).

According to Johnson (2017), a *composite material* is made up by two or more materials combined for the purpose of obtaining a product with superior characteristics. New composite materials have been developed using, in general, a structural fibre and a binder (e.g., plastic, resin), such as fiberglass, and other much stronger materials which incorporate carbon fibres in their composition. Resins applied to fiberglass are not biodegradable. Other treatment methods, such as grinding for reusing ground fiberglass as an admixture in concrete to improve its properties, especially in cold areas, have been researched. It has also been used with other recycled products such as plastic wood, asphalt, waterproof coatings, recycled tire products, etc.

New materials also have multiple applications in the field of renewable energies. In the specific case of wind turbines, the number installed and in operation has increased significantly in the region in recent years, for the crucial general goal of mitigating GHG emissions and reducing costs by lowering the prices of new technologies, amongst which is harnessing the energy of the wind. The drawbacks of this technological alternative include the fact that a few years ago an unclear space for the decommissioning phase of these equipment within their life cycle was detected, so it is important to pay attention to this sector as a potential generator of waste in the region, since at the current rate of expansion, estimations indicate that by 2050, a third of the global electrical energy requirements will be covered with wind-based energy (National Geographic, s.f.).

The management options available at the end of the useful life of wind powered generators consist of:

1. Second-hand sale for reuse in other sites
2. Restoration/repowering to extend the lifespan in the original site
3. Rebuilding and reuse of components. Recycling
4. Sanitary landfill (Welstead, Hirst, Keogh, Robb y Bainsfair, s.f.), although this last option is not valid anymore in some countries like Germany , due to the high carbon content of some parts (Schmidl, s.f.).

Even though some elements of wind turbines are manufactured with materials that can be recycled via conventional methods, some incorporate composite materials such as fiberglass /carbon reinforced with resin in the blades, or rare earth metals in magnets. In European countries, alternative treatment options consist of thermal processes such as pyrolysis and co-processing in cement kilns (Andersen *et al.*, 2014). For the latter, the recoverable thermal energy content is 14 MJ/kg, that is, approximately half of the content corresponding to carbon (anthracite). Aside from energy recovery, the ashes from the blades are incorporated into the clinker matrix during the cement production process in the kiln (Schmidl, s.f.).

3.5.8 Disaster waste (emergencies)

PAHO defines a natural disaster as *the occurrence of a natural phenomenon in a limited space and time that disrupts normal patterns of life, causing human, material, and economic loss, and environmental damage. And adds: it is an ecological event of such magnitude that requires external intervention to manage its effects* (CEPIS-OPS, 2003). Because of its geographic location and characteristics, the region is particularly vulnerable to natural phenomena such as floods, cyclones, droughts, earthquakes, landslides and volcanic eruptions. The occurrence of these events results in the generation of a significant volume of various types of waste, depending on the intensity of the phenomenon and the affected area. The lack of adequate emergency plans can make the aftermath very complicated. It is usually authorities who are in charge of handling the management of debris and waste, yet the occurrence of a disaster frequently disables the infrastructure used regularly for managing waste, and the capacity to respond of authorities is overwhelmed.

Even though the frequency of natural phenomena in the region in the past ten years has been decreasing, there is an upward trend since 1970; from that year and up to 2011, the main cause of natural disasters in Mesoamerica and South America was flooding, while in the Caribbean and Mexico it was hurricanes (UNEP, 2016). There are other natural phenomena which take place less frequently, such as earthquakes, volcanic activity and landslides; **TABLE 3.2** shows the occurrence of disasters per sub-region and type of event in the 1970-2011 period, in percentages.

The types of waste generated will depend, to a large extent, on the nature of the natural phenomenon. While an earthquake produces large volumes of rubble, flooding produces less rubble but larger amounts of household waste mixed with mud, sand and gravel, and possibly hazardous materials (UNDP, s.f.). The main types of waste consist of damaged buildings, bushes, remnants of private property, ashes and wood, soil sediments, as well as animal and human corpses (CEPIS-PAHO, 2003). During the tasks carried out in the aftermath of a disaster, it is important to differentiate an immediate response stage for the removal of rubble and waste for humanitarian purposes, with the imperative of providing immediate care to the affected population. Afterwards, there is a second stage called waste management consisting of activities carried out in the medium and long terms (CEPIS-PAHO, 2003).

Several organizations have prepared manuals or guidelines for waste management in case of disasters or emergencies, such as the Disaster Waste Management Guidelines published by OCHA/UNEP and the Swedish Civil Contingencies Agency (OCHA-MSB-UNEP, 2011). In the region, PAHO prepared in 2003 the document *Gestión de residuos sólidos en situación de desastres [Solid waste management in disaster situations]* (CEPIS-PAHO, 2003) that incorporates the regional experience accumulated after the occurrence of various kinds of natural phenomena, which have affected populations in the region in recent decades. **TABLE 3.3** provides waste generation amounts for times of disaster.

TABLE 3.2

Disasters per region and type of causal event, 1970-2011 (%)

Source: adapted from UNEP (2016)

Type	Event	Mexico	Central America	Caribbean	South America
Geological	Earthquakes	12.2	11.5	2.4	9.8
	Landslides	5.1	4.4	1.2	13.4
	Volcanic eruptions	4.1	5.2	2	3.7
	Total	21.4	21.1	5.6	26.9
Hydro-meteorological	Hurricanes and storms	38.1	23	57.9	8.1
	Floods	27.9	38.3	27.6	45.9
	Droughts	3.6	7.1	4.9	5.7
	Extreme temperatures	7.6	1.4	0.0	5.0
	Total	77.2	69.8	90.4	64.7
Biological	Epidemics and plagues	1.5	9.3	3.9	8.4

TABLE 3.3

Waste generation indicators after a natural disaster

Source: CEPIS-OPS (2003)

Size of the population or human settlement	Indicator
Small cities, rural areas, shelters, hostels and camps	200 to 400 grams per person/day (indicator used after the passage of hurricane Mitch in Nicaragua, in October and November of 1998)
Cities or larger villages	2 to 4 m^3 of waste per day/thousand people (equivalent to 300 to 600 grams per person)

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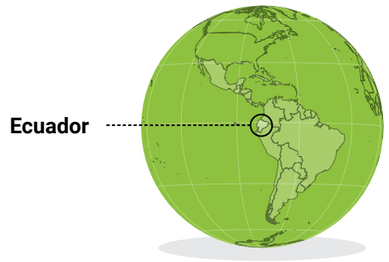
Debris removal after the earthquake. Portoviejo, Ecuador.

Case Study 6

Disaster waste. Earthquake in April 2016, Ecuador

Contribution from Lorena Tapia and Raquel Lejtreger



On April 16, 2016, a Richter magnitude 7.8 earthquake struck the provinces of Manabi and Esmeraldas in the North of Ecuador, killing 663 people and causing damage to more than 24,000 houses, buildings, schools, health-care facilities, amongst others.

Waste management issues

Before the occurrence of the natural phenomenon, solid waste disposal in the most affected districts was precarious, with 12 using uncontrolled dump-sites for final disposal, 2 districts having controlled dumpsites, 1 district operates a ground-level cell and another one has an open dumpsite.

Generation and disposal of debris

The generation of large amounts of debris is to be expected in an event like this. Activities to remove debris, clear structures to look for survivors and demolish constructions to look for victims began immediately after the earthquake and then, finally, the evacuation and cleaning of collapsed buildings took place. Eleven locations in eight districts were designated for the final disposal of debris and authorized by the authorities of each district of the province of Manabi, with a total capacity of 2,370,000 m^3.

Most of the affected cities have basic waste management systems, waste collection and cleaning services, and a precarious disposal system; many of them received support from other cities. During the first few days of the emergency, medical waste was disposed of in dumps and ground-level cells next to dumps, after which collection routes were planned in the districts of the province of Manabi. Hospital care, as well as other services, was provided in 190,000 instances to citizens in shelters, which gives an idea of the extent of medical and biohazardous waste generated.

As for the hazardous wastes that are part of the electrical transformers damaged in the earthquake, they were removed by the local electricity distribution company. In the post-event phase, several actions started on the fourth day after the earthquake in order to prevent cases and/or outbreaks of communicable diseases, such as epidemiological surveillance in hostels and shelters, immunizations through a regular vaccination Program and emergency vaccination, vector control, amongst others

Additional generation of waste

The dynamic of the generation of all kinds of solid wastes was altered in all of the affected populations. Displaced people concentrated in hostels, which became waste generation centres themselves; the enormous presence of police officers, the military, doctors and volunteers increased the generation of waste. It is also important to take into account the waste generated by humanitarian aid, which mostly arrives in small metal and plastic containers suitable for putting individual kits together.

Some noteworthy cases

Due to the emergency situation, debris were placed at ground level in the city of Manta for the first 15 days after the catastrophe in a site adjacent to one of the beaches of the city and close to populated areas. This location was chosen precisely because it was close and the environmental risks were not taken into account at that time, given the rush of the emergency. The Minister of Environment carried out an inspection and set a 10-day term for vacating the site and moving the debris to a location away from the city. The great amount of dust, the chaotic presence of approximately 500 informal waste pickers, combined with the potential pollution of sea water, are all clear effects of the lack of contingency plans for this kind of natural disaster.

3.5.9 Food waste

Approximately one third of the total food produced for human consumption –equivalent to 1.3 billion tonnes– is lost or wasted annually (Lipinski *et al.*, 2013). In the region, losses can be found in different links of the corresponding food value chain: 28 per cent occurs at production; 28 per cent at consumption, 22 per cent during handling and storage, 17 per cent in the market and during distribution and, finally, 6 per cent during processing, as shown in **FIGURE 3.14**.

About 56 per cent of total losses occur in developed countries and the rest (44 per cent) in developing countries (The World Bank Group, 2014). In general, whereas losses in developed countries are more frequent at the retail and consumption stages, in developing countries losses take place during production, storage, processing, distribution and marketing. At the regional scale, LAC reports the lowest rate of food loss in the world, accounting for only 6 per cent of global loss **(FIGURE 3.15)**. However, a considerable 15 per cent of the food available at the regional level is lost or wasted every year, for each country it can be very variable, as is the case of Mexico where losses reach 37 per cent of the food produced in the country (approximately 30 thousand tonnes a day)[16].

There are other negative impacts derived from this waste: an estimated 3,300 to 5,600 million tonnes of CO_2e were emitted in 2009 globally during the production of that food. Approximately 173,000 million m3 of water are wasted during the production of that food (24 per cent of the water used in global agriculture) every year in an area of 198 million hectares, equivalent to the area of Mexico. Moreover, 28 million tonnes of fertilizer are used and wasted growing this food .

For the dual purpose of reducing food losses and dealing with the hunger problem, several countries in the region have been working for several years on the idea of food banks. Food banks are *"not-for-profit, solidarity organizations that contribute to reducing hunger and malnutrition in the world. In order to achieve this, they receive surplus food from stores, companies or individuals, to be distributed amongst the population in need"* (ABAC, s.f.). Globally, *The Global Food Banking Network* has worked to create food banks around the world, and currently has a network which includes more than 33 countries, 15 of which are in the region: Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay and Peru[17].

> Approximately one third of the total food produced for human consumption –equivalent to 1.3 billion tonnes– is lost or wasted annually.

16. Food Banks in Mexico: [http://bancosdealimentos.org.mx].
17. [https://www.foodbanking.org/food-bank-resources/global-food-bank-community].

FIGURE 3.14

Food loss and waste in LAC by stage in the food chain

Source: FAO (2014)

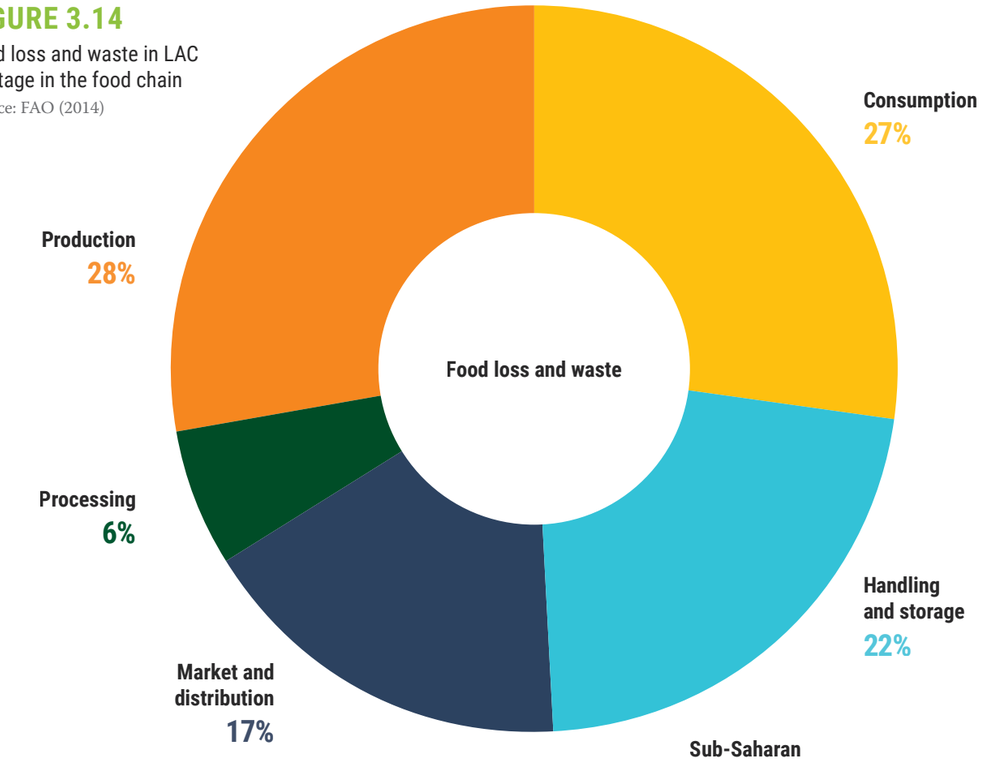
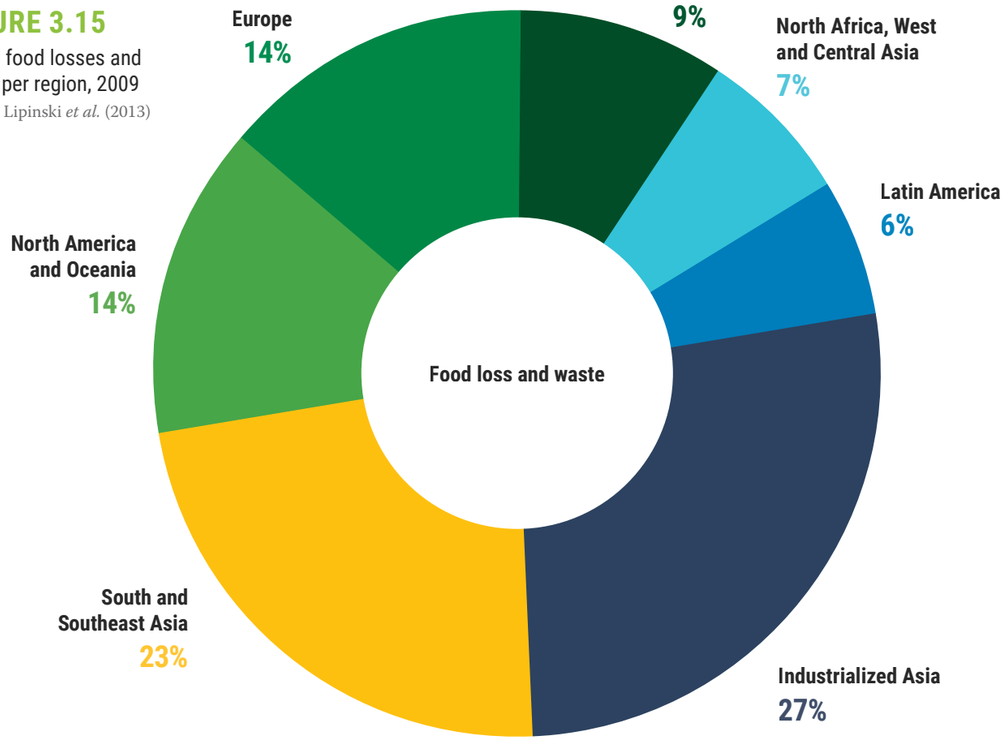


FIGURE 3.15

Global food losses and waste per region, 2009

Source: Lipinski *et al.* (2013)



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3.5.10 Marine litter

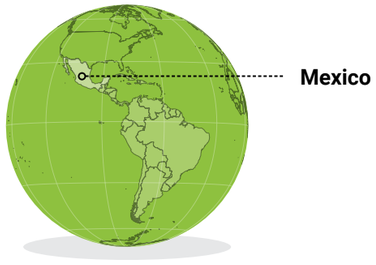
Seas and oceans have traditionally been recipient of all kinds of waste, receiving both continental and ocean discharges; despite treaties and agreements, their current pollution level requires urgent actions to control and revert the situation of seas and oceans. The UN defines marine litter as "any persistent, manufactured or processed solid material discarded, disposed of, or abandoned in the marine and coastal environment. Marine litter consists of items that have been made or used by people and deliberately discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or winds; or accidentally lost, including material lost at sea in bad weather" (UN Environment, s.f.a).

Plastic is the material most frequently found in coasts and marine environment globally (STAP, 2011), due to its increasing production and its physical and chemical characteristics; it has accumulated in large vortexes such as the one in front of the coasts of Chile. Plastic not only affects marine life when it gets tangled in ropes

Case Study 7

The Food for All Program in Mexico

Document prepared by Mariana Jiménez, APT



Alimento para Todos (APT, Food for All) is an institution of private assistance created in Mexico City in 1994 under the food bank model. It supports organized groups of people by focusing on contributing to the reduction of food insecurity by a weekly delivery of balanced food packages to over 32 thousand people, based on the Comprehensive Model of Food Care, which is based on a Food Care Program and a Comprehensive Education Program to instil healthy eating habits.

Most rescued food comes from donations of the City of Mexico Supply Centre traders, the largest Latin American wholesaler, where 25% of the city food is wasted, of companies from the food industries and more than 240 self-service stores. This food is selected and sorted for delivery in decent conditions with the help of 40 volunteers, which are engaged in this work every day in the APT stores putting together food packages.

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Commitments

- To gather donated food suitable for human use, making it the logistical and fiscal process of loss and excess destruction easier for the donor, thus reducing storage and transportation costs.
- To select the food that is in apt conditions for use, to dignify that which can be used but has damaged packaging.
- To sort the food according to its nutrition characteristic in order to make the conformation and nutritional balanced of the food packages more available.
- To put together food packages based on the needs of the population and supplies in stores and delivery to representatives of the communities, children's homes, hospitals, etc.
- To issue tax-deductible receipts for their donors and render accounts monthly by reports specifying the application of each of the donations received.
- To systematize their processes by means of an efficient and effective management system which allows, not only knowing the characteristics of the population served, having an optimum control of stores, gathering routes of the donations, but also ensuring traceability of the donated product ensuring the donor they can know at any time who the donated product was donated to.

Challenges and areas of opportunity

A significant challenge is the difficulty the main players of the food industry face when channelling excesses and losses which are still apt for consumption, to the food banks. In 1996, APT promoted an initiative to create the Altruistic Food Donation Federal Law, for the purpose of establishing a framework that facilitates the job of the food banks. Said initiative was transformed in an attempt to create the Popular Food Supply Law which, ultimately, did not thrive. However, as a result, in 1998 the Mexican Official Rule for Food Assistance to Risk Groups was published, according to which the responsibility for the quality and good condition of the food delivered to recipients is placed on banks and not on the donors. Furthermore, in January 2001 said responsibility was also embodied in the General Health Law.

Likewise, tax aspects of food donation which APT had also put forward has been covered by the Income Tax Law since 2003. All of the important items of this initiative have been taken up again by the laws for the altruistic food donation rolled out in six states of the country.

Alimento para todos in numbers

- In 2015, 9,500 tonnes of food and basic subsistence goods were rescued to be delivered to over 32 thousand recipients in the city of Mexico and suburban area.
- With this, the emission of 11,400 tonnes of CO_2e was avoided.
- 1,397,000 food packages were delivered to people in food insecurity.
- 3,659 tonnes of vegetables and fruit were rescued from the Supply Center.
- 2,252 tonnes of food were rescued from the Food Industry.
- 4,022 tonnes of food were rescued in self-service and convenience stores.
- 11,313 volunteers provided their support in selecting and dignifying the rescued food.

The future of *Alimento para Todos*

Hand in hand with its main allies, ATP is growing and becoming an increasingly consolidated institution. It has become a sustainable and constantly growing institution. This allows the establishment of new strategies to rescue even more disused food and products that may be useful to improve the quality of life of their recipients and serve even more people in need. In 2017, the goal is to rescue 12,000 tonnes of food apt for human consumption and other disused basic maintenance goods, almost more 3,000 than what was rescued in 2016. This means that ATP will be able to serve 4 thousand people more and a decrease of 14,400 tonnes of CO_2e.

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and fishing nets, but also when it is ingested, as animals often confuse plastic with food. Although plastics are generally inert, they can contain additives or absorb toxic compounds existing in sea water (PCBs and other POPs) (Zalasiewicz *et al.*, 2016). Micro-plastics also have an impact; they can be produced in the same size, or may be formed after degrading upon exposure to abrasion and UV light.

The presence of 5,000 pieces/km2 of plastic has been reported in the ocean at a distance of around 1,000 km from the coast of Chile, and near the Easter Island this value reaches a value of 50,000 pieces/km^2 (Eriksen *et al.*, 2013). Another survey (Cózar *et al.,* 2014) reports a load of plastic waste of 1.7 to 5.4 kt in the South Atlantic, with a mean of 2.6kt. For the South Pacific, values range from 0.8 to 5.6 kt, with an average value of 2.1kt; the most significant source of plastic contribution in the southeast region of this area (EPS, plastic bags, food bags of salmon farms) were the aquaculture-related activities (Eriksen *et al.*, 2013). Whilst in the Caribbean the five materials with the greatest presence in annual campaigns of marine litter collection in 2006-2012 were: plastic drink bottles (19.6%), plastic and paper bags (16.9%), caps and tops (11.4%), utensils, dishes and glasses (9.6%), and drink glass bottles (6.7%) (UNEP, 2014).

Polymers that biodegrade in terrestrial conditions also degrade in sea water; the difference is in that the degradation is much slower in the marine environment. The has led to the conclusion that biodegradable plastics will not make a great difference in the reduction of marine litter (GPA, 2015). Fortunately, there are currently a large number of Programs for the protection of the marine environment and prevention of marine wastes, such as the UNEP Regional Seas Program (UN Environment, s.f.b). The south west Atlantic, that is, the area opposite the coasts of Brazil, Uruguay and Argentina is not amongst the 18 envisaged sea regions (or regional seas) (UNEP, 2009). Another important organization is *The Global Partnership on Marine Litter* (GPML), dependent on the UNEP Global Program of Action, which emerged as part of Rio+20 in 2012.

3.6

Generation and management of leachates from sanitary landfill

According to the World's Water Quality Assessment (cited in UNEP, 2016), *around 25% of the sections of the rivers in the region can be catalogued as severely polluted, which implies the existence of 25 million inhabitants of rural areas in touch with polluted surface waters. Although there are some advances in the achievement of better welfare conditions, it is evident that these often take place to the expense of the natural environment, this along with the fact that the production and consumption patterns in the region are not precisely sustainable.*

Waste treatment and final disposal operations imply the potential generation of liquid discharges in recycling and waste treatment premises, as well as final disposal. In this section, special focus is placed on these premises, due to the potential pollutant of the leachates that are often discharged to the floor or receiving bodies with no treatment and in inadequate form.

The volume of leachate generation in sanitary landfills of the region is practically not available. As a general rule, this information must be considered and provided by the application of a model that allows obtaining the required data to the corresponding authorities in the process of authorization for building and operating a sanitary landfill. However, on the one hand, the volume of leachate generation depends on the local weather conditions and the building and operational characteristics of the site. On the other hand, measuring the leachate flow can be a difficult task depending on the conditions and characteristics of each site. In this regard, there is data from some of the sanitary landfills in the region, which may be seen in **TABLE 3.4** below.

TABLE 3.4
Generation of leachate in sanitary landfills of the region

Sanitary landfill	Litres/second
Hasar's, Zapopan, Jalisco, Mexico (Methane to Markets, 2010)	**1.7**
Relleno Norte III CEAMSE, Argentina (Johannessen and Boyer, 1999)	**1.7**
Doña Juana, Colombia (SCS Engineers, 2007)	**2.5**
Pichacay, Ecuador (Inga and Romero, 2011)	**1.2**
Nejapa, El Salvador (MIDES SEM de CV, 2008)	**1.96**

A frequent practise consists in collecting leachates for treatment in evaporation ponds located within the limits of the site, a practise that is not very functional in places that record heavy rainfalls. Another practise consists in recirculating and scattering the generated leachate in the work front, so that the humidity content is gradually reduced in this operation. In these cases, leachates are not purified but the pollutants present therein are concentrated, although the total volume can be reduced upon evaporation of the water contained in them.

There are cases in which leachates are processed differently, by treatment premises which incorporate processes that allow the removal of significant percentages of the existing components. In the CEAMSE Complexes in the metropolitan area of Buenos Aires, leachates are treated in a biological process, followed by another physical-chemical one, before they are discharged into the water bodies once the permissible maximum limits of pollutants have been reached. The Northern Environmental Complex has a more advanced removal technology, which consists of an ultrafiltration and nanofiltration (UF/NF) membrane, with an efficacy rate of 85% removal of pollutants. The capacity of treatment of the Ensenada Environmental Complex is 200 m^3/d, and the capacity of treatment of Gonzalez Catan Environmental Complex is 10,000 m^3/month, with a 15,000 m^3/month expected extension. These capacities allow an idea of the volumes generated in the different CEAMSE Complexes (CEAMSE, 2012).

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3.7 Atmospheric emissions from MSW management

According to the GEO6, waste and sanitary landfills, as well as biomass burning, are amongst the largest air pollution sources in Latin America. Particularly, it establishes that "attention should be given to waste burning considering the new chemicals that can be released by these practises, which unfortunately are still more common in the entire region" (UNEP, 2016).

Operations involved in waste management generate discharges to the atmosphere during their various phases, which are emitted in various sources depending on the premises or operated equipment. **FIGURE 3.16** shows potential emissions to the atmosphere during the different stages of MSW management.

Black carbon (BC) is added to the greenhouse gasses emitted by MSW management in the region. Deemed to be a short-lived climate pollutant (SLCP), BC is comprised of particles, generally produced by combustion. The Regional Action Plan on Atmospheric Pollution for Latin America and the Caribbean established in 2014 that waste burning in garbage dumps is one of the most significant sources of black carbon in the region, and it presumes these sources are rejected or underestimated in the corresponding inventories (UNEP/LAC-IGWG.XIX/7, 2014). Likewise, there is also a significant contribution of persistent organic pollutants (POPs) in the emissions to the atmosphere generated by MSW burning, particularly chlorinated dioxins (PCDDs) and furans (PCDF). The regional situation is briefly reviewed in relation to these emissions that take place in garbage dumps, as this practise is not done in sanitary landfills (see Annex 1 for a summary of the differences between these sites).

3.7.1 Greenhouse pollutant emissions due to waste management

The importance that the waste sector represents globally in greenhouse gas and compound emission was described in chapter 1; in this section, the aspects are reviewed regionally. MSW final disposal sites are ranked third in the methane anthropogenic emission sources, which is equal to around 11% of the total global emissions for this gas (Climate & Clean Air Coalition, s.f.). At a regional scale, contributions of GHG of all sectors are between 5 and 10% (CCAC Secretariat, 2016; UNEP, 2016), of GHG global emissions, despite some countries of the region reporting significant efforts that are translated into a reduction of emissions due to an increasing use of alternative energies.

However, on an individual country basis, and as an example, it is estimated that wastes are the source of 36% of methane emissions in Peru (UNEP, 2016). Paradoxically, the advances registered in the region by achieving a final disposal of a major fraction of MSW in more appropriate premises (sanitary landfills), have probably resulted in the increase of methane emissions as there are more favourable conditions for the anaerobic degradation in a sanitary landfill, than in an open dumpsite, this does not mean that a dumpsite is preferable over a sanitary landfill.

FIGURE 3.17 shows the percentage accounted for by methane emissions in the waste sector in several countries, as compared to the total emissions of the gas mentioned. Only the contributions of the waste final disposal subcategory have been taken, which is the most representative of the sector for this GHG. It should be noted that the reported years are also different and correspond to the year in which the latest Communication for each country was published.

Other activities such as transportation, transfer, waste compaction, etc., are complementary sources of climate pollutant emission, particularly carbon dioxide and black carbon, due to the operation of internal combustion engines in the noted equipment. Nevertheless, these activities are considered within the transportation rather than waste sector.

3.7.2 Nationally Appropriate Mitigation Actions (NAMA)

A NAMA can be understood as a set of voluntary actions (political, regulations, Programs, incentives, etc.) conducive to the reduction of GHG emissions in a certain country, actions that must be placed in the context of sustainable development, and must be measurable, reportable and verifiable. Furthermore, they must be supported and backed with financing, technology transfer and development of capacities (Mendieta, 2013).

Several countries in the region have developed waste-related NAMAs (along with many other fields). In the Global NAMA Finance Summit held in Copenhagen in May 2013, Costa Rica, Chile, Colombia, Peru and Dominican Republic presented the corresponding municipal solid waste proposals (except Chile, which also included organic industrial waste) (CCAP, 2013). *Other countries of the region who have also prepared NAMA proposals are Argentina and Mexico, amongst others.*

FIGURE 3.16

Simplified MSW management scheme and emissions to the atmosphere

Source: Amended figure of UNEP-GWMO, based on Natalia Reyna's adaptation of the original figure created by USEPA.

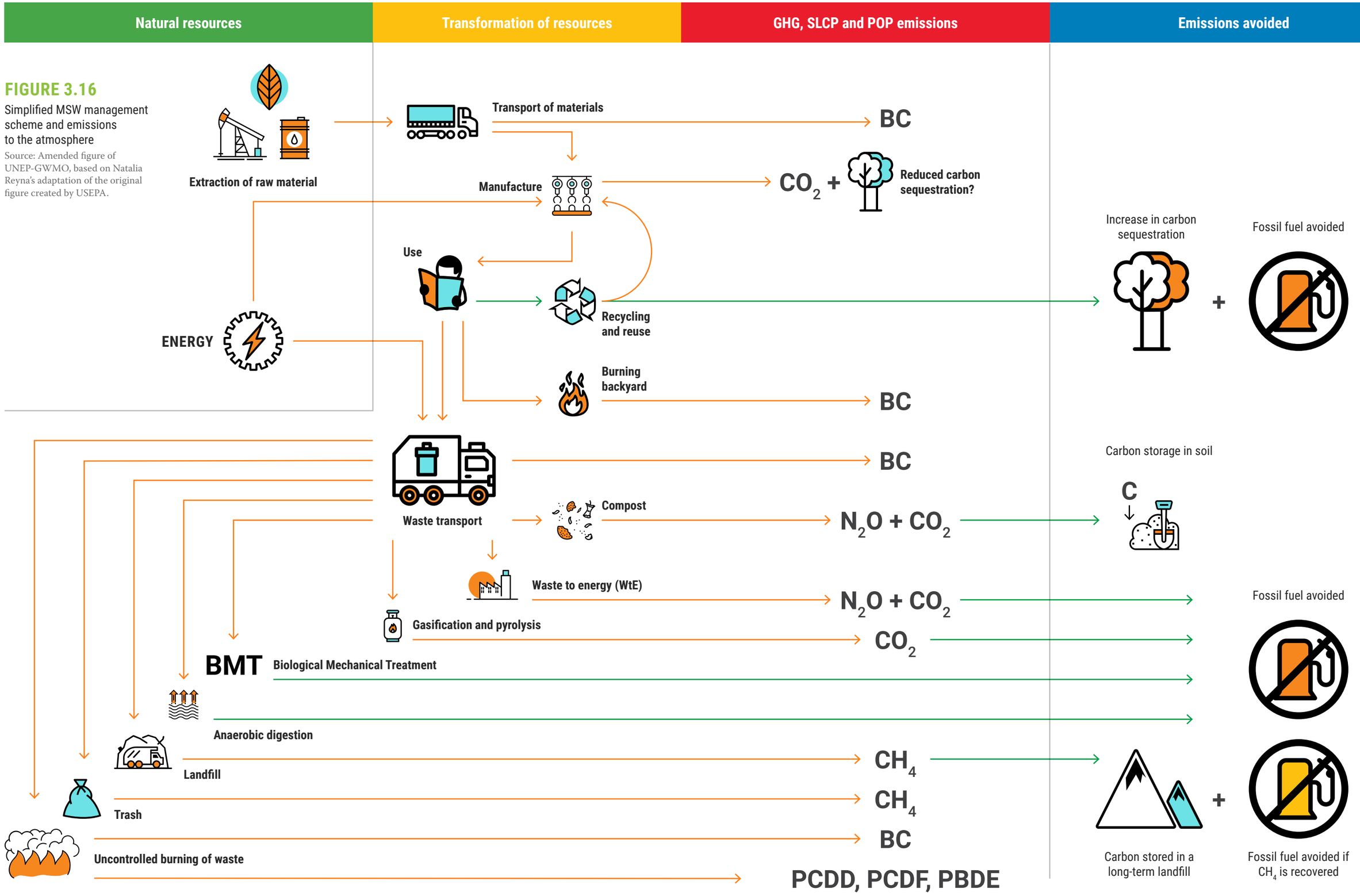


FIGURE 3.17

Share in methane emissions due to the disposal of MSW in total methane emissions by country

Source: National Communications before the UNFCCC.

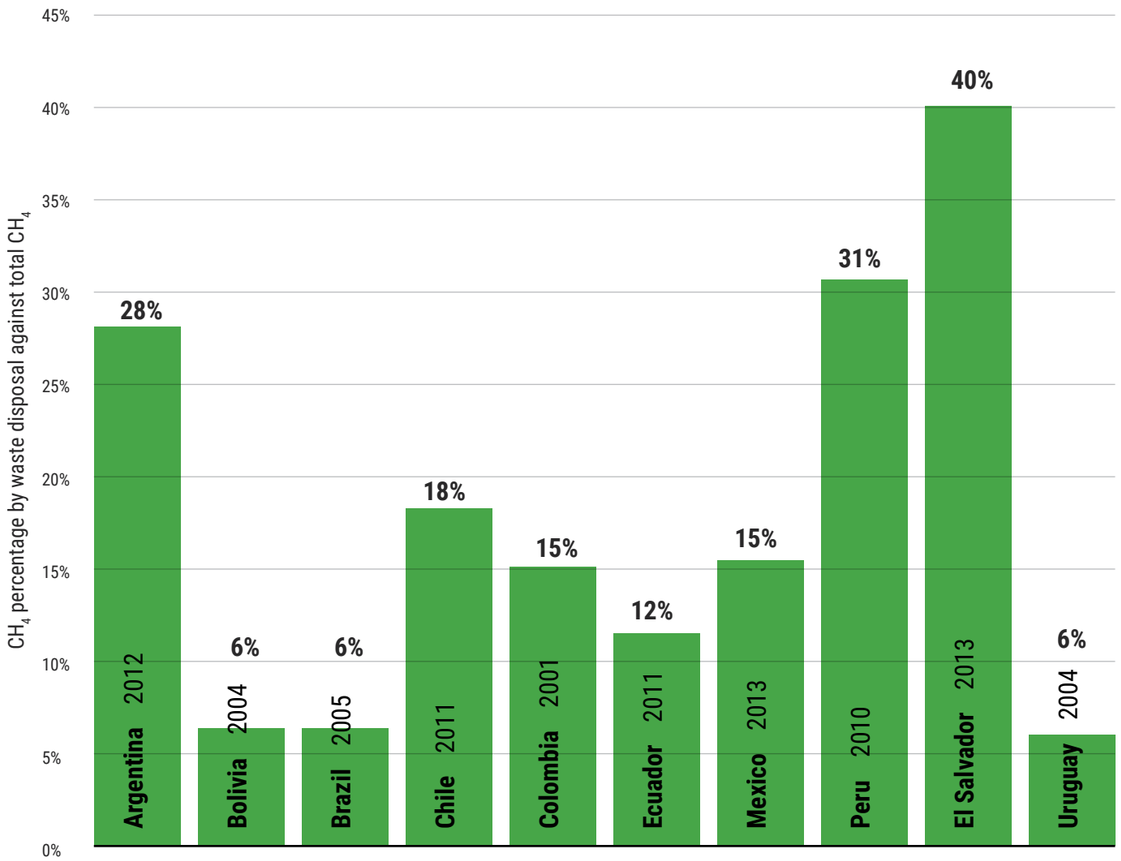
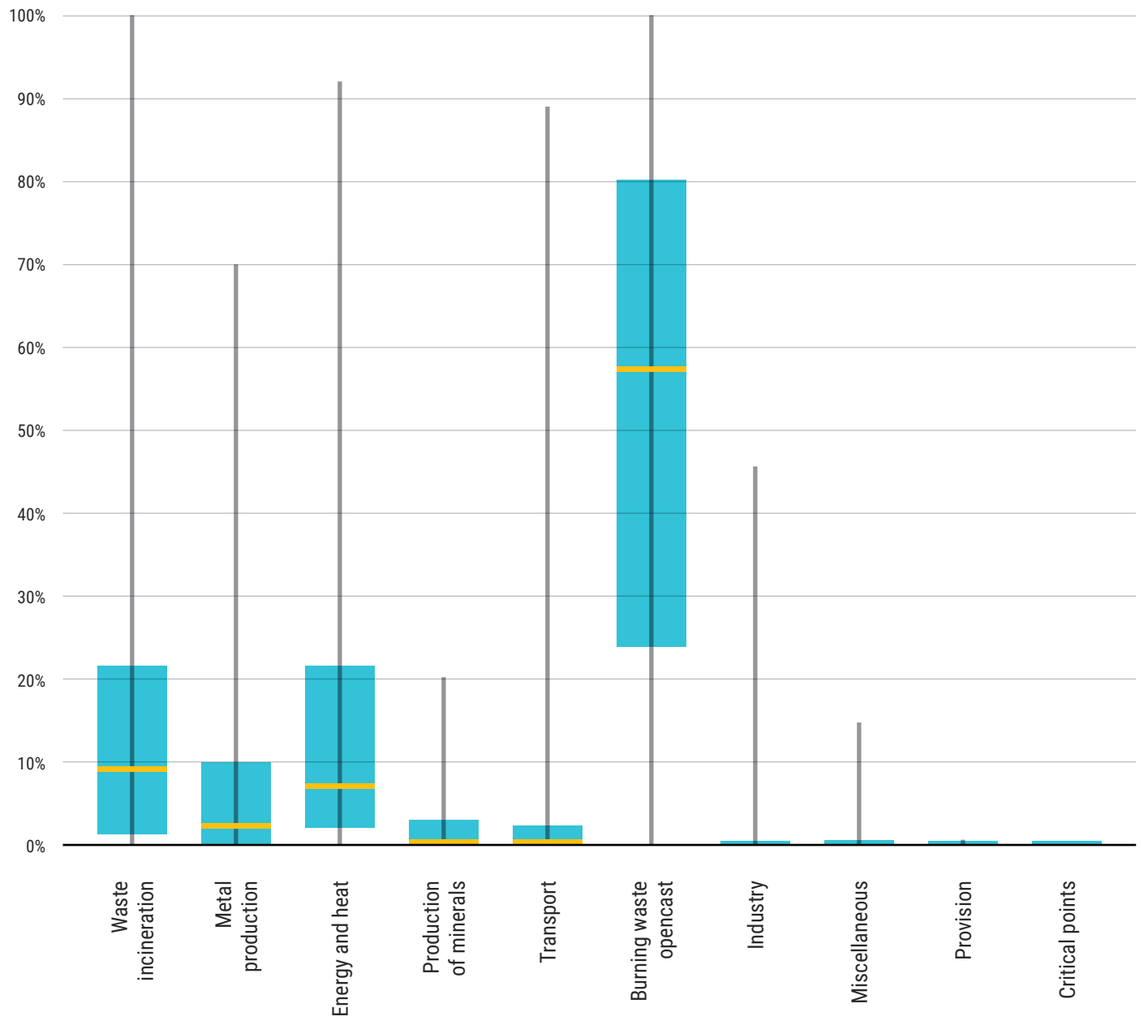


FIGURE 3.18

Contributions of the eight main categories of PCDD/PCDF emissions in national inventories of releases to the atmosphere of 86 countries

Source: Fiedler (2015)



3.7.3 Persistent organic pollutant (POPs) releases to the atmosphere

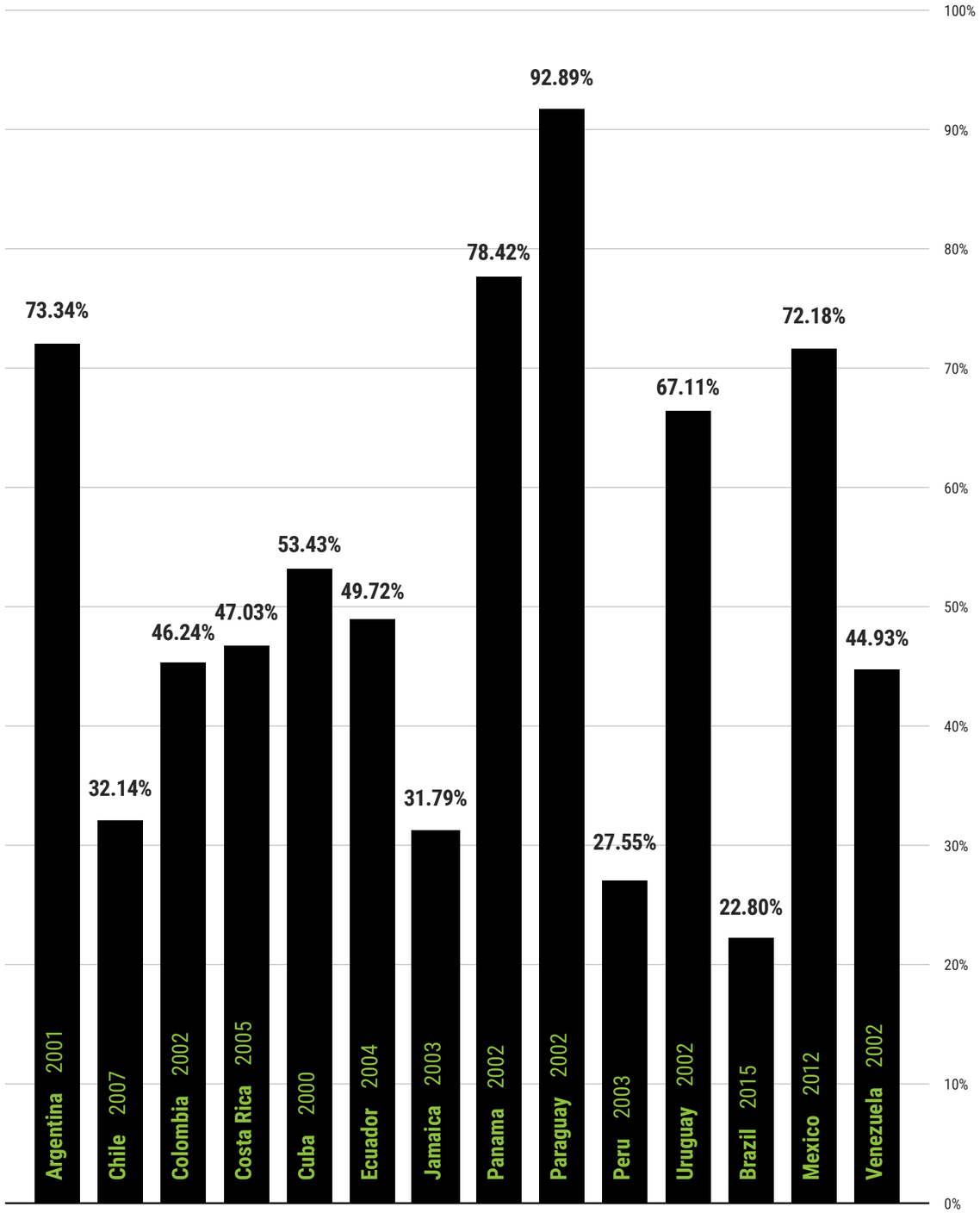
According to the World Bank (2011), MSW burning in dumpsites prevails in the region, and it is also used as a means of disposal in areas which lack proper collection services, thus forming important dioxin and furan sources. The UNEP's Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases concluded with one of the categories to be assessed by the Parties to the Stockholm Convention to Category 6 (Uncontrolled combustion processes), which includes MSW burning, an important source of PCDD/PCDF emission to the atmosphere in countries where this practise is carried out (UNEP-IOMC, 2010). FIGURE 3.18 shows that waste and biomass uncontrolled burning, of said category 6 (Air 6 in the graph) is the most important release source of these compounds to the air on a sample of 86 countries.

Emission and release inventories of these compounds have been prepared in the region, and in FIGURE 3.19 the percentage represented by PCDD/PCDF generation is shown in twelve of the countries of the region for the category of uncontrolled burning processes, with respect to the total of emissions released into the atmosphere (Maíz and Morales, 2012).

FIGURE 3.19

Share in uncontrolled waste burning in the total of POPs emissions by country

Source: Maíz and Morales (2012)



Box 3.2

Climate and Clean Air Coalition (CCAC)

As of May 2016, seven countries of the region are partner states of the Climate and Clean Air Coalition (CCAC), a voluntary alliance created in 2010 that links government, inter-governmental organizations, to the civil society and private sector in the first global effort to reduce short-lived climate pollutants (SLCPs- methane, black carbon and HFCs). The Coalition has eleven high-impact initiatives, one of which directly addresses the problem of MSW: mitigation of SLCPs from municipal solid waste, by which the CCAC supports the cities in the following aspects:

- Opportunities to identify and quantify SLCP emissions of the waste sector.
- Opportunities of direct technical assistance in projects, policies and capacity strengthening.
- Platforms for the exchange of knowledge and experiences with adjacent cities, including the membership in a solid global network of cities.
- Strengthening of links with reference frameworks of national policies and financing.
- Global recognition of the actions of the cities in the improvement of waste management and emission reduction.

In May 2016, the following cities were in different phases of project implementation supported by the CCAC:

- Letter of intent: Barranquilla, Colombia; Viña del Mar, Chile.
- Development of the Action Plan: Sao Paulo, Brazil.
- Development of Work Plan: Cali, Colombia; Concepción, Chile, and Rio de Janeiro, Brazil.

4 Waste management governance

Waste management governance comprises several interrelated factors and drivers which are vital to the results of management, of which environmental policy and management tools play a major role. This chapter showcases different regulatory, economic and social instruments, including examples of their application, and explains the diversity of players and their current and prospective roles.

We approach the political and institutional characteristics of the region and strategic planning (4.1), we analyse the region's regulation trends as well as its main characteristics (4.2) and the challenge its application and compliance implies (43). The economic (4.4) and social (4.5) instruments are discussed below, followed by considerations on the diversity of governance-related players (4.6), and especially, the role of governments (4.7). The conclusions and lessons learned are presented in chapter 6.

4.1 Introduction

4.1.1 Introduction to waste management governance

Environmental Governance has been defined by the United Nations Environment Programme (UN Environment) as *"the set of processes and institutions, both formal and informal, and including rules and values, behaviors and organizational modes, through which citizens, organizations and social movements as well as the various stakeholders, articulate their interests, mediate their differences and exercise their rights and obligations in connection with access and use of natural resources".*

The concept renders the idea of a system or gear, i.e., a set of elements which are related and work in an articulated manner under certain guidelines, and which are there to contribute to the achievement of a certain goal. If any of those elements is missing, faulty or not performing its function, the system itself will be at risk as well as the achievement of the intended goal.

Waste management governance implies a system, the goal of which shall be to achieve the best possible management in a certain context. The content of this goal may be different from one country to another, and even from one city to another, depending on the current situation and place. Thus, even though the ultimate goal could be the same for everyone (to achieve an optimum socially, environmentally and economically-balanced environmental quality and public health), the specific situation of each community shall be essential to define its own objective for a particular period. This customization is very important, especially for developing countries with different realities, which will certainly determine management possibilities.

The system must also determine the rules or principles and the tools to achieve this goal, identifying the players that cannot or must not be missing in the process. Knowing the players related to the goal proposed, the role they play, their rights, obligations, needs and expectations shall be a key aspect of a good governance. It must guarantee the largest possible citizen participation, with a special focus on the historically disadvantaged sectors, those who have more difficulty enforcing their rights due to their social or economic condition, amongst other factors. In that sense, the application of Principle 10 of the Rio Declaration -according to which the best way to approach environmental issues in which access to information and full participation in the public decision-making processes is guaranteed- is currently and totally relevant.

It will also be necessary to identify what instruments could make the achievement of the goal set feasible, to analyse if they suitably respond to that purpose or if it necessary to generate new instruments or adapt the existing ones. Hence, a set of tools including the rules, institutions and economic and social instruments, adapted to every specific context, will be essential to achieve a rational waste management and the way to materialize the principles that govern the system.

These public health and environment protection-oriented principles include the prevention in generation, revaluation of materials, the polluter pays principle, proximity, sufficiency and Extended Producer Responsibility (EPR) principle, amongst others.

The LAC region has 33 countries of very diverse characteristics. Indeed, not only are the geographical, economic, cultural and social conditions different, but also their political structures. The latter is highly relevant with regard to the legal and institutional system in force in each country, which of course will have consequences on the environmental regulations and the institutions which are to enforce them.

There are two types of government systems in the region[18]: *federal* states, in which power is distributed in the territory on different levels, and *unitary* states, in which power is concentrated on the central government.

Federal states, such as Argentina, Brazil, Mexico and Venezuela are based in the decentralization of power, which implies a division of the territory in autonomous unities, which dictate their own rules, choose their authorities, are self-administered and self-financed, even when some specific matters are contained in the national legal system and under the national government. In general, the constitution of each country, foundational and highest standard, establishes the distribution of powers between the national level and the autonomous states.

In many cases this decentralization of power has led to a complex framework of rules and institutions, as in these countries at least three levels of government levels can be found, each with the authority to self-regulate and establish its own institutions. This implies, both in terms of regulation and management, a huge challenge regarding coherence and efficacy as expected of any legal-institutional system.

Besides, unitary states, which represent most countries in the LAC region, have the centralization of power in a single government as their principal characteristic, that only splits the territory for administrative purposes. The immediate consequence of this system is that the central government establishes the policies and dictates the laws for all national territory, whereas the local governments are in charge of their enforcement and application. However, there are nuances, so in some matters while the local governments have limited autonomy, they always subject to the hierarchy imposed by the national order.

These models have both pros and cons regarding management, which, when it comes to environment, are evidenced in some simple observations:

- While the unitary system enables having uniform policies and legislations for all territory, which can result in a higher coherence and regulatory and institutional efficacy, the decisions and visions made from a single perspective - that of the central government - could be ignorant of the local characteristics and end up being ineffective, not applicable or unfair.
- The federal system implies a complex regulatory and institutional framework, which many times leads to overlapping and even contradictions and voids in regulations and competences, but it has the advantage of the immediacy of the governments in relation to their territories and problems, a matter of major significance in the search for effective solutions.

In light of this, we must bear the situation in the region in mind for its practical implications, though the responsibility for waste management is a priority for the local governments in almost every case, these being thus the focus of attention. In fact, as long as they lack the technical and economic resources to plan, execute and evaluate a strategy, the political system they belong to is of no relevance. Although all this implies that when local governments are autonomous (as in the case of federal countries) they are more likely to self-finance as they can dictate their own rules and self-administer, the practise reveals that this scheme has not worked better than in the case of unitary countries.

18. For the purpose of simplifying the nomenclature used in several analysed legislations and which varies in different countries, here we use the denomination "national government" to define the central or federal government, that is, the highest administrative authority body of each country. The phrase "local government" comprises all government levels under the national one, i.e., the administrative authorities that, according to the internal legislation, are referred to as "state", "provincial", "departmental", "municipal", "community" or others.

"Planning implies applying the key principle of environmental law, prevention, which requires acting diligently on the causes of problems."

4.1.2 Strategic planning

As it has historically happened with other public matters (health, safety) that are the State's responsibility, also in environmental matters many policies and measures have been created from the externalization of specific problems and impacts, which have already occurred. Soon after investigating their causes it was determined that they could have been avoided by attacking or preventing said causes, and it is as part of this experience where the idea of planning arises as the beginning of the solution. Indeed, planning precisely implies applying the key principle of environmental law - prevention- which forces prompt action on the causes and sources of environmental problems, trying to avoid the negative impacts on the environment. It implies acting *before* and on the elements or circumstances that could give rise to environmental impact, so as to avoid or minimize it.

Planning implies developing a strategy, a plan, for the achievement of one or several goals. It requires a prior analysis of the causes that could lead to unwanted scenarios and the identification of the aspects that must be taken into account for the achievement of the goals set. And in environmental matters, planning is the key to avoid, mitigate or control a myriad of environmental, social, economic and institutional impacts.

Solid waste management is not excluded. The governments must drop the practise of adopting measures which merely patch up situations beyond control or on systems that may have worked beforehand but do not now, and they must start thinking about a long-term plan, with gradually achievable goals, that will surely go beyond the political mandates of those who have started such planning. There must also be a wide political agreement within each country, which recognizes the urgent need to design and implement a comprehensive waste management system which will be executed for decades, and the success of which will mean less costs in public health and environmental sanitation, as well as new opportunities of circular businesses and green jobs.

Transformations in production technologies, investment in infrastructure, changes of consumption lifestyles and awareness that requires the operation of a system inspired in circular economy, needs sustained efforts both from the public and private sector and from the citizen on an individual basis, in reasonable time frames.

Essentially, strategic planning will be focused on local characteristics so as to be applicable and successful. The thorough knowledge of the type of waste generated, the quantities generated and its geographical distribution, the economic, social and cultural characteristics of the citizens, the array of management-related players, available technologies, possibilities for the recycling market, resources and institutional capacities are local variables of indispensable considerations.

Furthermore, as anticipated, the participation of all sectors interested in the planning process is not just a formal requirement of most legislations, but also a guarantee of success. This participation

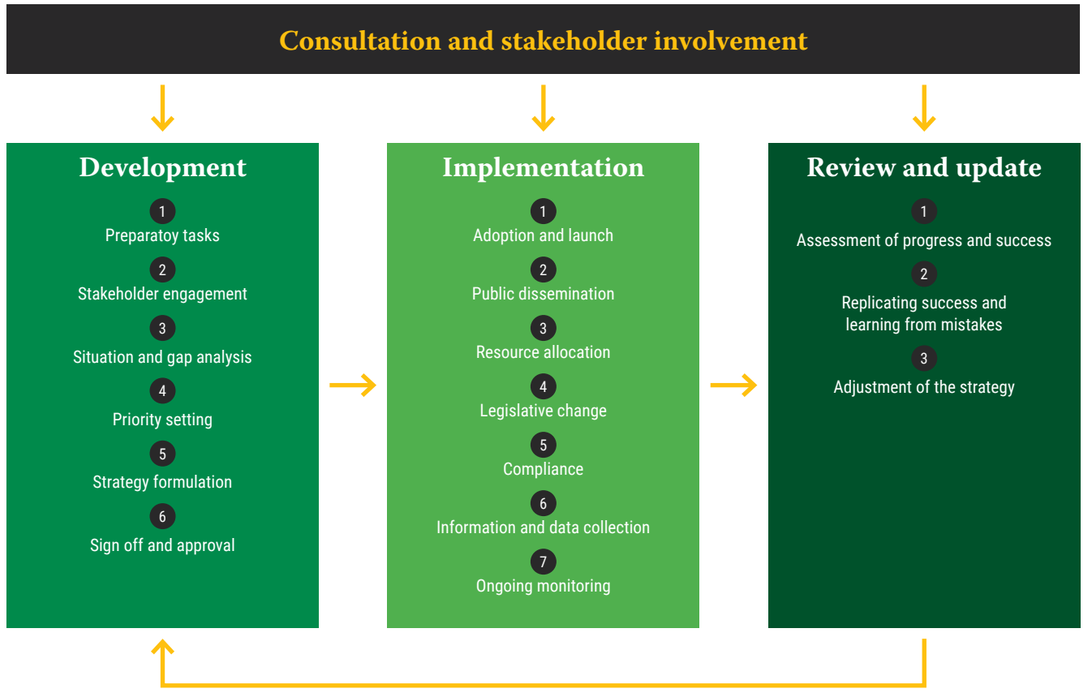


FIGURE 4.1
Overview of the process for developing, implementing and updating a national strategy
Source: PNUMA-UNITAR, 2013.

- which must also be planned - can take place in many different ways, taking into account the sector involved: from public consultations and audiences and workshops with citizens, educators and unions, technical work meetings with professionals, universities and industries to reception of written feedback. All that will enable putting on the table the different interests and concerns, helping the authorities to anticipate possible conflicts and problems, and make more informed and fair decisions.

Lastly, an essential part of planning will be to foresee its continuous assessment, for the purpose of incorporating the necessary changes to correct negative situations and update based on the experience and changes in the conditions and scenarios originally considered[19].

In the LAC region, some countries have a national strategy of solid waste comprehensive management - final or under review-, while others are in process of creation. Argentina, Bolivia, Brazil, Colombia, Costa Rica, Chile, Guatemala, Mexico and Peru are examples of the first group, whereas Belize, Honduras, Saint Lucia and Trinidad and Tobago are about to finish.

19. As for the development of the planning process, and following the elements we have considered in this section, the Guidelines for National Waste Management Strategies (prepared as part of the Inter-Organisation Program for the Sound Management of Chemicals) contains very valuable and detailed information, available on UNEP-UNITAR (2013).

4.2 Direct regulation

4.2.1 Introductory remarks

A direct regulation, or "command and control" instrument, is one based on dictating legal - mandatory - rules which respond to the coercion-sanction formula[20]. Its importance is vital in environmental matters as it is the principal method for the government to be involved in the achievement of environmental management and quality[21] goals as well as those of control over the governed persons, since these instruments seek certain behaviors or the performance of obligations, the non-performance of which implies a legal sanction.

One of the cornerstones of waste management-related governance in the legal regulations that, in practically all countries of the region, contain the provisions that are to be complied with by the generators and handlers of waste as well as the penalties applicable upon noncompliance. They make reference to the environmental licenses required to waste handlers, the mandatory nature of the Environmental Impact Assessment (EIA) for the facilities associated with management and provisions on the selection of sites for final disposition, amongst other requirements.

Thus, it is a coercive, ordering and compulsive instrument necessary for the organization of waste management, either nationally or locally: the regulation defines the types of waste and who are bound to perform - or not to perform - certain activities in connection with those.

Even when direct regulation is clearly indispensable, it is also evident that legal regulations alone shall not be sufficient to achieve a good governance in terms of waste. That is evidenced, for instance, in the existence of open dumpsites and burning of waste - both long-standing prohibition in most legislations - and the lack of comprehensive management systems in many cities of the region.

Years of experience gathered by developed countries with strict regulations in force for decades show that, yet making relevant progress in comprehensive waste management, even taking consistent steps towards a circular economy, it is necessary to continue using other type of tools that, although not mandatory, can contribute to achieve the desired changes. Thus, economic and information-based instruments can be important to discourage or prompt certain behaviors conducive to minimization, reuse, recycling and sustainable production and consumption.

In LAC, these instruments have been provided for in some regulations, that although provided for in some cases, are rarely used. The experience shows that, broadly speaking, there is a long way ahead, not only regarding effective implementation of the legal rules, but also - and especially - in the use of said instruments, which are undoubtedly complementary to direct regulation.

4.2.2 Legal definitions and classifications

Though legal norms countries define direction and desired specific approach criteria, and establish responsibilities, rights and obligations of each of the public and private players in connection with waste management. For that reason, the definitions that are to be added to the regulations need to be extremely clear, accurate and sound.

In waste management, its definition and classification according to its characteristics, composition, source, volume are very important, as the obligations will vary according to these criteria, both for the private sector (generators and handlers) and the Government, which must apply and see to the enforcement of the law.

The distinction between hazardous and non-hazardous waste particularly has great implications due to the economic cost its management represent under the law. As a matter of fact, hazardous waste generators must afford a management that involves handlers with a special authorization to carry out transportation and qualified treatments, which represents a much higher value than comprehensive household waste management. For the authorities, on the other hand, the control of the hazardous waste circuit will also require a larger budget, as its follow-up is carried out by specialized and qualified staff in person by means of inspections in the authorized sites and during transportation, and off site, by means of a continuous administrative control of mandatory documentation (shipping manifest).

Likewise, when the legislation enables hazardous waste to be considered as materials of other manufacturing process, making it possible to revalue or recycle them, there is also a considerable impact as they may be traded while avoiding costly treatment. In some legal systems and under certain circumstances, hazardous waste that can be recycled or reused is *declassified,* especially for the sake of transportation, with the resulting reduction in its management cost.

In other words, in practise the legal definitions and classifications adopted shall determine the course of the state policy in the matter, as different types of management will be enabled restricting, enabling or making it easier to make good use of the resources contained in waste.

From the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, countries tended to adopt, in the 90s, regulations that reproduced waste streams, constituents and characteristics of hazard established in the multilateral agreement[22]. They even incorporated a ban on entering or importing hazardous waste into the national territory into their constitutions and national laws and they set about the communication of prior justified consent between States, in compliance with the Convention.

For over 20 years, from the adoption of Basel to date, technological development regarding revaluation, reuse and recycle waste, as well as the awareness on the finiteness of natural resources and the impact of its exploitation, as well as the climate challenge, have shown the need to make changes in the legislation then created. Accordingly, the rules of different countries targeted at a differentiated management of hazardous waste such as minerals, pesticide bottles, lead-acid batteries, tires and electrical and electronic equipment, amongst others, underline the trend towards a circular economy that fosters recovery, revaluation and recycling of the materials contained therein.

Practically all countries of the region are parties to the Basel Convention, and some of them have made advances in the specific regulation for the management of the waste mentioned above, for which they had to update their legislations (legal definitions and management mechanisms) on hazardous waste. Thus, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru have made progress, by issuing, for example, regulations on Waste Electrical and Electronic Equipment (WEEE).

20. See the definition included in UNEP-ISWA (2015, p. 315).

21. An environmental quality goal represents the desired amount for a specific aspect of the environment which is usually not expressed quantitatively, unlike environmental quality standards. An example would be a reference to "the quality of water in a river, in such a way that native species of fish remain healthy".

22. This is the case, for example, of Argentina, Chile, Colombia, Cuba, Paraguay, amongst others.

It should be noted that updating the rules in this regard is a decision that is to be made taking into account aspects which are of course influential: on the one hand, the scientific-technical aspect, associated with the possibility of allowing certain elements - once considered hazardous waste - to reenter a productive circuit. The methods and technologies for this process must be evaluated, guaranteeing that -from an environmental point of view- this destination is more rational than the treatment and final disposal, as the health risks for the people exposed to management are also assessed. Other two relevant aspects are the economic and institutional: firstly, because it is necessary to consider the existence of a suitable market to make it viable and sustain the recovery of materials; secondly, because the ability of governments to perform the required control must be carefully evaluated, as this waste will be out of the *conventional* field of treatment and final disposal to other circuits. Lastly, all citizens must be informed of the possible regulatory changes and they must be able to take part in the State's decision-making process, knowing the technical, sanitary, economic, social and environmental grounds for the change of course, as well as the new roles taken by the environmental authorities in the control of management.

It is also noted that in the accurate analysis of the regulation of the region, there are as many definitions and classifications of the terms "waste' and "hazardous waste" as countries, although most take Basel as reference. Even in some cases these terms are defined differently in laws, decrees, technical rules within the same country. In federal states, instead, there are definitions contained in the local rules that are often different from the ones nationally established. In that regard, a harmonization effort is advisable, verifying that the definitions are consistent with the ratified international conventions, and in the case of federal states, it would be promising to articulate the mechanisms so that the local definitions and classifications are coherent with the national legislation, which is key, for example, if the regional waste management is to be favored.

4.2.3 Public health legislation

Although comprehensive solid waste management begins with proper source separation, the two main concerns for governments are to assure waste collection and its proper treatment and/or final disposal.

Abandoning waste in public sites, uncontrolled burning and open dumpsites that in many cases accommodate different categories of hazardous waste along with household waste all cause a series of environmental impacts on the air, soil and surface and underground water which are associated with several avoidable diseases. The recovery of recyclable materials from garbage that in the region is in many cases carried out by families who support themselves on the sale of the recovered materials must also be considered. This means that people of different ages, who often have no personal protection elements, handle waste daily without even taking into account the implication this activity has on their health.

From the review of ALC national legislations, it appears that in most of the countries there is an express obligation of the State to guarantee the collection of household waste, and this is usually the local governments' responsibility. Furthermore, there is a general obligation to dispose of this waste in authorized sites. Normally, at least in connection with the waste generated in private houses, it is the State who either by itself or by hiring third parties, provides the service of collection and final disposal. In several countries, these provisions are scattered across different regulatory instruments, such as constitutions, health codes and laws or decrees, by repeating or overlapping themselves[23].

23. Such is the case of Colombia, El Salvador, Guatemala, Honduras, Panama and Peru, amongst others.

Box 4.1

Ownership of waste

The trend in LAC region regulations reflects that the ownership of solid waste depends on its categorization as hazardous or non-hazardous, which then determines who is responsible for its comprehensive management. Indeed, hazardous waste, affected by the 'from cradle to grave' principle, cannot be abandoned by its generators, who are legally its owners, in some cases until it has been delivered to treatment plants or becomes a component of other productive processes, even after other stages. The condition of "owner" here implies a legal and economic responsibility of the management that cannot be transferred to the State or society.

Inversely, for non-hazardous household solid waste, almost all legislations consider that ownership falls upon the local government, once the generator has made the initial disposal, depositing the waste bag in the street or in public containers.

In view of the current need to revalue and recycle as much as possible, and taking into account that recoverable waste has an economic value if they can be included in new industrial processes, in some countries its ownership has been questioned, particularly due to the importance informal recovery has gained in almost every country of the region.

Here, a political decision shall be required, which governments must define based on public health and environmental protection requirements as well as on technical, social and economic aspects, by means of an extensively participatory process, which includes all players and interested sectors.

End-of-Waste Condition

The need to adapt legal rules to the circular economy shall require changes, including the definition of end-of-waste, which shall be carefully considered by each LAC country, since its implementation requires tight control.

That implies, for example, considering that wastes can be categorized as supplies from other productive process, for which it will be necessary to determine in which cases that is feasible (nature and composition of the waste and possible applications and market) and under which conditions (authorization administrative procedure), as well as the extent of the legal responsibility of the person who delivers the waste and the person who incorporates it as supplier to production (interruption of the generator's legal responsibility "from cradle to grave" and transfer to the recipient).

As for hazardous waste generated in institutions (companies, industries, stores, universities, health information centers, amongst others) the responsibility of its corresponding management is the generator's, who must proceed to source separation, to the correct temporary storage and hiring of carriers and operators duly authorized for its transportation, treatment and final disposal. That is not so for home generators, that in most cities of the LAC region have no other option than to discard these wastes along with the rest of the non-hazardous waste produced in households[24].

Generally, to regulate the management of hazardous waste, countries condense these provisions in one main rule, that is then complemented by lower ranking rules to deal with specific topics.

4.2.4 Environmental legislation

The countries of the region, especially continental ones, have profuse environmental legislation[25]. Most have expressly established the right to the environment, general laws that deal with different aspects of environmental policy, regulating the territory's environmental management, the access to information and environmental education, the participation of citizens in the public decision making processes, the access to justice, amongst others.

From these regulatory provisions a series of rights, guarantees, obligations and instruments arises which applies in a cross-cutting manner to all environmental matters, including waste management. Thus, the obligation of carrying out an EIA procedure prior to commencing any work project or activity that will cause an impact in the environment, is required in rules that apply both to public and private works, whether they are infrastructure or extractive works, industrial or commercial activities, including the necessary facilities for waste management. The natural consequence of the approval of the EIA is the granting of a license, permission, authorization or environmental certificate that implies that the project which obtained it may start its construction and further operation, under the terms established in the corresponding license and rules in force.

Usually, the rules that regulate EIA include solid waste treatment plants and sanitary and secure landfills. Then, by specific rules such as decrees or technical resolutions the building characteristics that these facilities must comply with are established in detail, including the selection of the site for final disposal[26].

24. There are some exceptions, such as the case of the city of Curitiba, Brazil, where the local environmental authority-dependent department of public cleaning also has organized a collection scheme, with the pre-scheduled sites, days and schedule. The service is exclusive for household waste and it admits the exception of up to 10 kg of materials such as batteries, printing toner, insecticide packaging, paint, expired drugs, fluorescent tubes (up to 10 units) and animal and vegetable oil (which must be delivered in PET bottles of 2 liters).

25. From the survey performed for this publication, it has appeared that in comparison with continental countries, the island ones have fewer general environmental rules. On the other hand, regarding waste regulation specifically, the lack of proper regulation for the management of waste in several island countries of the Caribbean is also generally noticed. In Haiti, for example, there is no regulation or strategy whatsoever concerning solid waste management. In Suriname, whilst it is not an island country, it is considered part of the Caribbean, there is no regulation, policy or plan either for the management of solid waste, except for two old laws from 1915 and 1929, which are not applied. One of the conclusions that arise from the recently published IDB's report (Riquelme, Méndez and Smith, 2016) points out that only a few Caribbean countries have a general regulatory framework for the management of solid waste, while in most cases regulation and policies are obsolete and require an update reflecting the current situation of the country and the sector.

26. Legislation Argentina, Bolivia, Chile, Cuba, Ecuador, El Salvador, Mexico and Nicaragua have established provisions for the definition of the final disposal site. In some cases, these provisions are directly related to the characteristics of the soils, the distance to water tables or the urban trace and in others, it is simply mentioned that the authorities will define its location.

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Also as part of the content of the environmental legislation, we find the provided bans concerning solid waste. As to non-hazardous waste, the two bans that have been more frequently identified concern depositing or abandoning waste on sites that are not authorized for final disposal as well as open-pit burning. Regarding hazardous waste, there are several bans, as those of importing of waste for the sole purpose of final disposal, importing or exporting without taking into account the provisions of the Basel Convention and national legislation, mixing of incompatible waste or mixing of hazardous waste with non-hazardous waste, storage, transportation, treatment or disposal through handlers non-authorized thereto.

Box 4.2

NIMBY Effect

A very important aspect related to the location of sanitary and safety landfills is worth mentioning, since there are numerous examples of the so-called *NIMBY effect*[27], especially in connection with the selection of sites intended for sanitary landfill. Communities have demonstrably objected to having sanitary landfills nearby , and this has led to social demonstrations against them, affecting the possibility of finding sites suitable for the final disposal of waste.

In these troubled situations, a number of faults are immediately noticed that almost in their entirety derive from pending issues of governments that even go beyond the site itself:

1. Largely in the region, cities have grown in a disorganized and unplanned manner, being it difficult to find examples of consistent works that pertain environmental management of the territory. This lack has collaborated with the genesis of a series of social and environmental conflicts, amongst others, for the destination of the surfaces available in respect of which there are conflicting interests. Territorial planning must be used as an instrument for medium and long-term planning, especially as a tool that is ahead of the conflicts, as it enables an informed, participatory and anticipated decision regarding the use of the soil. When all stakeholders have taken part in the decision, establishing which areas of the city and its surroundings are used for which destination, and the planning reflects that areas could be established for the different necessary uses, the possibility of conflict is reduced. Along the same line, if a *safety zone or buffer* is established in advance in which no human settlement or certain activities may be authorized, the rejection shall be less likely.

2. Other of the matters related to the occurrence of the NIMBY effect is associated with the weak control of the premises by the authorities and the lack of information regarding design, operation and monitoring of the sites. This general perception that these are uncontrolled or with a deficient control activities or premises, plus the lack of official communication about the technical characteristics of the landfills, the expected impacts and its mitigation plan, and the periodic control schedule and its results, have undoubtedly contributed to generating fear in the population. An efficient and independent control, the adequate access to the generated information and the greatest possible transparency are not only a duty of the authorities, but they could also contribute to clarify doubts, paving the way towards future informed and agreed territorial planning decisions.

3. Another essential aspect to take into account is the effective inclusion of the citizens in public decision making. The first step is to guarantee the citizens' participation in defining the territory's environmental planning. A second step will be the participation in EIA procedure, in which the citizens may access specific technical information on these premises and their operation and planned controls. This instance of participation is vital for providing detailed information, giving information, asking universities and independent experts to intervene and getting to know the doubts and concerns of neighboring communities. The exchange of information between the citizens and holders of the project should lead to a governmental conclusion which deals with the matters that resulted from that exchange, reflecting them in the requirements of the environmental license. Another dimension of civic participation may be the inclusion of representatives of the community in the control of the authorized activities, by means of mechanisms in which they participate, along with the environmental authority, of control. Furthermore, the requirement of environmental management system certification by impartial third-parties can add transparency and information on the activity and its impacts.

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4. Lastly, it is important to mention that the opportunity to provide information is key: in many conflicting cases the governments make huge efforts to explain facts and supply information when the conflict has already been unleashed. States must provide the information related to the projects whose authorization they must assess as soon as possible, anticipating the requirements of the citizens, so that they, based on official, true, complete, clear, updated and accessible information, with knowledge of which aspects might affect them. Taking the initiative to provide the information in advance is a key aspect of good governance that is also contemplated, with different nuances, in a series of legislations of the region.

> "Taking the initiative in providing information early is a fundamental aspect of good governance, which is also contemplated, with different nuances, in numerous legislations in the region."

27. "Not in my back yard" means people or groups of people who reside in an area and refuse the setup of any activity or premises that they deem to be harmful for their environment or health. They generally do not object to the activity or premises in themselves but to the proximity with their homes, due to the environmental impacts that could be caused.

An important matter related to environmental planning is the regionalization of waste management plans. LAC countries have, as anticipated, very different geographical, social, economic and political-institutional realities. There are countries with large extensions of territory, in which the power is distributed in hundreds or thousands of local governments, which raises a complex institutional scenario (such as Argentina, with 2,253 municipalities and Brazil, with 5,570[28]), countries in which the communities are close to each other - making regionalization easier-, and countries in which they are far away, which has a serious economic impact for the joint proposals. Another is the case of unitary countries, with small territories, or islands, possibly with few alternatives within the recycling market and whose economies are mainly based on natural resources, with the resulting generation of waste mainly derived from tourism, fisheries or agriculture.

We are presented with a very diverse scenario which will require every country to assess the advantages and disadvantages of the regionalization, not losing sight of the fact that usually the associative models allow environmental and economic benefits for all the parties. Public health and environmental quality being the goals, these well deserve sitting to negotiate. In the legal and institutional field, some substantial aspects should be taken into account:

- Legislation enables, in general, the regionalization for the purpose of management[29].
- This regionalization shall require planning which covers all associated local government bodies.
- The creation of a regional planning must be participatory, contemplating instances that allow for a proper exchange of information between the citizens and the governments.
- A central aspect shall be the definition of the host community of the management premises, especially that where the sites of final disposal are located; it is important to take into account that it is possible to agree upon compensation or benefit mechanisms for said community.
- All local governments associated, in the framework of regional planning, should be focused on working on minimizing, recovering and recycling waste for the purpose of deriving as little waste as possible to final disposal. This work will also have to respond common guidelines, to achieve a standardized quality in the recovery of materials and management.
- The matters associated with control and assessment of the regional system must be agreed within planning, assuring the participation of all associated governments. It is, therefore, necessary to have a system of indicators that accounts for the advances or setbacks of the system in order to timely make the necessary adjustments.
- The information generated from the management system must be available to all interested parties, taking care of its accessibility, availability, clarity and update.

In line with that the above, regionalization in terms of treatment and final disposal of hazardous waste is also crucial as the various waste streams require different treatment technologies, which are expensive and require a certain scale to be sustainable. In many cases, the scale may only be achieved as long as the handlers receive waste from different geographical areas, and for that, a strategic evaluation of the technologies and plants that will be authorized in each area, is key. The State is responsible for having this global view for the best possible environment management.

28. For more information go to: [http://www.ibge.gov.br/home/estatistica/economia/perfilmunic/2015/default.shtm].
29. Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala and Venezuela expressly admit this possibility.

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Argentina is an emblematic case where several local governments have set bans to enter hazardous waste to their respective territories through constitutional clauses, laws, decrees and ordinances[30]. These bans have operated since the 90s as an issue in management, which implies that tonnes of waste have to travel large distances as they cannot enter a certain local territory, not even in transit. As it is evident, due to the diversity of the existing hazardous constituents, the services of treatment and final disposal cannot be provided by the same facility or treating plant, and it is most likely that in most jurisdictions there are no operators for some or several of the hazardous waste categories generated. This leads to the dilemma of *what to do* with the waste.

In the 20-years plus of the existence of this scheme, the principle of proximity and sufficiency has been put sideways, increasing the risk in transportation, generating the conditions for monopolies in treatment of waste and therefore contributing to exorbitant prices for said treatments. Likewise, it is reasonable to presume that this scenario has influenced the proper management of unknown amounts of waste due to the legal difficulties and implied costs.

It must be recognized that, in many cases, these prohibition rules were set forth in an adverse context, in the sense of the near-zero transparency and participation that must be provided by the governments when defining an environmental policy, in this case, on hazardous waste

30. For the list and map of restrictions by provinces: [http://www.ambiente.gov.ar/archivos/web/URP/File/Promociones_Prohibiciones2_julio06.pdf]; [http://www.ambiente.gov.ar/default.asp?IdArticulo=687].

management. Many communities reacted dictating these rules in view of the scarce information and distrust on the State's control, as a way of protecting their health and environmental quality, although eventually the effect of these measures has turned out to be counterproductive. There was not enough information and participation, and also the guarantee of proper controls, which is a primary responsibility of governments, both nationally and locally.

Rationalization, for many countries and cities, is presented as a social, environmental and economic need for some stages of the comprehensive hazardous and non-hazardous solid waste management. The core matter is a timely and anticipated information, and the strict, sufficient and transparent control of the managers by the State, so that the citizens can verify how is their right to environment and health guaranteed.

As such, it is vital to take the implications of the Basel Convention and the reinterpretation required of it into account, not only based on the focus on the circular economy but also to provide a rational management in the region, which would necessarily imply the transboundary movement of wastes for the sake of their treatment and final disposal. For that purpose, a substantial strengthening of the governmental institutions - including justice - will be necessary, the typification of illicit traffic and amendment of the national legislations, as long as a strict control can be guaranteed.

4.2.5 Legislation for Resource Recovery

Regulating the recovery of resources or materials contained in waste implies a direct contribution to the main principles of circular economy based on the conservation and improvement of the natural capital and optimization of the use of natural resources. Additionally, it is a useful tool for reducing the amount as well as the hazard of waste intended for sanitary landfills, and particularly in the region where there is the additional problem of lack, in various cities, of controlled sites for the final disposal.

Although at least one third of the LAC countries have in their rules some reference to resource recovery, this provision is generally expressed as part of the principles or objectives in the laws, but not establishing specific measures to avoid the final disposal of certain materials. There is still a long way ahead when it comes to specifically forcing certain fractions of waste to receive a management that implies the reincorporation of materials to the economic circuit.

The establishment of bans, goals or specific time frames can be the regulatory model to follow, also taking into account that other instruments - such as the economic ones - must be added to a strategy in that sense.

Interestingly, there is the case of Ecuador, that establishes a clear provision on waste recovery in its specific regulation on WEEE and in application of the Extended Producer Responsibility (EPR) principle stipulated in the same (Agreement No. 190 dated December 28, 2012, issued by the Disused Electrical and Electronic Equipment Post Consumption National Policy):

- It bans burning and final disposal of disused electrical and electronic equipment - and their components – that are recyclable or treatable out of the country and in an environmentally-friendly way.
- By arranging management strategies in order, it establishes that the final disposal shall be applicable to those cases in which there is no technology for the reclamation, revaluation or treatment of the equipment in the country or abroad.

It is further noted that Ecuador's general environmental legislation, reformed in 2015, establishes a series of environmental principles which are declared of mandatory application and support all decisions and public and private environmental activities, and it also adds the EPS principle with the meaning of the WEEE regulation. Besides, it embodies the *cradle to cradle* concept (Agreement No. 61, published on May 4, 2015, arts. 2 and 3).

4.2.6 Legislation on waste prevention and sustainable consumption and production (SCP)

The regulations in the region include the concept of prevention, meaning actions aimed at reducing the generation of waste and minimizing or eliminating its hazard[31], but no express provisions exist, except in rare cases. Much less generalized is the regulation of sustainable consumption and production that exists in few of the legal norms analysed and more with a criterion or course to follow than as a requirement of the legal system.

Maybe the Colombian laws provide the clearest concept, by presenting it as a principle of its regulation on WEEE: *"Sustainable production and consumption. Based on this principle, decisions that seek the reduction of the amount of hazard materials used and hazard waste generated respectively by unit of production of goods and services are favoured. The above is in order to relieve the pressure on the environment, increase productivity and business competitiveness and simultaneously raise consumer awareness of the effect the products and their waste have on health and environment"* (Law No. 1672 dated July 19, 2013, art. 3).

The prevention of waste, material recovery and SCP must clearly be part of a good strategy of solid waste management, that can be incorporated by means of what we call "direct regulation", even when they point to different degrees of generators and manufacturers' commitment. The ideal to be achieved is probably a rational consumption -in quality and quantity- and the manufacturing of products more easily reusable or recoverable and less hazardous in their composition.

SCP especially entails a strong ethical commitment: on the one hand, the commitment of consumers oriented to the actual needs and awareness of the environmental implication of "buying" randomly; and on the other hand, the commitment of the business sector with the environmental impact derived from the use of raw materials and energy and from the generation of waste from the products placed in the market. It is urgent that they focus their research and development to contemplate the management of the aforementioned waste from design. Given said ethical component, it is very likely that the rules will not only contribute to the expected change in the habits or decisions, but it will also be necessary to resort to the use of other tools, such as the economic instruments and those based on information, that will be discussed below.

4.2.7 Regulation on waste handlers

Usually, the rules that regulate waste management characterize different subjects related to it and assign them responsibilities and obligations. Thus, most LAC regulations contain definitions for "generator", "shipper", "operator", "treatment plant" and "final disposal plant", and in connection, their different obligations.

31. By means of Law Nº 26,184, Argentina established in 2006 the ban on the manufacture, assemble or import cylindrical or prismatic, common carbon-zinc and manganese alkaline cells and primary batteries, with a mercury, cadmium and lead content of over 0.0005%, 0.015% and 0.200% in weight, respectively. They also banned the sale thereof from three years following the enactment of the law. In this context, the manufacturers, assemblers and importers must proceed to certify the composition of the batteries, by an authorized institution, as a prior requirement to sell. Additionally, the law established a requirement related to the information to be included in each battery, its shield (air-tightness) and the technical rules of duration they must comply with.

Box 4.3

Sustainable production and consumption

Contribution of CECILIA IRIART, B.A., Director of Clean Production and Sustainable Consumption, Deputy Secretary of Climate Change and Sustainable Development, Ministry of the Environment and Sustainable Development of Argentina

The consumption boom has largely been driven by increases in population, productivity and advertising in the 20th Century. Increasingly, more products are necessary to satisfy needs and even more natural resources are required to supply this demand. The impact caused by the production and consumption processes is considerable and varied, so transforming their influence is quite challenging.

The Sustainable Consumption and Production can be defined as: *"the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations"* (Ministry of Environmental of Norway, Oslo Symposium, 1994).

The focus of SCP is a practical implementation strategy to achieve sustainable development, which harmonically approaches economy, society and environment. It requires an active participation of all interested sectors, that is, the use of different public policies, actions from the private sector as well as investments that affect the offer and demand of goods and services. The aim is to reduce the negative impact of production and consumption in an integrated manner, a complex way that requires cultural changes and demands time, dedication and research.

© Enfasis packaging, Latinoamerica.

Actions to promote sustainable consumption include recycling, waste minimization and measures related to the efficiency in the use of resources, under the analysis of the products' full life cycle, so as to achieve a more efficient use of the renewable and non-renewable resources. Simultaneously, it is necessary to promote sustainable production, which includes the application of technological innovations in the design and improvement of the products and/or productive processes of all sectors (including services) as well as the promotion of the so-called industrial ecology and the focus on the life cycle.

Sustainable production covers a wide range of characteristics of the productive life cycle, including: a) as starting point, the design in harmony with the properties of the materials used, b) the productive processes and characteristics of products and packages in connection with the sources of supply and the impacts they have, c) the design for durability, the feasibility of repairing or dismantling after its use to allow the recovery of materials, d) water and energy consumption, e) the careful management of environmental impacts such as those related to climate change or biodiversity, f) the social impact on workers and local communities. Awareness, specific training and education are key components of its implementation and continuity. The greatest gains in all these aspects can be achieved as long as, both quantitative and qualitative, waste generation or its complexity, are avoided in all fields.

There is a clear link between sustainable consumption and production, as they involve a repetitive process through which producers can affect consumption by means of the design or characteristics of the products, and consumers by means of their choices in the market. Both the governments and the civil society perform a key role to foster this process.

Since the 1992 Rio Conference it has been internationally recognized the main cause of the continuous deterioration of the world's environment lies in the unsustainable consumption and production patterns. Thus, in the Johannesburg World Summit on Sustainable Development (2002) the challenge of initiating a world process in which governments could provide and assure a significant advance to achieve the SCP was presented. The response was to initiate a process that would lead to a 10-year Framework of Program, later known as "Marrakech Process." In Rio+20 the SCP objective was reaffirmed, adopting the Ten-year Framework of Programs on Sustainable Consumption and Production, which supports the creation and strengthening of capabilities, and provides access to technical and financial assistance to developing countries for this transition.

In LAC, there have been many global meetings about SCP: Buenos Aires (2003), Managua (2003 and 2005), San Pablo (2007), Peru (2010), Panama (2012), Chile (2014), Panama (2016), among others. The Regional Council of Government Experts on SCP produced a Regional Strategy that defines concrete actions and specific pilot projects. The Strategy, approved during the 14th Forum of Ministers of the Environment, emphasizes the importance of strengthening the capacity of the various interested parties to implement of activities and policies related to SCP.

In turn, MERCOSUR approved a strategy on SCP and cooperation in July 2007 and agreed on an action plan to implement the strategy that same year. Besides, SCP was included as a cross topic in the 2006-2010 Andean Environmental Agenda.

"For many countries and cities regionalization is considered as a social, environmental and economic necessity, both for some stages of the integral management of non-hazardous and hazardous solid waste."

For non-dangerous solid waste, the rules tend to require them to be registered and comply with the obligations related to the provision of the service for which they have been hired. In transportation, for example, there is a requirement of frequency in the collection and compliance with schedule, routes, types of vehicles, cleanliness and other aspects associated with urban hygiene, set by the local government.

Treatment, recovery and recycle plants must have a specific authorization that, in most cases, is preceded by an EIA and the resulting license or permission granted for the requested activity. In sanitary landfill setups in several countries there are a number of requirements related to the site's location and its building characteristics, which are also complemented - for the operation stage - with mitigation and monitoring plans, which in some cases extend to closing and post-closing.

It is worth noting that there is a need to periodically review the rules stipulated by the governments in order to achieve a continuous and gradual improvement of the comprehensive waste management. In that regard, it is essential to increase the environmental requirements in public tender processes of services to subcontract, through incorporating standards that encourage handlers to improve.

In turn, foresights related to hazardous waste handlers also include the specific authorization thereof and performing an EIA for the premises and storage, treatment and final disposal plants. There is also the generators' obligation to hire authorized handlers and deliver the generated waste only to especially authorized shippers upon the issuance of a shipping document or manifest, which provides proof that hazardous wastes were indeed transferred from the generation site to the final disposal site. The issuance of this document is usually complemented with records the generators, shippers and operators are liable to carry, and they must be consistent with each other and with the issued manifest. The registration and issuance system of the shipping document is then the documentary evidence - in some cases, in hard or digital copy - that accredits the route *"from cradle to grave."*

Case Study 8

Exchange of recyclables for food. Green Change Program – Municipality of Curitiba, Brazil

In 1989, the government of Curitiba proposed that an exchange of organic waste for transportation passes be performed for the first time, while in 1991 as a consequence of the cabbage record harvest in the metropolitan region, the local government opted to replace the transportation passes for food, including recyclable waste in the exchange. That is how the Green Change Program was created, which still exists nowadays.

The government purchases foodstuff from farmers' associations, which include small and medium scale horticulturists from the metropolitan area. By acquiring surplus goods that were unable to be located in the market, the government benefits farmers. Apart from substantially improving the low-income sectors' food quality, there is a contribution in the reduction of waste generation, not only due to the food that finds a final destination, but also due to the recyclables received in the exchange. With 4 kilograms of recyclables, 1 kilogram of fruits and vegetables is delivered. Furthermore, vegetable and animal oils are received (2 litres of oil equate to 1 kilogram of food). The exchange takes place in service delivery point that, every 15 days, as per a schedule annually published.

Through the Program, the city manages to jointly deal with education, environmental management and local development matters, adding tools to fight against hunger and poverty and encourage local food production and farmer's organization.

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Box 4.4

Limiting the content of lead in paints

Lead is one of the 10 chemical substances that generate greatest concern for public health, due to its effects in the nervous, gastrointestinal, cardiovascular and renal system. Children, more vulnerable to its neurotoxic effects, can suffer irreversible damage.

The Global Alliance to Eliminate Lead Paint (joint initiative of the WHO and UNEP), is focused in preventing children's exposure to lead contained in paints and limiting the exposure of those people that work with these products on a daily basis. In order to accomplish this, it promotes gradual elimination of production and commercialization of paints containing it[32]. Amongst the measures to reduce the use of lead and avoid the exposure of children and women of childbearing age, the Alliance suggests eliminating the non-essential uses (such as that of paints), guaranteeing safe treatment of lead waste and providing accurate information for the correct and safe disposal of the lead-acid batteries.

While Europe has limited lead concentration in paints to 90 parts per million (ppm), some LAC countries have established regulations to reduce said concentration to 600 ppm. This is the case of Argentina (Resolution 7/2009 of the Ministry of Health), Costa Rica (Decree 24334/1995, which also rules the maximum content of mercury), Chile (Decree 374/1997), Mexico (Official Mexican Rule 004 dated August 12, 2004, amendment of Mexican Official Rule of 1993), Panama (Law 36/1996) and Uruguay (Decree 69/2011). In the meantime, most countries of the region lack regulation in that matter.

32. For more information, see: [http://www.who.int/ipcs/assessment/public_health/gaelp/es/].

Case Study 9

Ban on plastic bags in Antigua and Barbuda[33]

Various countries of the region consider the urgent need to protect oceans from general waste spillage, single-use plastic bags being a special concern due to the impacts caused in the marine environment. This need becomes even more relevant in the Caribbean island countries, where populations live near the coast and depend on fragile coastal marine eco-systems.

In view of this situation, several countries tried to control the problem by banning the manufacture/import/use of disposable bags, Antigua and Barbuda - which estimated the use of 40,000 bags a week - being the reference of a recent action plan, which has combined the required direct regulation with economic and social instruments thus exercising, through rules, the principles of division in stages and participation.

Indeed, the sanction of the rule of ban was preceded by queries addressed to players and interested sectors that accepted the proposal, which was accompanied by tax exemptions in reusable bags imports. With a progressive timetable the ban on bag import was scheduled to January 2016, and by July and October of the same year the ban on supply by small and large supermarkets, respectively. The remaining shops had 3 additional months to comply with the regulations.

During the rule's implementation process, the Ministry of Environment informed the advances and response of the interested players in TV. The media reported systematically on the ban during its first week, with constant interventions of health, waste and environment public officers, which enabled public discussion of the restriction. These actions came together with a massive distribution of reusable bags and an inter-school competition to design the media campaign logo. A *jingle* for the campaign was composed, which is still broadcasted by State-owned media.

After the ban, public officers continued appearing in interview shows that extended the spreading of the measure and the exchange with experts continued, highlighting the recurrent internal and external queries, even their continuity after publishing the rule, especially with supermarkets, in order to identify missing elements or problems in implementation, and correct them along the way.

33. There are several experiences in the region regarding the regulatory ban on plastic bags. The City of Mexico banned the free supply of non-biodegradable bags in business premises in 2010, while the City of Buenos Aires dictated successive rules from 2009 which ended up in 2017 with the total ban on supply in supermarkets.

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"Increasing the environmental requirements is fundamental in the public bidding processes for waste management services that will be offered in concession."

Box 4.5

International conventions on chemicals and waste

Internationally, three important multilateral conventions share the objective of protecting the human health and the environment of the negative effects derived from hazardous substances and waste: *Basel,* on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, *Rotterdam,* on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides, and *Stockholm,* on Persistent Organic Pollutants. These have amongst their Parts almost all LAC countries[34]. Furthermore, the *Minamata* Convention on mercury is mentioned, which has been ratified by 16 countries of the region so far[35].

Transboundary Movement of Wastes

Basel recognizes Member States' right to ban waste imports for their disposal, as well as the duty of communicating these decisions by means of specific mechanisms. Simultaneously, it compels the Parties to ban or not allow the export of hazardous waste if the import State does not give its consent in writing, or if it has banned the import thereof.

Although this Convention initially sought to protect developing countries, as waste was exported from developed countries in order to avoid high treatment and final disposal costs of the source sites, today, under the approach of circular economy - as well as that of regional management - the LAC countries will probably need to review it. Clearly, in this review it must not be neglected that developing countries, mainly due to their institutional lack in terms of technical and economic capacity not to mention the limited technologies available are still in a situation of weakness regarding the entrance of waste into their territories.

In that regard, it must be noted that most LAC countries have established bans on the entrance of dangerous waste and that acts as a barrier to the approach of circular economy and regional management[36]. That is, taking into account the above in relation to the precautions that must be taken regarding the limited capacities of these countries, it will be necessary to find a balance between the need of material revaluation and recovery, their rational management - which could well require

34. Indeed, Basel and Stockholm have been ratified by all countries of the region, except Granada, whereas Rotterdam has been ratified by 30 countries, except Bahamas, Granada and Haiti.

35. On October 18, 2017 it has been ratified by 16 countries in Latin America and the Caribbean: Antigua and Barbuda, Argentina, Bolivia, Brazil, Costa Rica, Ecuador, El Salvador, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Saint Kitts and Nevis and Uruguay..

36. These bans exist both in constitutions and national laws. In LAC, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama have also entered into the Regional Agreement on Transboundary Movement of Hazardous Wastes, adopted in accordance with the Basel Convention, which provides for the possibility of entering bilateral, multilateral or regional agreements, that are equal or more restrictive, the signatory Central American countries have committed themselves to taking all corresponding legal, administrative or other measures within the areas under their jurisdiction, as well as baning the import and transit of hazardous waste to Central America from countries that are not part of this agreement. Likewise, they undertake the commitment of not exporting this waste when that is banned under an internal law or an international convention, or when they consider that in the country of destination the waste could be handled in an environmentally-healthy way. There is also a commitment of the Member States to ban the import and transit of hazardous waste in the region, to ban spillage of this waste in the sea and inland waters, to adopt preventive measures to avoid contamination as a precautionary measure and to enforce these obligations from the offenders. The parties have also committed themselves to establish criminal sanctions in their national legislations for illegal traffic.

regionalization - and the aforesaid limitations. At first, it will be fundamental to work on the strengthening of institutions, increasing their technical and control capacities, so that, health protection and environmental quality are entirely guaranteed while favoring a circular approach.

Illegal traffic

A fundamental issue dealt with by the Basel Convention is that of illegal traffic. The convention established that *"The Parties consider that illegal traffic in hazardous wastes or other wastes is criminal"* y and describes its criminalization in Art. 9. Thus, illegal traffic means transboundary movement of hazardous wastes effected without notifying all interested States; without the consent of an interested State; upon consent obtained by forging, falseness or fraud; when it does not match with the documents in an essential aspect and when it gives rise to the deliberate elimination of the wastes in violation of the convention and the general principles of internal law.

Illegal traffic regulations are seldom found in LAC, even when the region has been the target of *undercover* waste dispatch, as revealed by the cases reported[37]. In this regard, it is important for every country to check their national regulations in order to promote the criminalization of the offense, providing for the applicable sanctions and establishing the authority who will be in charge of its detection and prosecution. Colombia and Jamaica are examples of regulation in the region[38].

37. To see the cases reported: [http://www.basel.int/Implementation/LegalMatters/IllegalTraffic/CasesofIllegalTraffic/tabid/3424/Default.aspx].

38. Both countries penalize this offence with imprisonment and fines. Colombia regulates illegal traffic in its Criminal Code (art. 358), whereas Jamaica does it in the Natural Resources Control Regulations –Control of Transboundary Movement of Hazardous Wastes- (Rule 22).

It should be pointed out that, in accordance with the lack of information and indicators in terms of solid waste management, which has been verified in the preparation of this publication, it is particularly observed that there is a need to produce information related to the so-called *Chemical Agenda* (involving the mentioned conventions) for the purpose of orienting the implementation of the conventions both within the countries and the region itself.

International Convention for the Safe and Environmentally Sound Recycling of Ships (Hong Kong, 2009)

The aim of the Convention is to guarantee that at the end of the life of the ship its recycling will be performed avoiding the generation of risks for health and safety of the people and the environment. Within this agreement, each ship must keep a record (inventory) of the hazardous substances it contains, from its construction, as part of its structure or due to the activities performed, stating quantities and location thereof. That, based on the fact that ships that are intended for breaking can contain toxic substances such as asbestos, heavy metals and hydrocarbons, amongst others, which must be properly handled in order to avoid risks and damages. The reduction of existing hazardous waste in the ships is mandatory, before its entrance to the shipyard in charge of recycling.

Once broken up, the materials that result from this activity, shall be submitted to the legislation of the country in which the dismantling operation has taken place, and the regulation concerning hazardous wastes shall then apply. In turn, if the waste product of the break-up is transported to another State, then the Basel provision shall apply if the intervening States are part of it.

Since Basel expressly leaves out waste derived from the normal operation of the ships (operational and accidental discharges), which are regulated by another international convention[39], and since it also does not include the materials that are part of the ships' structure as they are not "waste" while they are part of its structure, it is possible to make reference to a complementation between the Hong Kong and Basel convention, in which the former shall regulate a very specific activity that has historically caused large scale accidents and pollution, while the latter shall apply to transboundary transportation of waste derived from ship break-up.

It should be mentioned that in spite of the various recommendations made for the countries to proceed to ratify the convention, including the one of Basel COP held in Cartagena in 2011, Hong Kong as of 2016 only had 4 ratifications (Norway, Congo, France and Belgium) that barely represent 2,27% of the gross capacity of the world merchant fleet[40], when for its entry in force 15 ratifications are required, that simultaneously represent at least 40% of that capacity.

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39. International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).

40. It should also be noted that the Organization of the European Community Shipowners' Associations (ECS) mentioned the ratification and entry in force of the Hong Kong Convention as important and urgent priority in order to have an international rule that serves as reference for the maritime sector. See: [http://www.ecsa.eu/images/NEW_Position_Papers/2015-03-16_Ship%20Recycling_ECSA%20Policy%20Position%20Paper_Final.pdf].

4.2.8 Voluntary Agreements (self-regulation and co-regulation)

Although it can be stated that the EPR principle has been added to the legislations mostly not as an option but rather as an obligation, there are cases in which it materializes totally or partially. In the first case, the producers responsible for the comprehensive management of waste derived from those objects placed in the market, maybe for reputational reasons, pressure from the society and consumers, being the processing of a certification process or because it is ahead of a regulatory trend, they decide to start a system of recovery of these materials without a rule that binds them, by self-regulation[41].

Co-regulation would take place, for example, in cases in which the authorities urge the voluntary application of the principle willingly, but take part in the implementation or approval of private sector agreements. In this case, we would have not a general rule issued by the Government, but a contract or public commitment that implies a regulation for the parties to it.

In Argentina, for example, where there is still no regulation for packages, some companies have developed initiatives for recovery and recycling[42]. Similarly, in Brazil[43], although there is a legal obligation to manage WEEE, the sectoral agreement required to implement the reverse logistics Programs for these wastes has been closed, under Law 12,305[44]. Likewise, in Chile, even before the enactment of Law 20,290, private actions were taken for the recovery and recycling of materials[45]. It is also worth mentioning that some sectoral "Cleaner Production" voluntary agreements have been entered into in some countries in Central America, with an emphasis on solid waste[46].

41. The recycling of print cartridges takes place in various countries of the region, which contributes to dispose less waste in sanitary landfills, and especially, less hazardous waste. By programs introduced by some of the most relevant companies of the market, mechanisms for customers to return to the product's manufacturer the print cartridges used for them to proceed to recycling are established. Only original brand toners are accepted, and if a minimum pre-established quantity is reached, a free collection thereof may be requested. The company provides packaging instructions as well as the tag that has to be placed on each of the boxes, and it states the possible withdrawal date. Withdrawn cartridges are derived by the manufacturer to an authorized company for its recycling, recovering plastic and metal to manufacture new products. The fraction that cannot be recovered is derived to a plant authorized for its treatment or final disposal. It is a typical case of application of the Extended Producer Responsibility principle, in which the responsible for the placing in the market manages the waste derived from the use of the products. For more information, see Hewlett Packard HP Planet Partners Program which operates in Brazil, Chile, Costa Rica, Ecuador, Mexico, Panama and Peru: [https://h30248.www3.hp.com/recycle/ereturns/tellmemore-hpe.asp?__cc=es&__la=es].

42. See: [http://www.cocacoladeargentina.com.ar/sustentabilidad/envases-sustentables/], [http://www.pepsico.com.ar/Argentina/PressReleases/RETORNABLE_Y_RECICLABLE_LO_NUEVO_DE_PEPSI_Y_7UP.html], [http://www.tetrapak.com/ar/sustainability/ciclo-de-vida-del-envase-en-argentina] y [http://www.tetrapak.com/ar/sustainability/recicladores-en-argentina].

43. See: [http://welcome.hp.com/country/br/pt/companyinfo/globalcitizenship/reciclagem_hardware.html]. Por su parte, la plataforma RELAC lleva un registro de las empresas recicladoras de RAEE en Brasil, disponible en: [http://www.residuoselectronicos.net/?p=217].

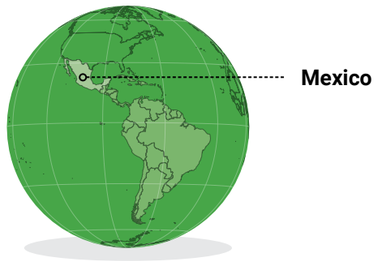
44. See official information on the progress of the reverse logistics sectoral agreements, including WEEE: [http://www.mma.gov.br/cidades-sustentaveis/residuos-perigosos/logistica-reversa/sistemas-em-implanta%C3%A7%C3%A3o] and [http://www.sinir.gov.br/web/guest/logistica-reversa].

45. For more information visit: [www.triciclos.net/es/].

46. The pig farming, slaughtering and cattle sectors in Costa Rica, dairy and poultry sectors in El Salvador, dairy in Nicaragua and the hotel industry in Honduras and Guatemala, are part of voluntary Cleaner Production agreements, developed between the public sector and each productive industry and which, aside from complying with environmental laws, emphasize the management of that particular industry's solid waste.

Case Study 10

Voluntary agreements in Mexico



ECOCE[47] is a non-profit civil association, made up of companies of the food and drink industry.

It manages the Packaging Recovery Plan to use them for recycling, it being one of the twelve management plans of wastes registered before the Mexican Secretary of Environment and Natural Resources. It main objective is to promote the massive stockpiling of PET packaging waste for their further recycling, as well as education and awareness on its importance.

It conducts different Programs conducive to receive the stockpiled PET, either social (involving highly marginalized and poor communities) or institutional stockpiling, delivering in the exchange basic products (such as food or hygiene items). It also keeps a Program with schools, in which the source separation and recycling are promoted, sending the waste to recovery and granting benefits in infrastructure to participating institutions. This Program, called ECO-RETO receives PET, HDPE and aluminum and implied for the 2014-2015 period the work with more than 5,000 schools and 1,400,000 students, recycling over 4,000,000 kg of PET.

47. For more information, visit: [http://www.ecoce.mx/] and en [http://www.ecoce.mx/files/2015INFORME_ECOCE.pdf].

"The problem does not end with the elaboration of perfect regulations, but with the very concrete fact that they can be applied and complied with. This requires establishing goals, preparation, human and material resources and the development of various tools."

4.3 Implementation and enforcement

The concept of enforcement has no translation from English into Spanish in only one term, and furthermore, in Spanish it has an even more comprehensive meaning than in English. Thus, enforcement is defined as the application and compliance with the rules, which implies, on the one hand, the process by which the authorities act so as those responsible for the activities regulated by environmental rules comply with them; and, on the other hand, the role of the citizens to spontaneously comply with the regulations and hinder their violation, report their non-compliance to the authorities and participate in the procedures of preparation and application thereof.

Although there are several countries in LAC with vast environmental and waste-related regulations, even if they are good rules from a technical perspective, they do not guarantee positive outcomes in the actual reduction of waste, the recovery of materials or the eradication of clandestine dumps.

The problem is not solved with the creation of perfect regulations but rather in their being implemented and enforced. In that regard, other variables come up, including the governments' ability to make the prescriptions of the law be verified later in reality. That requires setting goals, preparation, human resources and materials, and the development of a series of tools which efficiently cooperate in the achievement of said goads and desired changes.

So we can talk about a real implementation process or "commissioning" of the regulations, in which the Government shall be the main responsible for planning and assessing this process, including the establishment of time frames and resources.

Along these lines, it should be considered that many times it is necessary to *introduce* and *explain* the regulations, to ensure compliance thereof with. In most cases new specific, regulatory or complementary rules of the general law must be dictated, which are materialized through decrees, resolutions and provisions. These rules develop certain aspects that require a degree of detail which cannot be embodied in the general rule on waste management. That is the case, for example, of such rules that especially regulate the technical conditions of sanitary and safety landfills, pathogenic waste management, preparation of affidavits concerning the generation and traceability of hazardous waste or sanctioning procedures.

It is also feasible - and often necessary - to resort to the preparation of technical guidelines, recommendations and protocols which can be developed by professionals, experts and even companies in the different topics. These guidelines - which are not direct regulations- notably help unify the criteria and language between the different sectors, mainly between the authorities and the private sector, liable to comply with the regulations in an acceptable manner agreed with the authorities.

Another fundamental issue regarding enforcement is the definition of a proper authority to implement the regulation and also control those who are bound to enforce it. A weak authority with deficient resources and capacities will have a very limited power to enforce the rules and sanction accordingly, which is ultimately very detrimental to any policy or regulation. The existence of several authorities with overlapped roles can also be a serious obstacle for the realization of these very policies.

Furthermore, it shall be clear to have the necessary premises to enforce the law. The systems of waste collection, the treatment/recovery/disposal plants must exist and operate properly in accordance with the regulatory requirements. In that regard, and taking into account that in most cases when a city decides to change or improve waste management, these systems and premises are still not available, it will be vital to consider a gradual adaptation period for the handlers towards a new scheme.

This is how important the participatory processes of rule creation are, when the private sector can inform the State as to the real situation, available technologies and investments and time frames required for adaptation.

Lastly, it shall be vital to contemplate in the rule and its implementation an indicator system that enables a reasonable assessment of how the strategy works, both legally and institutionally, and in the management, itself. If we cannot periodically assess the results of management we will not be able to make the necessary adjustments either so as the goals set in the strategy can be achieved[48].

Enforcement is also related to the access to public economic resources to put forward the design and implementation of the waste management system. We can have an excellent legal rule and strategy which can then turn out to be impractical due to its implementation costs and the existing legal mechanisms for waste management.

How do local governments access these resources? Are these budgetary items that refer national governments to local ones or can these generate their own resources? Are these items enough and are they properly distributed? Do they have a specific destination or can local governments use them at their discretion? Is there a subsequent control of the fund application? Answering all these questions during the process of preparation of rules during the planning of strategies will solve many future problems.

In LAC, there are rules for waste management and, should it be necessary, the possibility to update and improve them. The greatest challenge is focused on enforcement, which requires, as structural conditions, the prior participation in the creation of a policy and regulations, and budget and institutional strengthening for its practical realization and its evaluation by specific indicators.

48. It is worth underlying in relation to this issue the relevance of the Regulatory Impact Analysis (RIA), a tool that has been developed by the OECD and that seeks to assure that the decisions and regulations on public policies are based on rigorous cost-benefit analyses, so that the adopted regulations are effective an efficient. For more information, see: [www.oecd.org/gov/regulatory-policy/ria.htm].

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4.4 Economic instruments

4.4.1 Economic and financial instruments

Several of the regulations of the region contain some reference to economic and financial instruments that can contribute to the achievement of certain objectives in the comprehensive waste management, although no consistent application arises therefrom. This implies a vacuum in terms of putting a circular economy into operation. The provided instruments are diverse and include from generic references to tax benefits, preferential treatment in tenders and public bids and circulation of local government listings, generators and handlers who have shown a good performance in management. These instruments are provided for in some cases of general laws of environmental policy or protection[49] and in others, in the sectoral laws that regulate waste management. The latter is the case of the Chilean law that provides a fund intended for financing local projects that establishes programs to prevent waste generation and promote reuse and recycling. The Costa Rican law expressly stipulates incentives for small and medium-sized national companies if they adapt to the legislation, to make technological changes or substitute materials and equipment.

Colombia, in turn, especially establishes in its WEEE law *"the generation of benefits and stimuli for those who take part in the reclamation and/or valuation..."* (Law No. 1672/2013, art. 3); and Uruguay, through a presidential decree has provided for a tax exemption for machinery and premises intended for lead-acid battery recovery operations (Decree 373/2003, art. 27).

49. Case of Argentina, Ecuador and Mexico, amongst others.

Box 4.6 Sustainable public procurement

Within the framework of the national economies, Governments are the main consumers, thusly creating the chance of making a difference in the promotion of a market that considers economic, environmental and social aspects in the production of goods and services. Its high purchasing capacity can significantly contribute to the development of a sustainable product and service market by a public procurement system focused on that objective.

Implementation is not simple, however, requiring not only strong political conviction, but also economic studies and studies of the legal and institutional frameworks in force to make the system viable, as well as of the design of policy and implementation plans, including a solid training of the officers that will put the procurement plan into practise.

Several countries of the region have had the initiative of implementing Sustainable Public Procurement, including Chile, Brazil, Costa Rica, Honduras and Paraguay[50]. Although most of them have focused mainly on energy efficiency, there are examples related to the need to minimize waste generation, reducing or eliminating its hazard and promoting the recycling market.

Costa Rica has drafted a Sustainable Public Procurement guideline as part of Law 8839 of Comprehensive Waste Management[51] which presents practical recommendations of specific criteria for consideration in the purchase of different categories of goods and services. This document provides for, amongst other criteria, the disposal of toxic or dangerous compounds in the products and the promotion of use and consumption of recycled or recyclable products.

In order to properly guide the procurement, Sustainable Criteria Cards are presented, which provide in detail the required directions for the selection of the goods and services: the ones for computer equipment, printing and reproduction, furniture, stationery, food and work clothes establish specific provisions regarding the toxicity of the supplies, the possibility to recycle and minimize waste.

It should be underlined that when a State takes the initiative of putting this procurement system into practise, beyond the real impact in management sustainability, it is "giving an example" to companies, institutions and citizens concerning very specific matters such as consumption habits. Additionally, this procurement system requires studies, systematized information, prepared guidelines and criteria, all of which can be very useful to contribute to sharing this experience and saving costs, especially in the private sector and other institutions, which could take these elements as a basis for their own plans[52].

50. For more information on the systems in operation, visit the Inter-American Government Procurement Network: [http://www.ricg.org/].

51. Available from: [http://ley8839.go.cr/blog/encuentros-nacionales/primer-encuentro-nacional-de-reciclaje-encuentros-nacionales/dia-uno-16052013/guia-para-compras-publicas-sustentables/].

52. For example, the City of Buenos Aires has implemented sustainable public procurement through different hierarchical standards, including the development of a sustainable purchasing guide. For more information, see: [http://www.buenosaires.gob.ar/hacienda/compras/guia-para-el-consumo-y-compra-responsable-de-papel] and at [http://www.buenosaires.gob.ar/hacienda/compras/compras-sustentables/guia].

"The producer's extended responsibility has modified the traditional view of who should take charge of the management of the waste generated, shifting that responsibility from the State to the producer".

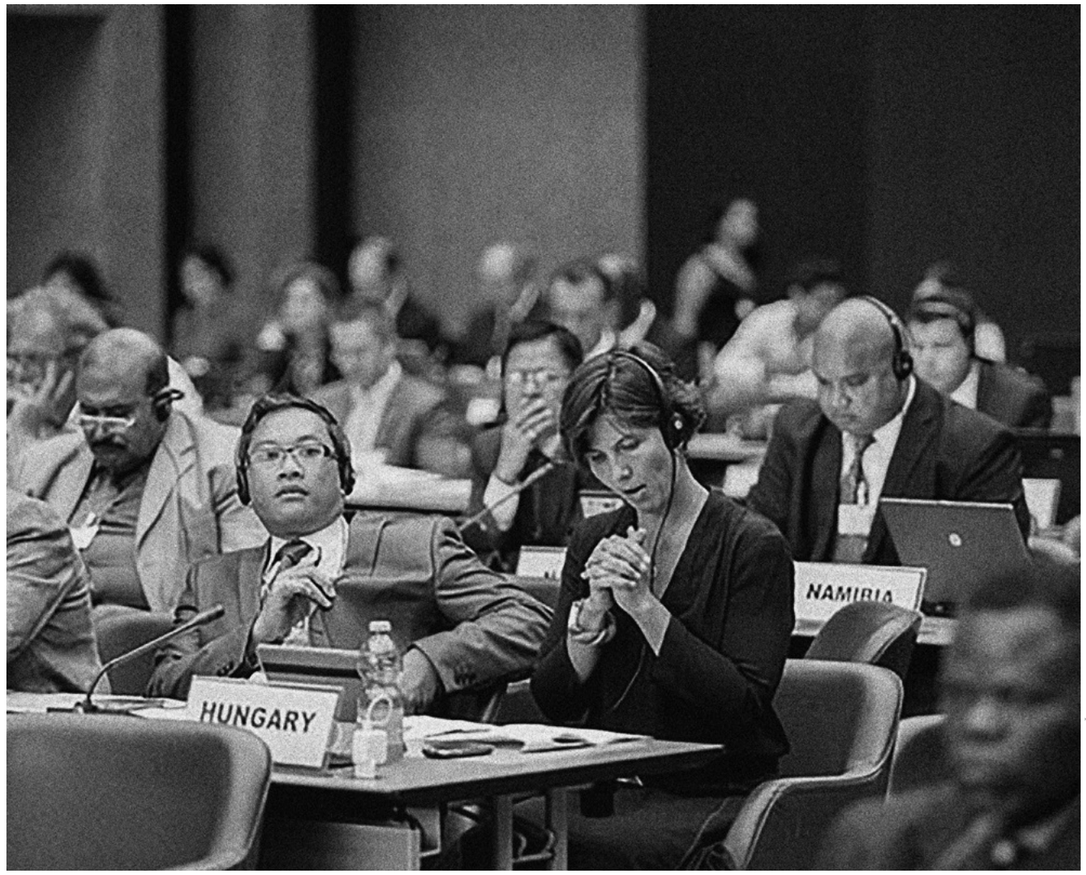
4.4.2 Extended producer responsibility (EPR)

The duty of preventing pollution, the Life Cycle concept, the Polluter-Pays Principle and the internalization of costs are the four main pillars that comprise the Extended Producer Responsibility Principle.

This principle or approach has changed the traditional view of who must take charge of generated waste management: whereas the responsible for managing almost all waste generated from consumption used to be the State, the proposal now is to focus analysis on the product, including its characteristics, composition, volume and even its mass consumption. The immediate effect of this approach is an essential change in the allocation of economic and factual responsibility for waste management which is transferred from the Government to the product's manufacturer, producer or importer. That is logical if we take into account that the producer dominates the value chain, who can best influence the behaviors of the remaining links, and be the only one that can make decisions concerning the design and composition of the products and marketing strategies.

In other words, this is not only about the displacement of responsibility but also a very important aspect that can work as trigger for sustainable production. Despite having an immediate and visible objective, i.e. the responsibility for the management of those wastes that, as a result of their economic activity, the producer introduced in the society, there is also a final objective which consists of making them apply their own resources to reduce the amount of waste generated, make recycling easier and creating a tendency to eliminate hazards. In that regard, the application of the ERP principle from direct regulations should strongly operate in a more environmentally-friendly design and production, either in the manufacturing of longer lasting and easier-to-recycle products or with a less dangerous composition or free of toxic substances.

The benefit for the producers is notorious: the lower the amount and hazard of the wastes or the more easily recyclable they are, the less expensive their management is. Eventually, not only should their finances improve but also the company's and products' image, adding competitiveness, which acts as a stimulus for improvement.



Box 4.7

Basel Convention Partnership Program

COP6 of Basel Convention, held in Geneva, Switzerland, in December 2002 established a Program called "Basel Convention Partnership Program" in which the public, private and academic sector as well as non-governmental organizations take part for the purpose of supporting the Convention work through dialogue and action. The Program emphasizes Extended Producer Responsibility, stating that the participation of the industry is essential, as it provides technical tools, knowledge and infrastructure to establish which would be the improvements that could be made to their own products, with a view to their management at the end of their useful life, either by recycling them or for their correct final disposal.

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LAC legislation introduces examples in which the EPR principle is expressly included, either in the general waste law or in specific regulations for a specific stream. This is the case of Argentina, Bolivia, Chile, Colombia, Costa Rica, Ecuador and Honduras. In the case of Uruguay, the pioneer in the region, the principle has been implemented for several waste streams by specific rules, albeit not having been expressly included in any of them[53]. Venezuela, for example, without mentioning the EPR principle, binds in its general waste law the establishment of return Programs for mass consumption product to be recovered or recycled (Comprehensive Waste Management Law, published on December 30, 2010, art. 35).

Bolivia, for instance, has included the principle of the comprehensive solid waste management (Law No. 755 dated October 28, 2015, art. 38) with the following wording: "Extended Producer Responsibility is a special regime of comprehensive waste management, according to which producers and distributors are responsible for the comprehensive management of their products, until the post-consumption phase, when they are converted into waste." That is also the case for Costa Rica (Comprehensive waste management law No. 8839 published on July 13, 2010[54]), which describes it as follows: "Extended Producer Responsibility: producers or importers are responsible for the product along its entire life cycle, including the post-industrial and post-consumption phases." The recent Chilean law, in turn, enters on this line, establishing the EPR in the general rule and providing that it shall apply to a certain class of products called "priority"[55].

In other cases, such as that of Colombia, the EPR is specifically in the regulation of electrical and electronic equipment (Law No. 1672 dated July 19, 2013[56]) and, yet without mentioning the principle, in the hazardous waste[57] and used tire management regulations (Resolution No. 1457 of July 29, 2010[58]).

53. Thus, the country has a regulation based on the EPR principle for lead-acid batteries (Decree No. 373/2003), non-returnable containers (Law No. 17849/2004), agrochemical containers (Decree No. 152/2013) and out of order tyres (Decree No. 358/2015).

54. This law establishes the EPR principle in art. 5 providing that it shall apply to special handling waste.

55. According to this law priority products are those substances or objects "that once transformed into waste, for its volume, hazard or presence of reclaimable resources, is subject to the obligations of extended producer responsibility." As of the date of enactment of the rule, and without prejudice to the fact that other categories could be included, these are: lubricant oils, WEEEs, batteries, containers and packaging, tires and cells..

56. This law establishes rules for the comprehensive WEEEs management, providing in its art. 3 that "It is the duty the producer of electric and electronic equipment has, throughout the different stages of the product's life cycle."

57. Indeed, Decree No. 4741 of December 30, 2005, establishes in its article 20 concerning wastes from the consumption of hazardous products or substances, that they shall be subject to a Post-Consumption Product Return Management Plan whereby they will return the production-import-distribution-commercialization chain, those hazardous products or used products, expired or withdrawn from the market of the following streams: disused pesticides and their contaminated containers and packaging, expired drugs or medicines and lead-acid batteries.

58. This resolution provides for the obligation of tire products for establishing collection and management systems.

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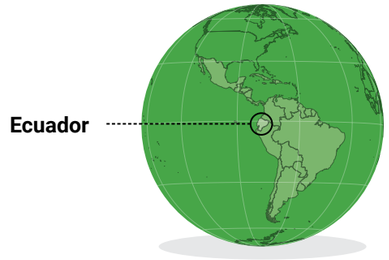
Case Study 11

Extended producer responsibility in Ecuador



Since 2013, the Ministry of the Environment has published and implemented rules related to comprehensive waste management based on the EPR principle, who is responsible for the products placed in the market throughout their life cycle. They must undertake selective collection and a proper management of the product at the end of its life, either reclaiming it or deriving it to final disposal.

Under EPR, producers must achieve annual recovery goals established in the agreements by waste stream, apart from financing the costs inherent to said responsibility, for which they can resort to strategies such as collection through reverse logistics, even under collective management systems. The companies must register and present and implement a comprehensive management program which provides a detail of the mechanisms and strategies to use at all management stages (establishment of recovery points for the citizens, collection, temporary storage, transportation and delivery to handlers for treatment or final disposal). Every January companies submit to the ministry all the progress declarations of the program of the year that ended for their validation generating annual indicators. Up to now, the implemented policies include used mobile phones, agricultural-use plastics and tires (Agreements 191/2013, 91/2013 and 98/2015, respectively).

Another mode that appears in some of the analysed legislations is the so-called Shared Responsibility or Shared and Differentiated Responsibility Principle, as it happens in Brazil and Mexico. Argentina, on the other hand, has recently enacted a law to regulate the management of agrochemical containers under this approach (Law No. 27279, 2016), although it previously had a tire management rule comprised in the EPR principle (Resolution No. 523/2013).

An example of the wording of this principle arises from the Mexican legislation[59]: "Principle whereby it is recognized that urban solid and special-handling waste are generated from activities that satisfy the needs of the society, through value chains such as production, process, packaging, distribution, product consumption, and that, therefore, its comprehensive management is a social co-responsibility and requires a joint participation, coordinated and differentiated from the producers, distributors, consumers, users of by-products, and of the three levels of government as applicable, under a feasibility market and environmental, technological, economic and social efficiency scheme."

The possible consequence of introducing this mode is the limitation to the four EPR pillars mentioned above. The limitation is evident also when, by restricting the responsibility placed on manufacturers, producers and importers for the entire management they must perform on the wastes, the ultimate aim of the EPR principle is eliminated, which consists of achieving a change in design and production of the products placed in the market.

By diluting the responsibility amongst other players (consumers, waste handlers and the State), the motivation of the producer to invest in sustainable products is also dissolved simply because, not being the only player bound to face management and while the cost is distributed amongst several players, there will be no economic pressure to allocate some resources for the design and creation of a more environmentally-friendly product. Shared responsibility could imply *partnering* with consumers, handlers and the State in the management cost and responsibility, when these players are not the ones who must or can change aspects of design and production, except by forcing changes by more extreme measures such as not consuming or prohibiting, for example, the use of certain materials or supplies.

Notwithstanding, each country could experience the application of shared responsibility differently. Brazil has regulated it but that does not seem to have been an obstacle, so far, to agree with the sectors that are developing and implementing *reverse logistics.* Most likely that is associated with the weight of the environmental institutionality in that country, the quality of the links built between the governmental sector and the private sector during the treatment of a series of environmental matters and the wide participation verified in the development of policies and rules on waste management. Still it must be underlined that, in the sectoral agreement on lubricant oil plastic containers, for instance, a clause is provided for whereby the manufactures are bound to develop technology to enable the incorporation of recovered material in the new containers' manufacture, this clause being more consistent with a genuine EPR principle[60] than with shared responsibility.

The Principle of Shared Responsibility seems to be perfectly applicable to ordinary solid waste where each link on the comprehensive management chain has a specific duty, from the generator, which will start with source separation and will pay for the collection and disposal service, to the State, in its role of system articulator and comptroller. But this logic is not verified in special handling waste, which is normally covered by EPR and the management cost of which is borne by the producer.

59. The General Law for the Prevention and Comprehensive Management of Wastes of 2003 embodies this concept in its art. 5. Guatemala regulations also establish so in the National Policy for the Integral Management of Waste and Solid Waste. Governmental Agreement 281-2015..

60. To see the sectoral agreement: [http://www.sinir.gov.br/documents/10180/12308/ACORDO+SETORIAL+SISTEMA+LOGISTICA+REVERSA+EMBALAGENS+PLASTICAS+LUBRIFICANTES].

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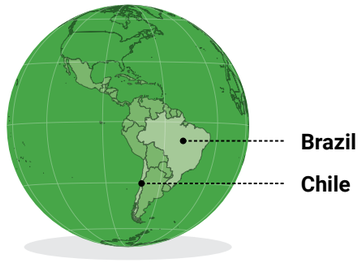
Box 4.8

Extended responsibility and shared responsibility



Extended responsibility (Chile)	Shared responsibility (Brazil)
"Extended producer responsibility is a special waste management regime, according to which producers of priority products are responsible for the organization and financing of priority product waste management sold in the country" (Law 20,920, art. 9, first paragraph).	"Shared responsibility for the life cycle of the products: set of individualized powers which are chained to the manufacturers, importers, distributors and traders, consumers and the holders of the public services of urban cleaning and solid waste management, to minimize the volume of solid waste and generated waste, as well as to reduce the impacts caused to human health and environmental quality derived from the products' life cycle, in the terms of this Law" (Law 12.305, art. 3, section XVII).

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Beyond how the principle is termed in each country, the broader responsibility of who puts the products on the market should be sought, so as to guarantee, not only management's legal and financial responsibility, but also more sustainable production.

In brief, regardless of how the principle is referred to in each country, what should be sought is a wide responsibility in whoever places the products in the market, with the aim of guaranteeing not only the legal and financial management responsibility, but also a more sustainable production. Likewise, it is highly recommended to focus on the establishment of a solid legal definition of "producer", for the purpose of avoiding *leaks* to the system[61], and define the new, historical and orphan products as well.

Lastly, an issue that must also be resolved upon concerning the EPR application is the collection of waste reached by it, taking its characteristics and both governments and producers' responsibilities' extent and limits into account. It is clear that, for example, WEEE collection requires a considerable infrastructure (premises and transportation) and that even though local governments with capacity could perform this activity, it implies major costs which must be compensated, as they escape the household or municipal waste, and surely waste management rates paid by citizens. In many cases, there will be lack of technical and economic capacities to take this responsibility, hence both public and private sectors will need to work together in order to achieve the necessary actions.

FIGURE 4.2 represents the 12 LAC countries in which legislation that expressly includes or applies EPR could be identified, either in general rules or by waste stream.

FIGURE 4.2
Countries of the region that consider the principle of extended and shared responsibility in their regulatory systems
Source: prepared by the authors based on the analysis of the legislation and queries to countries.

61. In this sense, it should be considered that it is not only the manufacturer who places the product in the market but other players could do so also, such as distributors, assemblers and importers. Therefore, regulations are to analyse the real and complete chain of supply to define the "producer", thus hindering certain producers from identifying themselves with the objective that there are no new orphan products and free-riders. The European Union contemplates in EP online sales, whereas in Japan and the USA they make the responsibility extensive to those who restore and place the restored product (for the second time) in the market. However, this latter could turn out to be difficult for developing countries, where repairs can take place in very small shops with differing degrees informality.

Case Study 12

Treatment of containers and packages in Brazil, Chile and Uruguay

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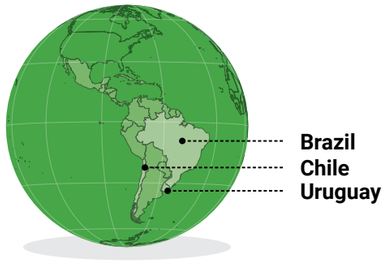
Waste containers. Uruguay.



The management of containers and packages has been added to the regulatory systems of Brazil, Chile and Uruguay. In the latter, the law dates back to the year 2004, having been regulated in 2007 (Law No. 17.849/2004 and Decree No. 206/2007). As has already been mentioned, it is an example of how the EPR principle is not expressed in the rule, but rather is applied through its provisions. Indeed, the law embodies all containers placed in the market and their wastes, including sale or primary, collective or secondary and transportation or tertiary containers, excluding the industrial, commercial and agricultural ones. It establishes a registration system for manufacturers and importers, who can only deliver or sell containers (and raw materials) to those who are also registered and authorized to carry out these operations. Packagers and importers of packaged products shall be registered and prepare a container and used container waste management plan, which can be collective and must be approved by the environmental authority.

Brazil included packaging in the general law of solid waste providing that they are made in such a way that they can be reused, or rather recycled, thus being covered by the obligation of being handled by a reverse logistics system. This obligation applies to manufacturers, importers, distributors and traders. Lastly, Chile in its new law on wastes refers to containers and packages as "priority products" and, therefore, subject to EPR and the obligation of organizing and financing collection, transportation and treatment thereof, as well as of achieving the goals and other associated obligations that may be placed.

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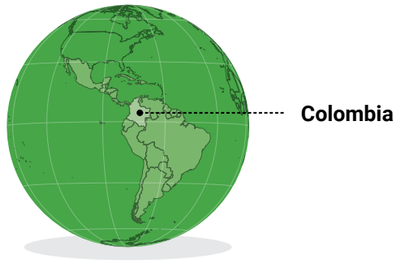
Case Study 13

Post-consumption product return management in Colombia



The existing post-consumption plans for lead-acid batteries, light bulbs, computers, tires, expired drugs, cells and pesticides, have been approved by the national environmental authorization in application of Decree 4741 of 2005, that regulates the management of hazardous waste along with several sectoral resolutions later dictated. The decree defines the Post-consumption product return management as management instruments *"to make the return and stockpiling of post-consumption products easier, which upon disposal turned into hazardous waste"*, for them to be properly managed, either valuing the materials or proceeding to its controlled final disposal.

The EPR principle, which is only explicit in WEEEs regulations is articulated in this decree by other principles that attribute responsibility to the manufacturer's management: *"comprehensive management, life cycle of the product, comprehensive responsibility of the generator, sustainable production and consumption, precaution, public participation, internalization of environmental costs, planning, division in stages and risk communication."*

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Material traceability is mandatory, regulating the registration of generators, shippers and receptors, and establishing a joint responsibility between them, which lasts until the waste has been used as a supply of other productive process or until its final disposal. Thus, the programs establish authorized handlers for recovery or treatment of waste, which must have approved premises and the corresponding environmental license to legally perform these activities. This way, the Colombian Ministry of the Environment and Sustainable Development has developed the norms that regulate the post-consumption Programs as part of a strategy aimed at avoiding that hazardous waste be sent to sanitary landfills[62].

The lead-acid batteries are handled by individual plans, whose holders are registered with the environmental authority[63]. On the contrary, for the remaining waste there are collective programs that were developed upon request of the National Business Association of Colombia (ANDI): *Close the Cycle* (household pesticide containers), *Blue Point* (empty containers or with expired or decayed drug and medicine remainders) *Batteries with the Environment* (AA, AAA, C, D and 6-volt batteries, no cadmium or mercury added), Tires (used pneumatics), *Lumina* (electric bulbs) and *Eco-compute* (computer equipment)[64].

62. Amongst these rules there is Resolution 693 of 2007 on pesticides, Resolution 371 of 2009 on drugs, Resolution 372 of 2009 (and its amendments) on lead-acid batteries and Resolutions 1297 (batteries), 1457 (tyres), 1512 (WEEE) and 1511 (electric bulbs), all of them dictated in 2010.

63. See in: [https://www.minambiente.gov.co/images/AsuntosambientalesySectorialyUrbana/pdf/Programa_posconsumo_existente/bases_datos_SRS/planes_posconsumo_06-2015/GDP_Baterias_07_2015.pdf].

64. For more information, go to: [http://www.cierraelciclo.com/], [http://puntoazul.com.co/], [https://www.pilascolombia.com/] and [http://www.ecocomputo.com/].

4.5 Social instruments

4.5.1 Education

Good solid waste management is not only achieved through the application of the law. The numerous violations to the rules that are daily verified, for example, clandestine landfills and open burning of waste, are evidence of that. These behaviors are punished in the regulations, yet continue to occur, and generally no sanctions for these acts are applied in the countries of the region[65]. Education and information emerge as very relevant aspects to take into account to contribute to raise awareness on the importance of a proper management, as an indispensable way to achieve the public health and environmental quality goals.

In that sense, the 2005-2014 United Nations Decade of Education for Sustainable Development (Unesco, s.f.), proclaimed by Resolution 57/254 of the General Meeting, seeks the promotion and improvement of quality education, guidance on the education programs from high-schools to universities, increasing citizens' understanding and awareness and providing practical training for the purpose of generating the necessary changes to achieve development sustainability. Improving and increasing the understanding and knowledge of the consequences of one's behavior can indeed help to achieve the engagement of people and institutions to change consumption habits and perform specific actions, such as source separation, reuse of elements and care for urban hygiene. The proposals range from including the topic in the mandatory syllabus to information, spreading and awareness campaigns on mass or personalized media. Also, as mentioned in 4.4.1 regarding sustainable public procurement, Governments have the huge opportunity to educate by example, properly communicating, in every decision, how they ensure the paradigm change.

Although educational campaigns in terms of waste are provided in a number of legislations of the region, the issue of formal education requires a special mention, which Bolivia, Costa Rica, Nicaragua and Venezuela is expressly stipulated. In the case of Brazil, for example, the law requires the solid waste national policy to be articulated with the environmental education national policy (Law 12305/2010, art. 5).

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Resource recovery pilot project in schools of Saint Lucia.

65. It should be pointed out that in a number of cases the application of sanctions could be a problem for the authorities in charge of management as many times the violations occur as a consequence of governmental failures, either because the required tools have not been provided to comply with the regulations or because there is a deficiency in the control to be performed by the Government

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Case Study 14

Environmental education in various countries of the region

1

Bolivia

"Education in Comprehensive Waste Management.

1. The Plurinational Educational System within its Regular Education Subsystems, Alternative and Special Education and Higher Professional Training must incorporate coexistence with Mother Earth and Community Health, Comprehensive Waste Management through different curricular programmatic structures in the very backbone of education.
2. The public or private instances must incorporate educational strategies or actions to promote individual awareness and community partner for the Comprehensive Waste Management" (Law No. 755/2015, art. 21).

2

Brazil

Brazil has a law that establishes the National Policy of Environmental Education (Law No. 9795/1999), and that considers it as a main component that must to be implemented on an ongoing basis in the different levels and modes of formal and non-formal education. It provides for, amongst others, a training program for educators, one to increase the number of environmental courses offered (in the framework of the National Program of Access to Technical Education and Employment -PRONATEC-) and another one to support interactive media that contribute to the spreading of the problems (Educomunicación)[66].

3

Costa Rica

"National Education Program for Comprehensive Waste Management

According to Law No. 8839, the Ministry of Public Education, in the context of formal education shall formulate and implement the National Education Program for Comprehensive Waste Management in the both public and private kindergartens as well as in primary and secondary educational centers across the country, which they must arrange with the Ministry of Health. Furthermore, higher and technical education institutions by means of a guideline must establish in the academic syllabi of the degrees in the field, the training in comprehensive waste management, according to the principles and objectives of Law No. 8839" (Decree No. 37567/2012, art. 34[67]).

4

Nicaragua

"The national policy of solid waste is subject to the following principles: Health Principle; Environmental education; Equity principle; Elimination of Child Labor principle; Shared environmental responsibility, Citizen participation; Information transparency; Polluter pays; Strengthening of local economy; Compensation; Competitiveness; Prevention principle; Precautionary principle; Comprehensiveness; Graduality; Flexibility; Responsibility from cradle to grave; Proximity; Simplicity and dynamism; Environmental sustainability; Use of the best possible technology; Self-sufficiency and national sovereignty" (National Policy on Comprehensive Solid Waste Management (non-hazardous and hazardous) 2004-2023, Art. 8).

As part of the strategy to implement the 2004-2023 National Policy on Comprehensive Solid Waste Management it is established that "For the purpose of incorporating citizen participation in the comprehensive solid waste management, implementing the national strategy of environmental education, both formal and informal, the solid waste management component, is required in the short and medium term, oriented to the separation of organic and inorganic waste for the economic use thereof" (National Policy on Comprehensive Solid Waste Management (non-hazardous and hazardous) 2004-2023, Art. 8).

5

Venezuela

"Environmental education in comprehensive management and comprehensive handling of waste and solid waste is aimed at promoting, developing and consolidating a culture of production and environmentally-responsible consumption, to prevent and minimize the generation of waste and solid waste, as well as fostering individual and collective participation in related plans, programs and projects. This guidance must be the subject-matter of specific programs addressed to all the population and must be a substantial part of the school curriculum" (Comprehensive Waste Management Law dated December 30, 2010, art. 79).

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66. For more information, go to: [http://www.mma.gov.br/educacao-ambiental].

67. According to the information provided by the authorities of Costa Rica, the education plan is in the process of being updated and a strategy for implementing it in elementary and secondary education is being defined.

Importantly, experience shows that changes are not achieved in the short term and that it is extremely necessary to provide clear and accessible information, sustaining both formal and informal education, including public campaigns. Therefore, it will be necessary to plan not only contents and their evolution, but also having resources to keep and update the strategies, possibly, for years.

Moreover, it is essential to consider that, depending on the management of waste by individual, institutional players and communities with various realities and interests, in the case of public campaigns they must be adapted to the local situation, their specific possibilities, their economy, culture and idiosyncrasy, noting that a customized product will not be efficient or apt if there is an intention to apply it indiscriminately to all situations. Additionally, it shall be taken into account that communication, informing and raising awareness requires specific knowledge. This will imply resources to access specialized training of professionals in different fields, whose knowledge and experience shall be necessary to achieve the goals set.

In the region, there are various communication examples ranging from door to door sellers to graphic material, web sites and social network campaigns designers. Although in the region the governments have made great strides in this regard, especially in the last decade, interestingly, it must be highlighted that non-governmental organizations have often been in the lead and demonstrate, broadly speaking, more experience in this type of initiatives.

4.5.2 Information and Communication

As mentioned above, the proper management of waste depends on more facts than the validity of the law. Curiously, in spite of the imposition direct regulations imply and armed by information related to the negative consequences of our actions, human beings persist in behaviors which ultimately harm us as individuals and as a society. A clear example is the use of tobacco, which has impacts on our health and the health of others, and of which there are plenty of regulations and information. Something similar happens with the scarce awareness in connection with the use of goods and services, and the environmental impact derived from the generation of waste, although more recently a greatest interest and concern has been observed in children, most likely due to the work done in schools. We find it difficult to understand the importance of our own and collective actions in protection of the environment in general and in relation with waste in particular; therefore, we will have to continue committing to education and information, especially targeted at raising awareness and a change of habits.

As foreseen, it will be necessary to have expert advice to select and present information, considering the characteristics of the groups at which it is addressed, and taking into account that, although governments will be primarily responsible for these actions, involving other players, such as the private sector, waste handlers, waste pickers and civil society organizations, can be very useful. Each sector has its own resources and experience and also has specific goals, so that the State, representing the common interest, could operate either as articulator, setting the scenario for a communication strategy planning, where public and private efforts add together in a coherent and coordinated manner.

From a regulatory point of view, most LAC countries have included in their regulations obligations related to the required information that must be provided, establishing public access systems and providing for media, informational and educational campaigns[68]. However, taking into account the generalized deficit there is in connection with public information on waste management, this is one of the items which should be seen in depth, especially in relation to the development and putting into action of indicators from which information can then be spread.

68. This is the case of Argentina, Bolivia, Brazil, Chile and Guatemala, amongst others. In the case of Honduras, it is specifically established that local governments must promote and arrange with governmental, non-governmental institutions and the private sector, the launching of media, outreach and educational campaigns aimed at provoking a behavior that favors a proper management of solid waste (Executive Agreement No. 1567/2010, Rule of Procedure for Comprehensive Solid Waste Management, art. 8).

FIGURE 4.3
Different actors in waste management and their roles

Actors	Roles
Waste generators	"Waste generators: Domestic waste generators, the first link in the consumption chain, requires effort to be made in relation to giving them information and increasing their awareness, especially in relation to consumption habits as well as separation of waste at source. Special or institutional generators will require a complete management plan, that is appropriate to the type and volume of waste generated.
	Under the Principle of Extended Producer Responsibility, producers will be legally and financially responsible for the post-consumer management of the products introduced into the market, as they, themselves, determine the products' design, the raw materials used and marketing.
Waste-pickers	Contributors in the urban management of waste have been key in raising awareness about recycling. Its inclusion, formalization and professionalization implies a challenge for the States.
Waste managers	In charge of transportation, treatment, recycling and final disposal, they must act in accordance with the legal and economic conditions of the country in which they are located.
State	A determining actor that guarantees the right to health and a healthy environment, through strategic planning for waste management by acting as an articulator and balancer between the actors involved in waste management.
	The State establishes norms and objectives of environmental quality, which in turn supervises for its due compliance.
	It also defines the scope of the obligations of each actor.
	Additionally, it determines the conditions for a circular economy, through regulation and economic incentives.
Civil society organizations	These contribute, through providing information and education as well as by raising awareness about waste management and recycling.
	The promote environmental public debates related to waste.
	They contribute in technical, social and environmental aspects.
	Additionally, they contribute to the monitoring of compliance with standards and strategies.

4.6 Involving players

4.6.1 The variety of players and their roles

Waste management involves various players and sectors, each with a particular interest in the matter. Waste generators, in their homes or in the institutions they are part of or attend, are presented as the first link of a chain that starts with consumption and triggers, from there, a series of environmental, social, economic and institutional consequences. This is why it is so important to work not only on the management of the waste already produced but also on improving consumption habits, sustainable production and Extended Producer Responsibility. Waste generation and its comprehensive management represent a pressing need for governments, which must be dealt with from the different approaches that allow reducing its amount, volume and hazard, and in general, managing all the impacts implied for the environment.

In many cases, home generators gather in informal groups with the aim of taking some specific waste-related actions (neighborhood organizations) and in others they adhere to the campaigns conducted by non-governmental organizations as part of their institutional agenda. Companies have also turned to the incorporation of organizations to deal with aspects of waste management generated as a result of their business activities[69].

Waste pickers, on the other hand, are a certainly important sector interested in waste management in most LAC countries, having reached various degrees of acknowledgement and formalization, to the point of even building networks beyond national boundaries. Furthermore, waste handlers, public and private companies in charge of shipping, treatment, recycling and final disposal, will be particularly interested in the legal and economic conditions of the cities or countries where they operate.

The State, both national and local, is presented in all cases as a determinant player, given its primary responsibility as guarantor of the right to health and a healthy environment in charge of the necessary strategic planning of waste management. Its duties are to establish the rules and objectives of environmental quality which must be complied with and to control them, to define the extent of the obligations of every player, to favor the conditions required for a circular economy. All that generating the institutional spaces so that these aspects are defined through participation and in a transparent way, paying attention to the expected environmental quality and the demands of all interested players, all seeking the common good.

In this regard, the State shall be prepared to undertake an articulating and balancing role, taking into account that interested players have different levels of power and that, many times, very important players for management and primary recipient of a good waste management effects, such as citizens, lack enough power for their rights, views and expectations to be properly reflected in public decisions. Especially when it comes to the low-income sectors of the population.

It is also important to note the role of organizations of the civil society that not only contribute to waste management and recycling but also contribute as promoters of many environmental waste-related public debates. More than once, especially in LAC, these organizations have been the ones who managed set those topics in the public agenda, generating participatory talking spaces that would have otherwise not taken place.

It is essential to mention the role of organizations in monitoring the compliance of the rules and strategies. This role can be a great contribution to governments, which will then have a look or external control of their management. This contribution is economic, since other sectors finance the control, but it is also a collaborative contribution in the technical, social and environmental aspects that make up the know-how of the organizations committed to the task and that, in general lines, provide valuable information on the successes and deviations of the public and private management. An interesting case is that of the Solid Waste National Policy Observatory established in Brazil in 2014 by 26 organizations from the social, environmental and academic sector, the aim of which is to create the conditions for the civil society to monitor the compliance with Law 12,305 and efficient, ethical and transparent implementation of the Solid Waste National Policy established by it[70].

69. An example of that is *CEMPRE* –Business Recycling Commitment- which has similar organizations in Argentina, Brazil and Uruguay. These are non-profitable business associations that work in various actions conducive to waste reduction and recycling, mainly though information, research, and training.

70. More information on: [https://observatoriopnrs.org/].

Case Study 15

La Pintana, Chile – A successful plan of communication and community participation

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La Pintana, Chile

La Pintana is an urban municipality located south of Santiago de Chile, part of the metropolitan region of Santiago. It has a surface of 30.31 km^2 and by 2015, total population amounted to around 212,000 inhabitants, 76% of them are considered poor[71]. It was founded in 1984, as a result of the partition of La Granja municipality. It is governed by a major and a municipal council made up of 8 members.

71. According to the Climate Change Local Plan – Municipality of La Pintana 2015 (Red Chilena de Municipios ante el Cambio Climático, s.f.), "the great majority of those defined as non-poor are covered by this classification only because they have an income slightly over the poverty line (76% of the population, PLADECO - Community Development Plan). Besides, the average household income amounts to $468,958 (CASEN 2009), the lowest of the Gran Santiago communities."

For over 20 years, the municipality has been in charge of the territory's environmental management, and since 2008, its initiatives and actions are part of the Community Strategy for Global Change, which is aimed at *"reverting the negative effects of Global Change, through a local management strategy that strengthens and coordinates actions aimed at suppressing carbon or greenhouse gas emissions, increasing carbon reservoirs and enabling adaptation to the new conditions, thus helping in resolution of global problems and improving the quality of life of the people in La Pintana and the planet."* This strategy deals with five central axes: energy, waste, citizen participation, water and vegetation cover.

Based on the prior analysis of the characteristics and amounts of waste generated, on the engagement of the primary players related to waste management and the clear conception that a great part of the discarded items contains a resource to be used, in 2005 the municipality started a waste management which could be described as *"unconventional."*

The "Community Program of Waste Source Separation" is based on two main ideas: a) the handling of waste must involve and engage its own generators, as primarily responsible parts and b) since all wastes are generated inside

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community territory, dealing with the problems locally and with the participation of the community is essential.

Opposite to the situation in most available examples, hence its *unconventional* nature, La Pintana started a management Program with the separation of plant waste (fruit, vegetables and yard waste) based on the data from its own analysis: 1) in the district, this fraction is equal to the greatest part of the total (56%), 2) these wastes are the ones that pollute the remaining recoverable fractions and 3) they are also the ones which generate leachate and greenhouse gas emissions on the final disposal sites.

The community emphasized the media campaigns conducted to put the program into practise and also the delivery of special containers for initial disposal of vegetables, measures that contributed to the success of the Program. This way, by separating vegetables, a significant reduction of the total waste volume and resulting final disposal cost saving could be achieved. According to 2012 data, source-separated green wastes were collected three times a week by the municipality and by a private company, and taken to a community treatment plant. It had a composting and vermiculture plant which treated, in total, 36 tonnes of green wastes per day.

Vegetable recovery provided La Pintana specific collection and disposal saving. Regarding collection, since the transfer station was located farther than the composting plant there were higher fuel expenses. As for treatment, the composting and vermiculture techniques turned out to be cheaper than disposal in sanitary landfill. Treatment cost per tonne, according to the local Board of Environmental Management, was 1 dollar by vermiculture, 3 dollars by composting and 20 by sanitary landfill. Thus, the savings of one treatment compared to the other was US$ 750 a day by 2012.

In addition, there was the initial low cost of the commissioning the system, which could be covered by current budget and only required employing four people.

The produced compost is allotted to the municipal plant nursery, squares and divides, having enabled the increase of green areas and forest cover in La Pintana. Another accomplishment is the collection of used vegetable oil from the private and business houses, which is recovered and transformed into biodiesel by the municipality that then allots it to waste collection trucks and the employed machinery. This oil collection initiative is part of the community energy sustainability.

It is a special case, but worthy of analysis for similar communities: the government directs its main efforts to recover green waste, instead of directing them to the recyclable dry fractions which are more valuable in economic terms. In La Pintana, the local government does not make efforts for the separation of these fractions, yet glass, plastic and multi-layer containers are recovered by "green points". Those locations have been enabled by the municipality in closed, delimited spaces an under the control of non-governmental organizations which obtain benefits from the money gained by trading these materials. Waste pickers also collect part of these wastes, with the support of the municipality, which makes its contribution by requesting on the leaflets handed out by them to foster source separation that these recyclables fractions be delivered to retrievers. That is, La Pintana has managed to reduce in over 45% of the amount of wastes derived to Santa Marta sanitary landfills, where wastes of another 18 Chilean municipalities are received.

The local government currently continues to manage the Program by the Board of Environmental Management, which is also in charge of removing large debris and dead animals, and of cleaning of micro-dumps[72].

La Pintana by 2033

The municipality recently drafted its 2015 Climate Change Local Plan, by a participatory process, developing the vision for the territory of La Pintana, in the context of the challenges and opportunities of climate change, by the year 2033. In this framework, and in connection of waste management, it aims at: "*A final disposal rate (in dump or sanitary landfill) in Household Solid Waste (HSW) of 28% or lower", "With a green waste treatment plant still active, but slowly giving way to domestic internal treatment of this fraction as supply for Urban Agriculture.*"

Citizen participation, is key

After 22 years, the municipality especially emphasizes the value of the participation as key to the advances in policy and environmental management, acknowledging that the current environmental management model could not have been achieved if the people of the municipality had not actively been engaged in it. The achieved behavioral changes - also a consequence of participation - contribute daily to settle a communitarian motto: "Local solutions to Global Problems."

72. For more information on municipal management: [http://www.digap.cl/wpress/] and [https://mail.google.com/mail/u/0/#inbox/159a5542080c6e7d?projector=1].

4.6.2 Inclusion of the citizen/user

It should be clarified that, broadly speaking, the perception of the citizen/generator of waste as the *user* of the management system is not usual in the region. Maybe this perception is based on an old but still valid conception as particular generators do not deem themselves responsible whatsoever of the management of their own waste - except for taking them out to the street to be collected, and as they do not pay for this service explicitly, as they do with water or power, they do not see themselves as "users" of the system.

By stating that home generators do not *particularly* pay for the waste management service it should be noted that there is a number of systems in the region in which collection, treatment and urban cleaning (cleaning the streets and pavements and public sites in general) costs are included in a generic rate, which also covers other services, such as public lightning, where there is no detailed breakdown of the items paid for and how much specifically each one costs.

This remark is important because ignoring the costs waste management service implies for a local government - which, by the way, in many countries, is the largest part of the local budget - also contributes to a scarce awareness of the need to reduce, reuse and recycle. Besides, without changing the global idea that waste management is completed only with the removal from the public streets, it will be difficult to understand the high costs implied in the subsequent stages of comprehensive management.

In the last decade, this idea has changed partly thanks to incipient information on the matter and to the conflicts caused, for example, due to the NIMBY effect. With the news of the refusal by neighbors to the establishment of sanitary landfills or the mode of operation thereof, the implications of indiscriminate burying became known, and later, consequently, the possibility of reusing and recycling much wastes which were previously disposed of directly in garbage bags. Nonetheless, the citizens are still not particularly interested in the management cost within the local budget, and neither do governments make efforts to determine that cost and communicate it.

Therefore, openness about actual costs of a good local management and how much every stage of the management means in money seems essential. Then, it shall be necessary to analyse how these costs could be reduced based on specific actions that can be taken in each city and clearly report on this situation so that the citizens understand that small individual actions can cause a major impact on the local public budget, and accordingly, on the rates everyone shall pay for the management.

Most likely, if the citizen has accurate and solid information on the total and itemized costs of waste management - what can be saved, the environmental impacts prevented or minimized, the relationship of this budget with public health's budget, the economic and social framework associated with the recycling market and how the ERP works in their community, they will be able to see why it is essential to change habits from a personal and social point of view, and particularly, why and what for they are bound to pay that amount of money. Information is key for engagement and the basis of a proper participation. Then, maybe the citizens may be able to recognize themselves as authentic *users* of the service, who are, therefore, entitled to be provided with information on operations and efficiency, give their opinion and assess it by institutionalized participation channels. As long as citizens fail to understand that waste management has a value that must be paid just like water consumption, energy or transportation, they will hardly see themselves as users.

One of the most frequent problems faced by many cities in the region precisely is that the rates fixed for the waste collection and urban hygiene service are not enough to cover the costs of the mentioned service. That is because few LAC countries have accountability systems that enable the determination of such costs, which are essential to evaluate their efficiency and to fix suitable and fair rates. For decades, no efforts have been made to determine those costs or conduct studies of the most equitable way of reflecting them in rates, or the most convenient way to perceive them, and consequently, there has been no report either to society on the composition of this value, the need for the rates to be timely paid and the public saving an efficient and properly financed waste management system means. Additionally, and particularly in the cases of very small local governments, these do not even charge or invoice for their service[73]. On the other hand, when these rates are not associated with the collection of essential services such as water or power - when included in the same invoice - in many communities they end up being practically irrecoverable.

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73. According to research in 2010 for the LAC region, it was determined that in Brazil only 50% of the municipalities charge the service, followed by Bolivia (39,7%) and Guatemala (37,9%). Only in Costa Rica and Uruguay 100% of the municipalities charge it, as per the 2010 Report on the Regional Assessment of Urban Solid Waste Management in Latin America and the Caribbean, Pan-American Health Organization (PAHO), Inter-American Development Bank (IDB), Inter-American Association of Sanitary and Environmental Engineering (IAASEE), available on http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=36466973. Without prejudice to the above, Uruguay reports that waste rates are practically non-existent, the financial resources coming mostly from a generic property tax.

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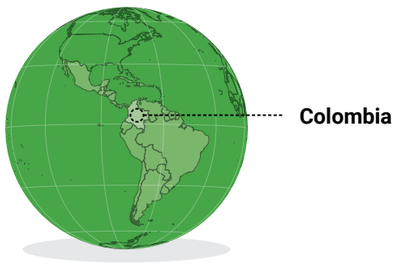
Medellin, Colombia

Case Study 16

Socio-economic stratification in Colombia



In order to be able to charge household public services differently by social class, Colombia makes a stratification based on the classification of real estate, which has been regulated by the Household Public Services Law (Law No. 142/1994). The grounds of this criterion are the principles of solidarity and redistribution of income, adopted in the Constitution (arts. 1 and 367). Thus, the system establish enables the granting of aids to the lowest classes and requires extra contributions from the highest ones.

As per the law, it is the duty of each local government to classify in classes the residential properties that must be provided the public service. It provides for six socioeconomic classes: 1) low-low, 2) low, 3) medium-low, 4) medium, 5) medium high, and 6) high.

As for invoicing, it is set forth that it shall be mandatory to record each item separately on the invoices in which several services are charged, and they could be paid irrespective of the others, *except the household public service of cleaning and other basic sanitation services.* Those who provide any of the public services referred to by the law are bound to provide the joint invoicing service to the cleaning service providers, for which they can perceive the cost of said activity, plus a reasonable profit. In those cases, in which on the joint invoicing collection has also been agreed upon, the provider who performed it shall transfer to the cleaning service provider all the sums collected within thirty days at the most. By 2010 the invoicing of the cleaning service was made in all the country through the aqueduct and sewerage services, with the exception of Cartagena de Indias, which invoiced it with the power service.

The inclusion of citizens is also related to the engagement in public decision making concerning the different segments of waste management. That contributes to the engagement in the application and enforcement of the rules and policies that have been discussed and agreed. Likewise, it is healthy for citizens to participate in the assessment of the management system operation as the evidence of its results - what worked and what did not - shall be the basis for future changes and corrections.

Location of treatment and final disposal sites is an issue to be particularly considered, in which information and citizen participation are primary matters to be approached by the Government, who must do so promptly and with absolute transparency. Although participatory processes do not guarantee specific results or of the agreements reached, they always make governmental decisions better informed and grounded while giving a lesson on constructive dialogue on matters of public interest, transparency and articulation of sectoral interests and the incorporation of social needs to technical matters. This lesson is equally important for governments and citizens: for the former because they must incorporate the practise of better informed and more transparent decision making, and the latter because it is necessary to be involved in the community problems, whether they are environment-related or not, thusly contributing to their solution, or management, by the contribution of knowledge, information, and why not desires or expectations for the city they belong to.

As it might be observed, the matters described throughout the chapter are intertwined, and it is evident that the access to public information, the duty of the governments to generate information and supply it, as well as to establish citizen participation channels are key elements of governance. Public audiences and consultations[74], the participatory drafting of rules, workshops and meetings on specific topics, technical consultations, rule implementation follow-up committees, social monitoring are examples of participation mechanisms that can be applied to waste management.

Furthermore, both in the public and private sector, channels to receive the users' reviews, resolve claims and complaints can be created, usually by toll-free hot lines or e-communication. The information from the claims is of vital importance for the governments and companies which provide the services, as it provides the operational issues generated by the conflicts, which are to be corrected and improved.

In LAC, the inclusion of specific mechanisms through which users are involved in the management system is verified in isolated fields. The Chilean law (20,920) is an example of that since it establishes the participatory drafting of decrees to regulate instruments intended for the avoidance of waste generation, source separation, promoting its value, establishing of deposit and refund systems, labelling, amongst others. It provides for the making of queries to private organizations, including base recyclers, as well as the opening of a public consultation stage of at least 30 business days. In the case of setting goals and other related obligations concerning the so-called "priority wastes"[75], regulatory decrees must consult during its creation process with producers, waste handlers, consumer associations, the academic sector and non-governmental organizations.

Costa Rica, in turn, establishes the participatory constructions of the policy, plan and

74. Interestingly, there is the example of public consultations carried out by Costa Rica in the drafting of environmental regulations. Registration, import, control and labeling-related technical regulations concerning hazardous chemicals are now under way. For more information on the proposed regulation, visit: [https://www.ministeriodesalud.go.cr/index.php/propuestas-de-ley].

75. To date, these are lubricant oils, WEEEs, batteries, containers and packages, tires and cells.

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technical regulations in its law, providing that the national authority shall be responsible for guaranteeing the participation of comprehensive waste management-related sectors. It requires the waste local plans to be submitted to public audience and also stipulates the participation in the control of the compliance with the law, policy and national plan. Simultaneously, the general regulations of the law create a consultative platform the aim of which is to offer the coordination, consultation, exchange and advising for the participatory construction and execution of the instruments required for the application of the law. This platform consists of representatives of the environment, agriculture and education ministries, local governments, private sector chambers and non-governmental organizations in addition to the provision of public consultation, physically or electronically, mailbox of remarks and opinions and local, regional and sectoral work meetings.

In the case of Peru, environmental regulations, as applied to wastes, establish that the participation mechanisms must be provided when creating and spreading environmental information, formulating policies and rules, in plans, programs and environmental agendas, in management, control and environmental monitoring and public entities' budget definition.

Notwithstanding the aboves and even when several countries of the region include citizen participation in their waste-related legislations, they do so hazily, only mentioning the principle and right of the citizens without an in-depth discussion of the specific mechanisms for an effective participation. Addressing this deficiency is an unresolved matter that would differentially contribute to management as a whole.

4.6.3 Inclusion of the service provider (including the informal waste sector)

As anticipated, local governments are the ones who must guarantee the provision of the public service of household waste management. Its effective provision can be performed by the government as well as by companies contracted for that very purpose; there are even cases in which the State and the companies take on different segments. Besides, waste pickers have acquired a crucial role in the recovery of recyclables in the last decades, which has led to the regulatory acknowledgement of their work, even as part of the public service of urban hygiene[76].

As for household waste generated by stores and industries, in several countries they are expected to be managed separately from public service, due to their amount or volume, and this is determined by the services of companies engaged in this activity. Something similar applies to construction and demolition wastes. However, in many cases, waste from small institutional and commercial generators is sent to the household waste collection circuit, precisely because these wastes are similar, in quality and quantity to those generated in domestic homes. In turn, hazardous wastes coming from the private sector are managed by said service and regulated by the State through different regulated instruments mentioned on 4.2.4.

On the other hand, and along the same lines presented in 4.6.2, private sector participation in the discussion of the policies, plans and regulations linked to waste management is provided for in a number of rules from the LAC countries. Participation channels are also provided, for example, by the handling of complaints and claims. Some companies also offer guided tours to their facilities for citizens and organizations, as a way of supplying transparent information and management while improving the relationship with the communities they operate in[77].

> "Even though several countries in the region include citizen participation in their waste legislation, they do so in a very general way, without developing concrete mechanisms for effective participation"

76. This is the case of Law No. 992/02 of the City of Buenos Aires, which incorporates scavengers at the stage of differentiated collection, as part of the public service of municipal hygiene.

77. An example is the case of the public company that for over 30 years has managed municipal solid wastes from the Autonomous City of Buenos Aires and part of Greater Buenos Aires, CEAMSE, composed by said city and the Buenos Aires Province. They receive visitors at their Environmental Centers. During thoese visits, the daily activities and applied technologies can be seen. These visits are open to the public, their most frequent visitors being primary school, high school and college, undergraduate and graduate students, engineers and technicians of environmental and waste treatment organizations, non-governmental organizations and civil servants, amongst others. For more information, visit: [http://www.ceamse.gov.ar/conciencia-ceamse/visitas/].

Box 4.9

Waste pickers

The recovery of useful materials from the garbage is a long-standing activity in developing countries, but which increased, in the case of LAC, with the successive economic crises and endemic poverty of many of the countries in the region.

Additionally, to said crises there is the generalized lack of comprehensive waste management systems in the cities of the region, which especially include a differentiated collection; this encourages informal recovery.

Both factors - the economic need and poor public management in relation to recovery of materials from wastes – together create a favorable scenario for the development of this activity by the most under-privileged sectors of the population.

There are mixed feelings about the inclusion of waste pickers in the public management systems: while some sectors demand their inclusion –and cities which have recognized very specific rights in this sense in their local regulations- other sectors maintain that the recovery of materials from garbage is not a dignified nor a safe job, and that governments should make an effort to create proper economic conditions so that no person should work doing that task, or at least, not under the current conditions: on the streets, without protection or regulations. Also waste pickers themselves are divided into two groups: Those who consider it necessary to formalize the activity in order to be able to enter into the management public system with the characteristics of a small business, including the typical rights and guarantees of any formal occupation, and those who defend their right to recover materials without any formalization whatsoever.

It cannot be denied that the activity has grown in the region, that the sector of waste pickers is highly heterogeneous even within the same city (registered cooperatives, groups of people or families and individual waste pickers live together) and that it has differentially contributed to the achievement of a citizen environmental awareness in relation to recycling and to "put the matter in the public agenda", perhaps in a way that not even local governments have achieved yet. It cannot be ignored that waste pickers, apart from making a living of it, have been providing a service to cities, generating an economic benefit by avoiding the paid collection and disposal of a certain amount of waste.

From another perspective, it is notorious that in numerous cities of LAC the tasks carried by waste pickers, under conditions of absolute insalubrity and insecurity, generate an unacceptable hazard. It is common to see entire families (including children) searching for materials to sell, with no protection elements and even barefoot in clandestine garbage dumps and sanitary landfills.

So there appear to be different points of view regarding recovery of materials in poverty contexts: the security and health of waste pickers and their right to make a minimum income for their survival, the environmental and economic benefits generated by their activity, both on an individual or collective basis, their aptitude to proceed before the various types of disposed wastes that might require special management both for the waste picker's health and the protection of the environment. In this regard, each country must assume the responsibility for a multidimensional and transparent analysis of the issue, with the intervention of the interested parties, so that political decisions are right and fair.

Colombia expects Comprehensive Solid Waste Management Plans (Planes de Gestión Integral de Residuos Sólidos, PGIRS) to incorporate waste pickers, and local governments to formalize them so that they can be engaged in an

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organized and coordinated manner in the good use of the recovered materials[78].

In the case of Uruguay, the regulation on packaging establishes that management plans should contribute to the inclusion of the garbage sorters by labor formalization (Decree 260 of 2007, regulatory of the Container Law). Likewise, it is worth mentioning the case of Bolivia, which by regulations of cities such as Cochabamba and Santa Cruz de la Sierra provide for the inclusion of recyclers[79]; or the case of Peru, which establishes a national framework for the specific regulation of the activity by local governments (Law 24.419 of the year 2009[80]).

Locally, the Autonomous City of Buenos Aires legally declared the activity of waste pickers as part of the public service of urban hygiene, creating two registries, one for individual waste pickers and another one for cooperatives and small and medium-sized businesses connected to the activity (Law 992 of the year 2002).

Saint Lucia, in turn, does not have regulations on the activity of waste pickers, but its government recognizes that the informal sector has an important role in waste management, for their contribution to the care of the environment – recycling and resulting extension of the final disposal sites' life -, as well as for the generation of a business activity[81].

78. This is pursuant to Decree 2891 of 2013 –a regulation of the public service of waste collection- and Resolution 714 of 2014 (methodology of formulation, implementation and follow-up of the PGIRS) which provides that the plans should consider a Scavengers' Inclusion Program. For more information: [http://www.minvivienda.gov.co/DecretosAgua/2981%20-%202013.pdf], y [http://www.metropol.gov.co/Residuos/Documents/Legislacion/Resolucion754-2014.pdf].

79. For more information: [http://www.pasocierto.com/esp/assets/dd5-bo_reglamento-municipal-gesti%C3%B3n-residuos-(cochabamba)_bolivia.pdf] y [http://www.pasocierto.com/esp/assets/dd6-bo_ordenanza-basura-cero-(santa-cruz-de-la-sierra)_bolivia.pdf].

80. Several local governments have enacted since 2004 guidelines that establish the inclusion of scavengers, such as Cajamarca, Coronel Portillo, Piura, Huaraz, Taricá, Callao and Puente Piedra, amongst others. More information on: [http://cdam.minam.gob.pe/novedades/guiacapacitacionrecicladores.pdf].

81. According to the opinion of Santa Lucia government in the Questionnaire to countries especially prepared for this job

Box 4.10

Waste management and gender[82]

The gender perspective involves, in broad terms, taking into account in treating these issues the characteristics of the roles and behaviors attributed to women and men within a specific historic, cultural, social and economic context. Gender equity, on the other hand, implies fairness in the way women and men are treated; it is often the suitable tool for levelling the historical social disadvantages women have suffered in different areas and spheres of decision-making and action. Thus, equity is the instrument to achieve equality, that is to say, for women and men to be able to thrive through access to the same opportunities.

Accordingly, and because the development of a waste management policy and its subsequent implementation involve, to a great extent, the actions of women, it is key to understand that the gender perspective must be integrated from the beginning. This will make the policy more efficient and generate more benefits for society as a whole. This is evident just by thinking of the array of different responsibilities borne by women: from their domestic responsibilities, including the management of the expenses of the family, childcare and the organization of domestic chores, to their work and professional responsibilities.

Several studies show that both in the formal and informal waste management sectors, there is a prevalence of men in prominent decision-making positions. Therefore, for example, when it comes to formalizing workers or providing financial support, men are preferred over women and, in the informal sector, men have access to the most profitable materials in the recycling market, while women receive the less valuable ones. This, combined with domestic chores and childcare, which take time from work, means women, even working in more difficult situations, generate lower incomes than those of their male counterparts.

Even if, in broad terms, the integration of the gender perspective is very limited in public policies in LAC, for example, regarding the working conditions of female recyclers, it is also true that there are experiences in Latin America that show that it is progressively being incorporated by cooperatives of recyclers. Along this line, Bogota, Quito, São Paulo and Santa Cruz are starting to boast more women in leadership positions in these organizations (The Economist Intelligence Unit-IRR, 2017).

Finally, it is worth mentioning the experience of Brazil which has sought to deal with gender inequality in recycling activities, at home, at work and inside the organizations of scavengers, in order to integrate gender issues into the national agenda of the movement via the Gender and Waste Project (a partnership between WIEGO, the Centre for Research on Women (NEPEM) of the Federal University of Minas Gerais, INSEA, the National Movement of Recyclers (MNCR) and Red Lacre (De Brito and Dias, s.f.).

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82. This section features contents from The Economist Intelligence Unit-IRR (2017) and BID-FOMIN-INE/WSA (2013).

Box 4.11

Waste pickers' Network

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An interesting phenomenon related to materials recovery in LAC is the existence of networks between different types of organizations, which has differentially contributed to position waste pickers in a scenario in which, about two decades ago, they were almost invisible for the governments and for a large part of the society.

Referring to networks entails discussing links, frameworks, relationships between different types of organizations that by gathering ideas, information and resources have managed to support waste pickers, diverse projects and goals in the field of informal waste recovery.

Often, the joint work of waste pickers, whether organized in cooperatives or not, as well as civil society organizations related to the environmental protection has provided interesting results, for example the inclusion of the topic in the public agenda, a certain social awareness on the matter, both from the human and environmental and economic perspective, approval of specific rules for the activity, amongst others. This phenomenon also led to the inward improvement of waste pickers' associations, i.e., in its organization, dynamics, claim of rights, dialogue with the authorities, professional development and, in some cases, its formalization.

An example of joint work, regionally, is the Latin American and Caribbean Recyclers Network (Red LACRE)[83], an organization that gathers waste pickers of countries of the region for the purpose of achieving the improvement of their working conditions, and which is also aimed at working as a basis for dialogue amongst the countries, in order to exchange experiences, propose actions and carry them out.

Red LACRE is one of the founders of the Global Alliance of Recyclers[84], created in 2008 after the First World Conference of Waste Recyclers that took place in Bogotá, Colombia, with the support of Fundación AVINA and WIEGO (Women in Informal Employment: Globalizing and Organizing)[85]. The Alliance defines itself as an *articulation process* amongst organizations of waste pickers from Latin America, Asia and Africa, working on aspects directly related to their tasks, such as climate change and legislation.

Another interesting case is the Regional Initiative for the Inclusion of Recyclers (RIIR) in which the joint support of organizations of the civil society, multilateral agencies and the private sector converge. The RIIR appeared in 2011 for the purpose of improving the access of waste pickers to the formal recycling market (by specific projects, training, technical assistance and communication), working as a base for articulation of the dialogue and action amongst governments, organizations of waste pickers and companies[86].

Lastly, Paso Cierto constitutes a platform that provides information about practical matters related to the activity of waste pickers, in relation to its formalization[87].

83. For more information: [http://www.redrecicladores.net].

84. For more information: [http://globalrec.org/].

85. For more information: [http://www.avina.net/avina/micromundos/reciclaje-inclusivo/ and: http://wiego.org/].

86. For more information: [http://reciclajeinclusivo.org/].

87. For more information: [http://www.pasocierto.com/esp/pasocierto.html].

"Governments will have to make the effort, according to the demands of their legal and institutional systems, to respect constitutionally attributed competencies while simultaneously developing the instruments that permit the implementation of a rational management strategy."

4.7 The government as a key player

4.7.1 Possible roles of governmental institutions

Governments are key players in waste management. In most cases, they are responsible for assuring a minimum environmental and health quality and, therefore, must create public policies to achieve those objectives, dictate the necessary regulation and take care of its subsequent control. These obligations arise from legal regulations, sometimes from the national constitutions themselves, and other times, from laws related to public health or the environment. In some countries, local governments are also involved in the provision of services related to the collection, treatment and disposal of wastes, performing said activities by themselves or through companies subcontracted to that end.

It is important to outline that, as stated above participatory work shall be required in order to define the public policy for waste management in the quest for the most transparent decision-making process as possible, balancing the interests and strengths of the involved players and thus considering the technical, economic and social matters that said management implies. At this point, the State acquires a highly significant role, which might as well describe as non-delegable because of its characteristics and implications.

It is no longer exclusively about a regulating-controlling-sanctioning State, but rather there will be a prior and an ongoing planning work in addition to these elementary functions in connection with the generation of information and its spreading, to education, to the articulation of the different interests (not only for the agreements but for the exchange of information, knowledge, technologies and for the synergy amongst them) and even the supervision of market variables that must be considered for an adequate comprehensive management. It must be also considered to review and update the established planning, given that the variables it entails can change or evolve towards new goals, players, relationships and interests.

As can be seen, the requirements of this policy can be testing for States, as they are challenged to play more modern, active and improved roles in relation to what is traditionally expected from them. This could imply a major challenge for small local governments of LAC, with little human and financial resources, where any national planning must surely consider the local realities, to establish requirements and include assistance and support mechanisms that allow meeting those requirements locally.

The State also plays an essential role to facilitate the creation of networks that might enable diverse players to exchange information and experiences. This simplifies the first steps for those who do not have enough resources, since it allows access to already proven cases and also contributes to the synergy of ongoing projects, in case they have contact points or possibilities to combine or assembly.

4.7.2 Institutional coherence

It is complex to perform a specific recommendation about the most suitable institutional model for waste management. Government systems and distribution of environmental powers in the territory are features that cannot be shunted aside as they are in the Constitutions of LAC countries, precisely limiting the powers of the national and local governments. Each form of government (unitary or federal) has its advantages and disadvantages in relation to waste management, the former marked by centralism, the latter by the fragmentation of power.

Those states with central power –the vast majority of those in the region- surely face the challenge of the implementation, execution and control of the compliance with the rules from a sole national agency that has, if not all, most of the powers in the matter. In these cases, the management will become more complex depending on the extension of a country's territory and the different cultural, social and economic characteristics of each region or city, where a very general approach could not be applicable in some communities. Uruguay, for example, with a centralized government and a small territory, faces minor difficulties related to the overlapping of powers amongst different levels of government and the regulatory superposition or contradictions[88].

In the case of federal states, which rely on the local powers, the main challenge will be the creation of a national strategy, which contemplates the harmonization of the regulations and the focuses on implementation, and also considers the actual capacities of local institutions. This harmonization will require mechanisms that allow local governments to reach an agreement on positions with the national government. Nevertheless, it should be clarified that federal states tend to regulate harmonization mechanisms , especially regarding the powers to dictate norms; it should be noted that the regulatory issue is not the most complex problem as it could be agreed upon, rather the specific execution of the defined policies is.

In the case of Argentina, the National Constitution recognizes the autonomy of local governments, implying the competence to regulate the environmental matter. Thus, the national government sets the minimum requirements of environmental protection for the whole country, the ground level, whilst the local governments

88. Information provided by the government of Uruguay through the Questionnaire to countries prepared for this document.

"The lack of resources, both human and material - including the lack of training, is one of the problems to be solved in the institutional field."

can complement said requirements[89]. Furthermore, there is space for discussing the national environmental policy in the Federal Environmental Commission (Consejo Federal de Medio Ambiente, COFEMA) that was created by an inter-province convention in 1990 and was ratified in 2002 by the General Environmental Law 25,675 in which all provinces, the Autonomous City of Buenos Aires and the national environmental authority, have the possibility to agree and dictate resolutions with a binding effect. However, COFEMA has not performed its relevant, legally attributed role so far[90] as there are significant legal loopholes that require the work of the jurisdictions in that field[91]. Especially in terms of municipal and household solid wastes, there is a major unresolved matter regarding the management thereof, a matter on which COFEMA should work, especially in relation to the possible regionalization.

Brazil, larger than Argentina and with more than double of its local governments, recognizes in the Constitution the competence of unity (at a national level), and of the local government levels to protect the environment and fight pollution, as well as a joint regulation on this matter (Arts. 23 par. VI and 24 par. VI). Law 6938 of 1988, by establishing the National Environmental Policy, thusly creating the Environmental National System composed of all the government levels mentioned above, and recognizing their competence to govern but always in compliance with the higher regulations. Lastly, Law 12,305 of 2010 which establishes the National Policy on Solid Wastes determines that it is composed by objectives, principles, goals, actions, which can be defined by the national government itself, and in cooperation agreements with local governments.

Thus, federal countries have developed legal and institutional tools to articulate basic consensuses when defining environmental public policies. Nevertheless, harmonization criteria,

89. The peaceful interpretation of art. 41 of the Constitution of the Argentine Republic indicates that the provinces and municipalities can dictate rules complementary to the minimum requirements set by the federal government, which can be more strict, but not less rigorous.

90. According to the above-mentioned convention, i.e., the Articles of Incorporation of COFEMA, it was created to *"Formulate a comprehensive environmental policy, as a precautionary and corrective measure, based on the corresponding diagnosis, taking into consideration the local, provincial, regional, national and international scales."* Instead, the General Environmental Law, by creating the Environmental Federal System with the objective of coordinating the national environmental policy, recognizes COFEMA as an instrument to make this objective feasible and assigns specific responsibilities in environmental planning of the territory and environmental education, responsibilities that are elaborated on by other sectoral laws. That is the case in Law 25,916 that regulates the Comprehensive Household Waste Management and mentions COFEMA as the agency of inter-jurisdictional coordination, making it responsible for "a) Agreeing on policies of comprehensive management of household wastes; b) Setting technical and environmental criteria to employ in different stages of the comprehensive management; c) Agreeing, along with the Enforcement Authority, on the goals of valorization of household wastes."

91. In relation to waste management, a very important aspect to deal with and that remains unresolved is the inter-jurisdictional transportation of wastes and the prohibitions of access, described in 4.3.4.

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"Having the right skills can imply costs, but these costs will never be as onerous as those incurred by not having them."

coordination and implementation issues have always existed. Rather, unitary states have always seen the need to work on power decentralization in the territory to put those policies forward, which also requires certain coordination.

Waste management, mainly for environmental and economic reasons, undoubtedly requires an unambiguous view of each country, at least internally. That is, governments will make an effort, based on their legal and institutional systems' requirements, to respect the competences entrusted by the Constitution while developing the instruments that will enable carrying out a rational management strategy.

Finally, and taking into account the implications in other areas, such as taxes, labor and commercial aspects, there should be inter-institutional coordination mechanisms for waste management policies to appropriately and adequately deal with each issue.

Case Study 17

Institutional organization in Honduras

A recent work conducted by the government of Honduras shows the complex legal and institutional outlook of the country regarding solid waste management[92]. There are diverse regulations from different periods that regulate the matter and that have generated their own institutions or entrusted competences to different ministerial portfolios. Both legal loopholes and concurrent competences between the Ministry of the Environment, the Ministry of Health and local governments are noticed, and particularly, poor competences of the former regarding comprehensive management of solid wastes; the Ministry of Environment also lacks powers to inter-institutionally lead and coordinate management in the framework of the General Environmental Law, approved by Decree 104-93.

The Ministry of Health has several environmental waste-related competences attributed before the approval of the General Environmental Law, which overlap with those in the aforementioned law as they have not been repealed. In practise, this Ministry has functions which have been imposed by this law and which are being performed by the Ministry of the Environment.

Local governments, governed by a specific norm (Decree 134-90, whereby the Law of Municipalities is approved) have very few environmental powers, thus they are not empowered to perform all the roles required to handle solid wastes in their field of action, although some competences have been recognized by the Regulations for the Comprehensive Waste Management (Executive Agreement 1567-2010).

In short, as a result of the approval of successive organic and environmental rules that have not suitably acknowledged the previous regulatory framework, integrated management and handling are hindered, resulting in priorities being disregarded, extra efforts and disarticulation amongst different institutions.

In response to this situation, the Government of Honduras is working on the development of a proposal for a Comprehensive Waste Management Law for the purpose of strengthening and giving coherence to the institutional framework, as well as the formalization of a national discussion and coordination body on comprehensive waste management. To facilitate the implementation of the new legislative and institutional framework, Honduras is also developing a national strategy of comprehensive waste management, as part of a cooperation project with UN Environment.

92. Said consultancy work conducted in 2015 was provided by the government of Honduras as part of the Questionnaire to Countries especially drafted for this document.

4.7.3 Institutional capacity development

A core aspect to consider in good governance is the strengthening of civil servants' professional and technical capacities. Therefore, their formal education in diverse related fields is the starting point so that the system can be designed, implemented and improved. Regardless of the body in charge of actual policy design, the creation of regulations and subsequent control of their application and compliance must have enough qualified and trained staff to perform these tasks. Likewise, continuous training and motivation of the civil servants to remain within the State are a must. That requires planning and a specific budget based in the long term on the need and convenience of a solid governmental authority in all regards.

Most likely, many countries in the LAC region do not have sufficient resources in their national budgets for the development of the institutional capacity, and that should be reviewed. Governments must take into consideration that having the corresponding capacities for the challenge a comprehensive waste management system in operation implies can be burdensome, but never as much as the costs implied in doing nothing. Along these lines, Argentina, Belize, Chile, Ecuador, Mexico, Santa Lucia, Trinidad and Tobago, and Uruguay[93], all share the lack of human and material resources as well as the lack of training, which is one of the problems to be solved institutionally.

A tool that can be useful here is the information exchange agreements and joint work with universities and non-governmental organizations that can have knowledge and experience on specific aspects as these are institutions which can be part of a support network for the strengthening of governmental capacities as they are used to cooperate and join efforts to pursue certain objectives,. The extension of this network towards companies willing to incorporate this challenge as part of their social responsibility can also be very productive[94].

Besides, small communities that will have greater difficulty to access a budget that allows the training of their civil servants must be considered especially in these alliances.

To sum up, it should be admitted that the success of local governments in charge of waste management will depend especially on the actual technical and economic capacities. Approaching this matter is urgent, also considering the need of a minimum symmetry between big, medium and small cities.

93. Information from the Questionnaire to countries, prepared for this document

94. One example of this is Red GIRESOL (Integral Solid Waste Management Network), created after the Mexican environment authority asked the German Cooperation Agency in 2003 to implement a training course on municipal solid waste. In turn, this initiative then resulted in a training system for promoters and advisors of the public, private and social sectors in order to standardize criteria and knowledge about the subject matter. In 2006, Red GIRESOL was replicated in Guatemala, and then spread to Ecuador and the Dominican Republic, with support from the Central American Commission for Environment and Development (CCAD, in Spanish). For more information, see Heredia, Marenco and Méndez (2009).

5 Waste management financing

Financing is a key issue for the sustainability of waste management schemes, especially in Latin America and the Caribbean, where models directly financed by municipalities prevail and in many cases the costs of the service are not recovered.

The chapter begins by presenting key messages on the financing of solid waste management in Latin America and the Caribbean, and then analyses the costs and benefits, including the cost of inaction and the benefits to society and the economy of carrying out responsible waste management (5.1). After introducing waste management both as a public service and a business activity (5.2), the chapter presents financing models of waste management (5.3) and service delivery models (5.4). The next two sections define the sources of revenue for solid waste management (5.5) and investment financing (5.6), and it ends by providing a toolkit to decide upon the appropriate financing model for solid waste management (5.7).

5.1 Costs and benefits associated with solid waste management

Investments in the public sector must start from the analysis of the costs and benefits that the implementation of a project would mean to the society, beyond the income, costs and financial indicators that are traditionally analysed. This analysis is crucial for the solid waste sector where resources compete with the investments that must be made in other sectors essential for the well-being of the population such as health, poverty reduction, employment, education or infrastructure. For countries in the region, where budget constraints are significant, economic analysis of waste management becomes important, taking into account the positive and negative impacts (externalities) on the environment, health and the economy in general.

5.1.1 Financial and economic costs and benefits

Waste management will always represent a cost to society (Scheinberg, 2001) and improving management standards implies an increase in these costs. However, the waste generator would be willing to pay as little as possible for such management, as, by definition, waste is something discarded or unwanted. In general, assessment of waste management costs is limited to identifying the investments and operation and maintenance costs for waste collection, transport and final disposal, which leads to the adoption of solutions which may not consider the environmental and social benefits of better waste management (e.g. natural resource efficiency, green job creation and a healthy and clean living environment, etc.).

When waste management is not implemented properly the negative social and environmental impacts can be very high. Quantifying these costs is not an easy task and the countries of the region have not shown significant progress in their assessment.

Waste management requires providing incentives and adopting standards that give viability and sustainability to projects, for example taxes or fees for cost recovery, extended producer responsibility schemes, taxes on final disposal, amongst others.

5.1.2 The financial costs of taking action

Financial costs and revenues of waste management refer to purely monetary values, that is, those that should be recorded by accountants in the financial accounts and used in the financial analysis. Although this is the first step in determining how to address responsible waste management, most countries in Latin America and the Caribbean fail in this assessment.

Investment costs include all costs related to developing and constructing a project, such as preparation, planning, studies, permits, public consultations, designs and land costs, amongst others. These costs may be easier to quantify and compare with other investment alternatives, as they depend on local conditions and the acquisition of technological equipment and supplies. In the region, investments in specialized equipment and infrastructure with a high technological component are scarce due to the high costs in comparison to the payment capacity of the population.

Operation costs can be decisive in the sustainability of waste management schemes. The GWMO (UNEP-ISWA, 2015) lists some of the main operation costs for the different activities associated with waste management and different types of technologies. Quantifying these costs is crucial and sometimes efforts to improve waste management fail in this aspect; for example, it is noted that in some cases governments have financed investment projects and are later abandoned due to the lack of local capacities, both technical and financial, to continue with the operation of the built infrastructure[95].

Identifying operation costs is also necessary for implementing improvements in management efficiency. In the countries of the region this is not always easy because service delivery in many cases directly involves municipalities and accounting is not recorded separately from other municipal accounts. In this regard, a recommendation for these countries is that they break down the operation costs of each of the activities associated with waste management (collection, transport, transfer, recovery, treatment, final disposal) and even if it is a service delivered directly by municipalities, that they keep separate accounting records enabling the traceability of figures and informed decision-making.

Annex 3.5 collates the costs involved in the main activities associated with solid waste management for 14 of the 33 countries of Latin America and the Caribbean according to available information; it is important to note that costs are not comparable, since the social, economic, cultural, technical and technological conditions of the countries are different (e.g. personnel costs, fuel, land, environmental requirements).

5.1.3 The cost of doing nothing

The costs of inaction, i.e. doing nothing to improve solid waste management, lead to the transfer of economic costs to society, commonly called negative externalities in terms of environmental remediation, treatment of diseases, limitation in the development of other economies and in safety itself (Potet and Lejtreger, 2015).

For the reasons explained above, decisions on waste management should start from the assessment of the economic and social costs and benefits of investments, beyond financial costs. In the countries of the region, some cases of accidents or public health issues associated with low management standards have been identified (e.g. fire, landslides, water pollution), leading to the payment of large compensations or associated costs to the population health care, which could have been avoided with better waste management. In particular, the financial burden associated with environmental pollution generated by open dumpsites for national and local health systems should be assessed (Mavropoulus and Newman, 2015). In fact, evidence from the countries of the region shows that the costs of poor solid waste management are higher than the costs of carrying out such management as described in the document Global Waste Management Outlook (GWMO) (UNEP-ISWA, 2015).

5.1.4 Benefits to society and economy

Environmentally sound solid waste management has positive effects on the environment, public health, inhabitants' quality of life and the economy in general. Despite the indisputable existence of such benefits, society is often unaware and is not willing to shoulder some of the costs that such management entails. Annex 3.9 summarizes some of the benefits of environmentally sound waste management.

95. For example, see experiences of the World Bank in the construction of sanitary landfills in Colombia.

Case Study 18

Economic and financial matrix for calculating the costs of integrated municipal solid waste management in Argentina

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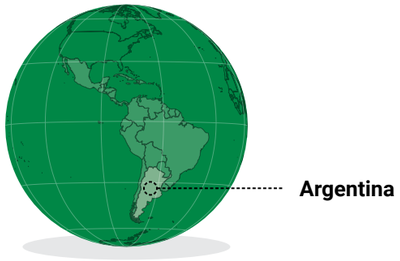
Taken from the document Economic and Financial Matrix to calculate the costs of the integral management of urban solid waste in Argentina, annex to the Country Questionnaire (Argentina)



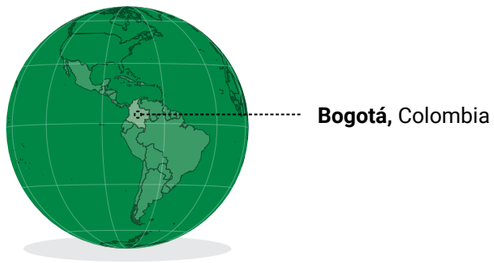
In 2011, as municipalities in Argentina needed to know the real cost of waste management so that they could adapt their tax collection structure better to the real needs for resources to cover maintenance and operation costs and new investment needs, the GIRSU Executing Unit developed the "GIRSU Economic and Financial Matrix" with external financing from the Secretary of Environment and Sustainable Development (SAyDS).

This tool was introduced to municipalities during training workshops held in the different provinces, together with the sharing of management experiences and the analysis of different performance indicators from cost estimation and the trend towards a "comprehensive" view on cost management. Representatives from different municipal areas, such as treasury/finance, environment and public services, were invited to these workshops to work together on the development of indicators, and to embody the notion that integrated waste management is a "cross-cutting" issue.

The tool divides the comprehensive waste management of each municipality into phases: final disposal, sweeping and cleaning, yard and green areas waste, collection, transfer, transport, recovery and sale of materials, composting, amongst others; and for each phase the tool allows the calculation of costs for the different activities/programs according to their category (e.g. staff, capital and consumer goods), collates information on waste generation, population, financial-accounting, amongst others, and allows the development and analysis of performance indicators.

Case Study 19

Compensations associated with health damages caused by the Doña Juana landfill in Bogotá, Colombia



In September 1997, 1.2 million tonnes of waste slid into the Doña Juana sanitary landfill, which receives solid waste from the city of Bogotá. This incident had considerable impact on the health of the local inhabitants located within an area of approximately 5,000 meters around the landfill, causing respiratory infections, allergies, vomiting and skin rashes, mainly in children. In addition, it affected a nearby water source, generating the impoundments of the Tunjuelito river bed and several ravines in the area and contamination of the waters by leachate spillage. Consequently, those affected filed a lawsuit against the District of Bogotá in 1999, which was settled in favor of the plaintiffs in 2012. The District was ordered to pay a sum close to 76 million US dollars to compensate those affected, who received differential compensation amounts according to the distance of their homes from the sanitary landfill. The resolution initially recognized the existence of 1,472 people affected but it also acknowledged that this number could increase since after the passing of judgment about 630,000 requests to be joined as a party in the action from people who proved that they lived, worked or studied in the affected area in 1997 were accepted[96].

Better management of the sanitary landfill would have probably prevented this. Moreover, if the monies allocated for repairing the damages of those affected by the occurrence had been used to improve the conditions of the landfill, it is unlikely that the accident would have taken place and the present environmental and social conditions of the area would be better. Possibly the compensation provided will never compensate those affected for the damages suffered whereas the environmental impact caused is practically irreversible. This type of analysis is not currently performed when assessing the economic costs of a sanitary landfill, which does not contribute to underscore the importance of public investments in the sector.

96. Council of State, Republic of Colombia, Administrative Litigation Court, Third section (2012). File number: 25000232600019990000 2 04 and 2000-00003-04. Plaintiffs: Leonor Buitrago Quintero et al. Class action against the Capital District of Bogotá. November 1, 2012 and Office of the Ombudsman, Colombia (2016). Class action in Doña Juana lawsuit. Information on the requests for joining the final judgment in the class action "Doña Juana Sanitary landfill". Bogotá, Colombia. Available from: http://www.donajuana.defensoria.gov.co/index.html

5.2 Understanding waste management as a public service and as a business

The need to comply with environmental regulations has made it possible for solid waste management to be considered as an economic activity and as a result the private sector has become interested in taking part, mainly through service contracts.

Based on the GWMO approach, this section examines key aspects related to waste management: its provision as a public service; delivery of services for waste management as an economic activity; and resource recovery activity.

5.2.1 Waste management as a public service (and a "public good")

Responsibility for waste management has traditionally been allocated to governments because of its nature as a "public good". The service is so classified as it is difficult to control citizens' access; and if some citizens escape from their responsibilities for MSWM, they may cause significant harm to others and to society as a whole (UNEP-ISWA, 2015). This situation makes it necessary for governments to guarantee its provision; but management costs should be borne by the population, i.e. it should not be free.

Therefore, the provision of this service has come to be seen as a remunerated environmental service, through which waste is appropriately handled and in some cases the materials or energy obtained therefrom are recovered. However, this situation has aroused controversy regarding ownership of waste which may be difficult to resolve.

While the recovery of materials in the region has been the livelihood of hundreds of families who have developed these activities informally, the search for their formalization and inclusion within the delivery schemes is transforming this activity.

5.2.2 Waste management service delivery as a business

The requirement to have transport, treatment and final disposal services that comply with environmental and legal regulations has led to the emergence of private providers worldwide that deliver waste management services. Therefore, the development of private contracts for waste management is a common practise mainly between large waste generators and service providers. However, in the countries of the region, industrial and commercial waste management has often been left in the hands of municipalities or integrated into the management of municipal solid waste.

Private sector participation in the management of waste is presented in these countries for the provision of municipal services, for which services contracts are executed between the municipality and the respective service provider. Through these contracts municipalities grant a company the exclusive right for the provision of waste management services, in all or some of its stages. In many cases, through these contracts the contractor agrees to finance investments (BID-AIDIS-OPS, 2011).

5.2.3 The resource recovery business

The main activity of resource recovery in the region is the recycling of "dry" waste, which starts with the collection and transport stages developed to a greater extent by informal workers or also called waste pickers for whom this activity is a significant source of livelihood.

In some countries of the region, large waste generators form alliances with formal managers or recyclers who receive the material to be recycled previously classified and under the basic necessary conditions to be sent to high-technology facilities for its leverage; profitability of this alliance is associated with the high quantities of waste classified delivered that represents a good source of income. Revenues from waste recovery depend on the type and quality of waste to be recovered, as well as on fluctuations in the prices of waste in the international market.

On the contrary, informal waste pickers' livelihoods depend on the tonnes of waste material recovered after selective collection at the household level, which is limited by the low rates of source separation in some countries, and in general on the revenue from the sale of material which does not cover recovery costs, so waste management must be somehow supported by society.

Some of the recommended measures intended to increase recycling and recovery include the implementation of extended producer responsibility schemes, taxes on final disposal, or increased service fees, which generate additional sources of revenue. For example, Colombia has committed itself to strengthening recycling activities with the aim of improving the financial viability of the solid waste management activity and of formalizing the recyclers, so it has contributed to the recognition of this work, regulating the use of waste as a complementary activity to street cleaning and its collection within the fee paid by waste generators.

According to a recycling study conducted for the IDB (Correa, 2014) in four countries in the region,the low waste production compared to developed countries, high generation of organic waste and the limited size of the manufacturing industry impose limitations on the recycling activity of "dry" waste. The national recycling market in these countries focuses mainly on the use of paper, cardboard, scrap metal (ferrous metals), some plastics (PET and HDPE) and glass; while the use of organic waste is minimal. The aforementioned countries are mainly importers of paper, cardboard and scrap metal, despite the fact that these materials are the ones mostly recovered; likewise, while plastic is traded in smaller

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"Operating costs can be decisive in the sustainability of waste management schemes."

FIGURE 5.1
Main international routes for the trade of recycled paper and cardboard for some countries in the region (thousands of tonnes per year) – Year 2013

amounts, exports to China and the United States prevail. International transactions related to glass do not involve significant figures.

In 2013, the international trade of recycled paper and cardboard in the countries of the region was dominated by imports from the United States and amongst these same countries. The main destinations of exports of these materials are Colombia, Chile and Ecuador. Average import (USD 236.9 per tonne) and export (USD 234.6 per tonne) prices are similar.

On aggregate, the imports of scrap metal (600 thousand tonnes) in Colombia, Ecuador, Panama and Peru was much larger than exports (258 tonnes). Imports were mostly from the United States (455 thousand tonnes to Peru and Ecuador), Venezuela (86 thousand tonnes to Colombia and Ecuador) and Costa Rica (25 thousand to Ecuador and Panama). Moreover, the destination of the exports from these four countries (258 tonnes) were Asian countries, such as Taiwan (88 thousand tonnes), Korea (59 thousand tonnes), Thailand (59 thousand tonnes), China (7.5 thousand tonnes) and Indonesia (6.6 thousand tonnes). The main exporters were Panama (177 thousand tonnes) and Colombia (75 thousand tonnes). The average export price (USD 326 per tonne) is higher than the average export price (USD 214 per tonne).

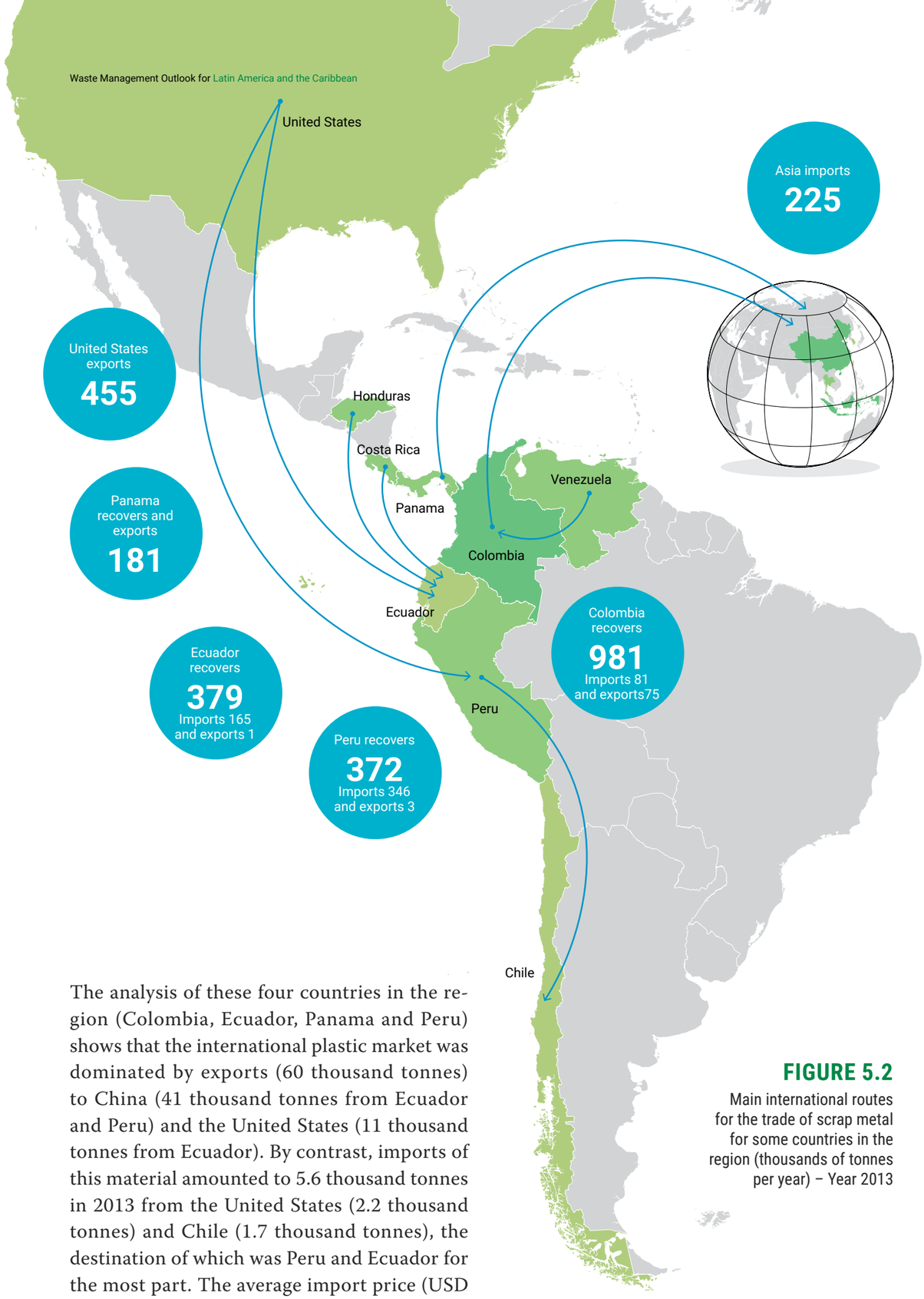

FIGURE 5.2
Main international routes for the trade of scrap metal for some countries in the region (thousands of tonnes per year) – Year 2013

The analysis of these four countries in the region (Colombia, Ecuador, Panama and Peru) shows that the international plastic market was dominated by exports (60 thousand tonnes) to China (41 thousand tonnes from Ecuador and Peru) and the United States (11 thousand tonnes from Ecuador). By contrast, imports of this material amounted to 5.6 thousand tonnes in 2013 from the United States (2.2 thousand tonnes) and Chile (1.7 thousand tonnes), the destination of which was Peru and Ecuador for the most part. The average import price (USD

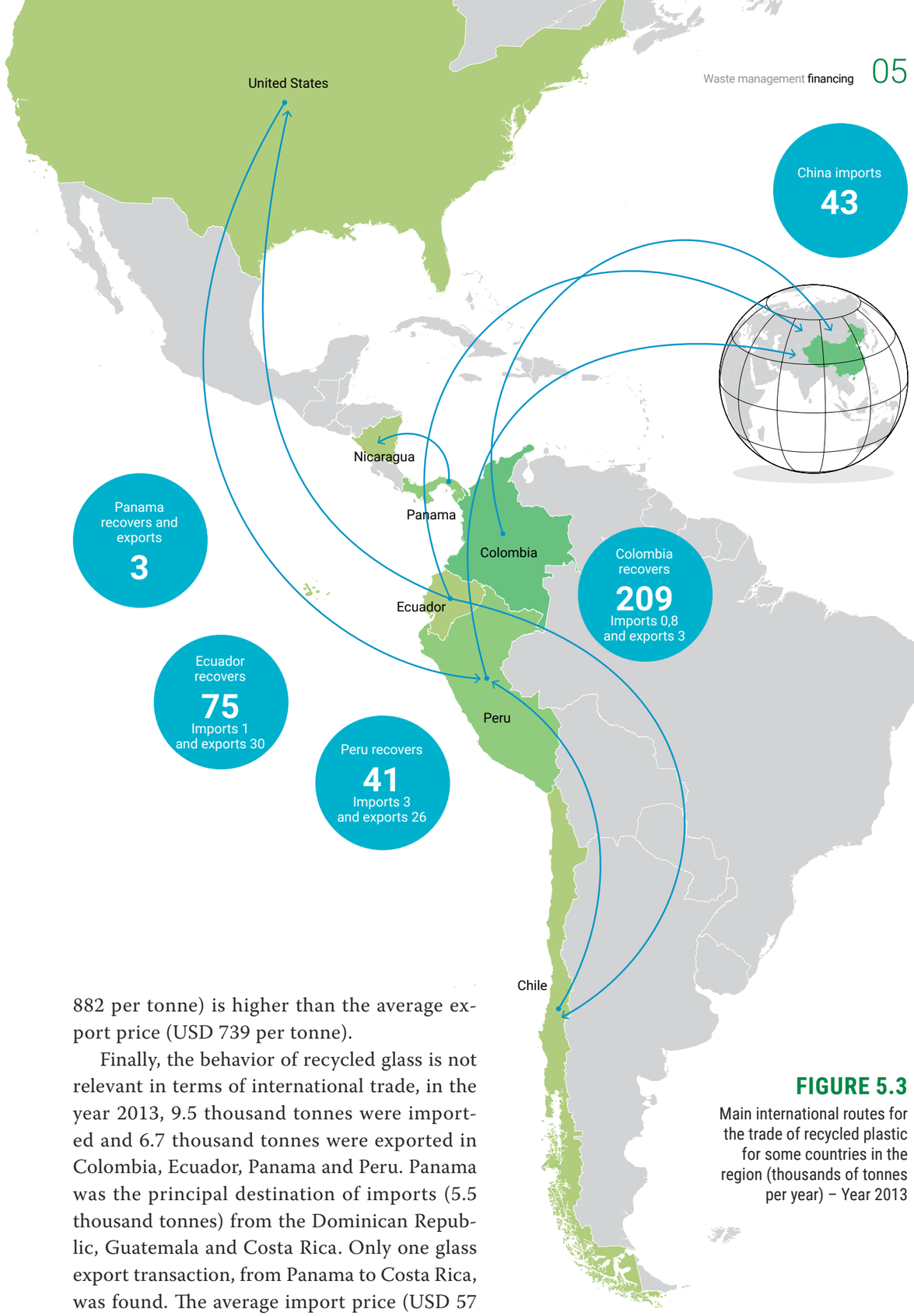

FIGURE 5.3
Main international routes for the trade of recycled plastic for some countries in the region (thousands of tonnes per year) – Year 2013

882 per tonne) is higher than the average export price (USD 739 per tonne).

Finally, the behavior of recycled glass is not relevant in terms of international trade, in the year 2013, 9.5 thousand tonnes were imported and 6.7 thousand tonnes were exported in Colombia, Ecuador, Panama and Peru. Panama was the principal destination of imports (5.5 thousand tonnes) from the Dominican Republic, Guatemala and Costa Rica. Only one glass export transaction, from Panama to Costa Rica, was found. The average import price (USD 57

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per tonne) is lower than the average export price (USD 127 per tonne).

Transboundary movements of recycled waste have shown an interesting dynamic worldwide in the last few years. Notwithstanding, traded volumes depend to a large extent on the primary production of waste materials. An example of this was evidenced in the 2008 economic downturn, where China, as a major consumer of recycled plastic, stopped buying plastic and recycled paper, directly affecting its main suppliers (United States, Japan, Germany and UK). The Latin American and Caribbean region appears to be outside the sphere of influence for this market (Velis, 2014).

In spite of the recognized importance of circular economy and resource recovery, one of the major concerns related to the use of recyclable waste materials has to do with the quality of by-products and techniques and conditions used in production.

5.3 Waste management financing models

The way in which the four essential component parts are organized and related to one another in the solid waste management (generators or municipalities, the operator or service provider, revenues to pay for the cost of the service, and investments required for the development of infrastructure) defines the financing model. Some of the waste management financing models in place in the region are discussed below, taking into account the relationships between these component parts.

5.3.1 Polluter pays

When waste generators are responsible for the treatment and final disposal of waste, they usually contract the provision of waste management services directly with private companies. In these cases, it is feasible to apply the "polluter pays" principle, s individual contracts make it easy to measure the amount of waste that must be collected, transported and disposed of. This collection method also encourages reduction of the amount of waste generated and the use of treatment alternatives. In the region, the separation of such waste and subsequent delivery of part of it to recycling operators is not a common practise.

5.3.2 Raising investment finance

One of the challenges in waste management is raising the investments required in infrastructure for proper waste management. Therefore, recovery of these costs should be fully factored into the service fee. In the countries of the region many of these investments are taken over by the municipalities, but due to the budgetary constraints of the public sector, investments are insufficient to ensure responsible waste management.

In many cases, the rate or service fee charged to users does not allow for the recovery of investment costs, which makes it difficult to improve management standards. However, there are isolated successful cases in which the progressive financing of the service and its investments has been achieved, through fees charged directly or included in the bill of other public services such as water or electricity. Section 5.5.3 of this document presents the successful experience of Colombia, where service fee collection methodologies have been established to recover both the costs and the investments needed for waste management.

In some cases, investment efforts to build facilities such as sanitary landfills in the region have been adversely affected during the process

> "Quantifying operating costs is essential to guarantee the success of investment projects".

due to a lack of technical and financial capacity to ensure their operation.

5.3.3 Integrated service providers

Some countries in the region are developing integrated markets for waste management going beyond collection and final disposal; in other words, they are working towards managing resources which have traditionally been considered waste.

Some companies provide integrated services for waste management that involve recovery, treatment and trade so that they can be transformed into new materials that can be reused in production processes.

5.4 Service delivery models

5.4.1 Options for delivering waste management services

In Latin America and the Caribbean, municipalities use different alternatives for the delivery of

FIGURE 5.4

Main waste collection and transport service delivery models in Latin America and the Caribbean

Source: Based on the IDB, AIDIS, PAHO (2010) Regional Evaluation on Urban Solid Waste Management in Latin America and the Caribbean. According to this report, the aggregate variables of the modality of service provision are presented according to the population covered.

MSWM services including purely public, private public partnership schemes and purely private models (BID-AIDIS-OPS, 2011). **FIGURE 5.4** shows the most common delivery models in the countries of the region, which were identified from the information collected in the update of the regional evaluation carried out by the IDB in 2016. It should be noted that the service delivery models shown in the map are not the only one inexistence in each country, in fact, in most cases a combination of different models are in use. Further details are given in the annex to this report.

Direct municipal service refers to services that are provided directly by the municipality; service delivery contract generally refers to the provision of services by private parties; in some cases, the service delivery is carried out by cooperatives and exceptionally by the central government.

Private delivery schemes may be vulnerable when waste generators or governments are not certain that private companies will provide the best possible service, so that clear regulations are needed to ensure quality, efficiency and coverage of the population as well as the expected simultaneous return on investments.

The financing mechanisms for service delivery associated with each scheme are usually different. For example, in the case of public delivery of services funds come from a fee that is charged as a municipal tax. In service contract schemes that have a larger private component part, cost recovery is pursued through charging user fees.

Financial sustainability of delivery models will only be achieved if revenues are sufficient to cover the costs of the services. According to the regional evaluation conducted by IDB in 2016, only about 60% of the countries in the region have charging schemes, and few of these could be considered financially sustainable.

Regarding selective collection and recovery of recyclable waste, it is clear that this is a component part that is usually left outside the delivery schemes and is mainly managed by informal recyclers. This situation is even worse given the fact that there is no culture of source separation in the region and, in some cases, service delivery is paid on the basis of the amount of waste disposed of in the sanitary landfill or final disposal site. Some progress has been made in the past few years based on the formalization of recyclers; the efforts made by the Regional Initiative for Recycling in Latin America and the Caribbean are particularly noteworthy, which, is seeking to develop mechanisms for social and economic inclusion for these workers with the support of IDB and some private companies.

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5.4.2 Public models

Public models where the service is delivered directly by municipalities or through municipal enterprises remains the most common in the region. In many cases, financial sustainability issues are observed, because sometimes services are not charged to the population or the collection does not have a specific destination or are not cost-related, creating imbalances that accumulate over the years and hold back the improvement of service delivery.

5.4.3 Private delivery of services

Private sector participation in the waste delivery service is gaining ground in the region. Feasibility of implementing this type of models depends on its legal, technical and financial viability, and, in particular, on the political will, regulatory stability and socio-economic conditions of the specific country. For example, Colombia and Chile agreed to adopt mostly service delivery schemes with private participation. These private participation models must be coordinated with the participation of waste scavengers and promote the progressive formalization of these workers.

Box 5.1

Options for service provision by the private sector

Based on UNEP-ISWA (2015)

There is a variety of options for public-private partnerships (PPPs) or private-sector participation (PSP) in the delivery of MSWM services. The methods of PPP most common in SWM are contracting, concession, lease, franchise and open competition each with its own particularities:

Contracting: Following a competitive procurement process the government awards a fixed-term contract to a private firm for the delivery of municipal solid waste collection service, street sweeping service, the collection of recyclables, transfer station operation, disposal site operation, or fleet maintenance. The private firm is paid for service delivery by the government under the terms of contract.

Concession: The government awards a concession to a private firm to set up a facility that utilizes government-owned resources. This concession may require the private firm to recycle materials from waste and/or to transfer or final dispose of waste. The concession is in the form of a long-term contractual agreement, whereby the private firm builds and operates the facility. In some cases, the private firm may maintain ownership indefinitely; in others, the private firm may transfer ownership of the facility to the government after a specified period.

Franchise: Following a competitive procurement process the government awards a fixed-term zonal monopoly (a franchise) to a private firm for the delivery of solid waste collection services. The private firm deposits a performance bond with the government and pays a license fee to cover the government's costs for monitoring. The private firm recovers its costs and profit through direct charges to the households and establishments that are served, while the government provides control over the tariff charged to the consumer through the development of adequate competition and control of price collusion or through price regulation.

Open competition: The government freely allows qualified private firms to compete for refuse collection, recycling or disposal services. In open competition, individual households and establishments make private arrangements with individual firms for refuse collection and/or recycling. No firm holds a zonal monopoly, and any number of firms may compete within the same zone. Similarly, in open competition, the government grants a license to qualified individual firms for the private provision of disposal services. One city may be served by several disposal sites competing for business from the area's local governments and private haulers, as well as for business from remote governments and haulers. The government's role in open competition is to license, monitor and, as needed, sanction private firms. Under open competition, costs are directly billed by the private firm to their customers.

Longer term service contracts may be further differentiated from each other depending on which combination of components are included in the contract: Design (D), Finance (F), Build (B), Own (O), Operate (O) and Transfer (T) components. The main types of PPP contracts are included below:

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Design, Build and Operate (DBO): The private contractor is responsible for the design, construction and operation of the SWM facility.

Design, Build, Finance and Operate (DBFO): The private partner is responsible for the design, construction, financing and operating of the SWM facility. It is the most complex contractual relationship between a public authority and a private investor.

Build, Operate and Own (BOO): The private partner builds a facility based on a defined design and owns and operates it.

Build, Operate, Own and Transfer (BOOT): Same as BOO with an additional clause for transfer of assets to the public partner at the end of the contract.

Rehabilitate, Operate and Transfer (ROT): The public good created is transferred to the private investor. The investor has the obligation of financing, rehabilitation and operating the public good for a certain period of time.

Build, Operate and Renew (BOR): The private investor assumes the financing, building, and operational costs and the costs of renewing of the public good for a certain period of time.

5.4.4 Achieving economies of scale in service delivery

Waste management involves activities that rely on economies of scale and economies of scope (Solanes, 1999). It has been shown that the more waste is being disposed of in a facility, e.g. a sanitary landfill or an energy from waste plant, the lower is the cost per tonne of this activity, or that the transportation in bulk or in vehicles of greater capacity allows for the reduction of transportation costs.

Regionalization in service delivery is the most common way of achieving economies of scale in solid waste management. Regional solutions have been developed in different countries of Latin America and the Caribbean. Municipalities have created inter-municipal cooperations with the objective of achieving economies of scale and better regulation enforcement. These inter-municipal organizations are beneficial both for cities that cannot access new areas to locate waste disposal sites and for small municipalities that cannot afford the high costs of a facility.

In Latin America, the current supply of WEEE, demolition and construction waste management services and other streams of waste is limited in comparison with the growing trend in its generation. Moreover, hazardous waste management has been oriented mainly to the final disposal in security landfills or incineration rather than to the use. This represents a barrier for the countries of the region in the management of waste other than ordinary waste, which could be overcome if a regional waste management system within the continent could be implemented amongst those countries allowing for the reduction of environmental pollution and taking advantage of economies of scale of this activity.

"Regionalization in service delivery is the most common way of achieving economies of scale in solid waste management."

5.5 Revenues for solid waste management

Collecting waste management fees through a property tax is widely practised in the countries of the region but revenues raised are not sufficient to cover the real costs involved because they are not proportional to the actual cost of the activity, which is one of the main causes of the current situation in the region. As a result, investments are paid for with direct resources from the municipalities or the nation. Notwithstanding, investments in the sector are usually not a priority for governments, so they tend to be minimal and overall good waste management is not guaranteed.

To remedy this situation, it is necessary to adopt collection mechanisms to households that are cost and investment related and that are billed together with high-revenue schemes, such as the electricity bill, and to implement new sources of revenue such as extended producer responsibility schemes, the final disposal tax and other economic instruments.

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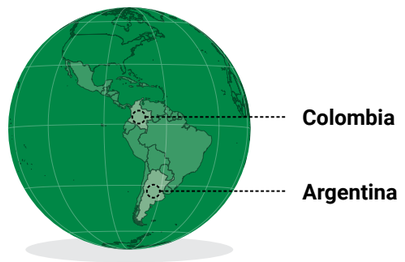
Case Study 20

Some regional models for solid waste management in LAC (Argentina, Colombia)



Argentina - Regionalization of treatment and final disposal of waste in a set of environmental facilities in the province of Buenos Aires

At the end of the 1990s, the state-owned enterprise CEAMSE, comprised of the governments of the both City and the Province of Buenos Aires, embodied the concept of an "environmental facility" to transform what used to be controlled final disposal zones into "areas where garbage undergoes a set of processes for recycling the waste so that they can return to the productive circuit and where the technology permits not only the reduction of the environmental impact but also taking advantage of the biogas from organic waste decomposition to generate renewable energies." In terms of geographic scope, the company serves more than 14.5 million inhabitants, representing more than 36% of the total Argentian population, which generates about 17,000 tons of daily waste (households and large generators) that correspond approximately to 40% of the total waste

generated in the country. For the management of this waste, the company has 5 transfer stations through which it achieves "economy of transportation, work and energy saving, reduction of wear and tear/or breakage of equipment costs, greater versatility, better resolution of the discharge front in the landfills and lower emissions." In addition, CEAMSE runs three environmental facilities in operation and one in the post-closing stage. In such facilities waste separation and classification, biogas collection, leachate treatment and compost or organic amendment production[97].

Colombia - Regionalization of sanitary landfills

In 2005, Colombia began to issue a series of regulations aimed at prohibiting the final disposal of solid waste in systems other than sanitary landfills. These environmental measures, coupled with the creation of economic incentives to favor municipalities that allowed the construction of regional sanitary landfills, enabled the eradication of a large number of open dumpsites as well as the general improvement of waste final disposal conditions throughout the country. By end of 2014, Colombia had 360 disposal systems to receive waste from 1,102 municipalities; while not all sites have the right environmental conditions or are regional, the progress made in the country is a good example of the effectiveness of using different mechanisms to achieve the expected results (DNP, 2014).

To achieve the regionalization of sanitary landfills in Colombia, the 2006-2010 National Development Plan created an incentive for municipalities to locate regional sanitary landfills in their territory, whereas the Departmental Water and Sanitation Plans laid down the development of regional schemes, including public street cleaning service. Later, the Water and Regulation Commission (CRA) promoted the construction of transfer stations in order to make better use of economies of scale.

In addition, other types of instruments were implemented: the first takes a command and control approach, which includes an order to prohibit open dumpsites, control and surveillance of order enforcement and prohibition of imposing unjustified access restrictions to regional sanitary landfills. The second corresponds to economic instruments, such as the calculation of the variable cost of final disposal depending on the number of tonnes disposed of; payment per tonne to the municipalities that allow the location of regional sanitary landfills in their territories and financing of the National Government for setting up regional schemes and construction and/or adaptation of regional landfills.

The process of sanitary landfill regionalization in Colombia has evolved positively since by 2015, 91% of the country's waste from 803 municipalities, were disposed of in 62 regional final dumpsites meaning that there is a higher number of municipalities disposing of in fewer sanitary landfills.

La Pradera Sanitary Landfill is an example of a regional final disposal site in Colombia as it receives about 3,200 daily tonnes of waste from more than 30 municipalities in Antioquia, including the metropolitan area of Aburrá Valley and the city of Medellin. Resources from the regionalization incentive are allocated to Don Matías municipality, where this final disposal site is located, and are targeted to social investment works and amount to 1.2 million US dollars per year.

97. [http://www.ceamse.gov.ar/].

Case Study 21

Redeemable tax on PET bottles in Ecuador

The Law on Environmental Promotion and Optimization of State Revenues, published in Supplement to Official Register No. 583, dated November 24, 2011, created the Redeemable Tax on Non-Returnable Plastic Bottles in order to reduce environmental pollution and to encourage the recycling process, further establishing that the operations on which this tax is levied will have to be declared within the month subsequent to which they were performed.

According to the aforementioned law, the taxable event is to bottle beverages in non-returnable plastic bottles, such as alcoholic, non-alcoholic, soft drinks, non-carbonated beverages and water, or their customs clearance in the case of imported products. Consumers can recover the value paid in this tax[98].

This tax must be paid by the bottle manufacturers and money reimbursement will be made to those who deliver the bottles; however, in the case of recyclers the money is only given to those who are certified by MIPRO, which in fact encourages the formalization of those engaged in this activity.

The study conducted by Correal (2014) evidenced that with regard to recycled PET, retailers request greater intervention of the State, since the incentives are not enough for the industry to decide on the use of recycled material. In the course of an interview with Mario Bravo, an entrepreneur with market knowledge of recycled materials retail business, he stated the following:

"The difference in prices of virgin raw materials versus recycling does not fully convince the industry," says Bravo. One tonne of virgin PET (used to manufacture beverage containers) is quoted between $1,600 and 2,000 – delivered to Ecuadorian port - while that recycled material sells for up to $1,200 - $1,300 per tone. *"In other countries there is public awareness and governments issue laws that force companies to use pelletized (washed, ground and selected) plastics because it helps to preserve the environment. Here, exports are what save the recycling sector, because the businessman is not obliged to use recycled material in his production."*

98. [http://www.sri.gob.ec/].

5.5.1 Public financing

Public financing of waste management is included in the municipal budget, which in some cases is fed by the collection of local taxes or direct user charges. These resources are used mainly to cover the operation and running costs of the systems in place. In general, financing of investments is assumed by municipalities in the form of non-refundable funding, except for those countries where private sector participation has been promoted and user charges are applied through rates that incorporate the return on investments.

In Mexico, for example, the Federal Government created the Solid Waste Program (PRORESOL) through which solid waste projects are financed with a non-refundable funding approach. In Peru, a result-based financing system, called the Program of Incentives for the Improvement of Municipal Management of the Ministry of Economy and Finance, exists and consists of a set of recycling goals, and municipalities that can prove achievement of those goals to the national government will have access to non-refundable resources with a specific destination. In El Salvador, municipalities are authorized to use up to 15% to 75% of the funds allocated from the Fund for the Economic and Social Development of Municipalities (FODES, in Spanish) for carrying out the activities related to the collection, transportation and final disposal of solid waste, as well as the technical closing of dumpsites . Likewise, Colombia has implemented a system for cost recovery based on tariffs that are billed monthly to households and include the value of investments and financing costs, which means that resources of the municipal budget are used to guarantee the balance between the subsidies and contributions that are charged to users under a cross-subsidy scheme. This has helped reduce public contribution needs to less than 15% of the total income of the sector.

5.5.2 Direct charging

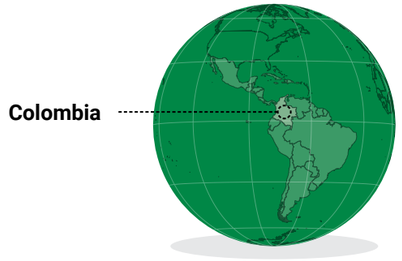
Successful cost recovery requires that sums charged reflect the actual costs of the service and that collecting mechanisms with high collection rates are used. The most important issues that arise in the region regarding service charging concern the fact that the amounts charged are not based on the actual costs of the service and that collection rates are low (BID-AIDIS-OPS, 2011).

In this regard, some countries like Ecuador charge the service through the electricity bill with high collection rates; however, this country, like many others in the region, should work on issuing methodologies that guide the municipalities on the value to be charged. Given the importance of the service for public health and the environment, this service should not be suspended due to lack of payment, which is why it is important to bill it together with other services with high collection rates.

The new Integral Waste Management Law of Peru (Law No. 27314, Decree-Law 1278 of 2016) enables municipal governments to charge for waste management services through partnerships with sewage companies, which should help solve the problem of late payment of municipal service fees. The information on the average amount billed to a house in the different countries in the region is shown in Annex 3.7.

Case Study 22

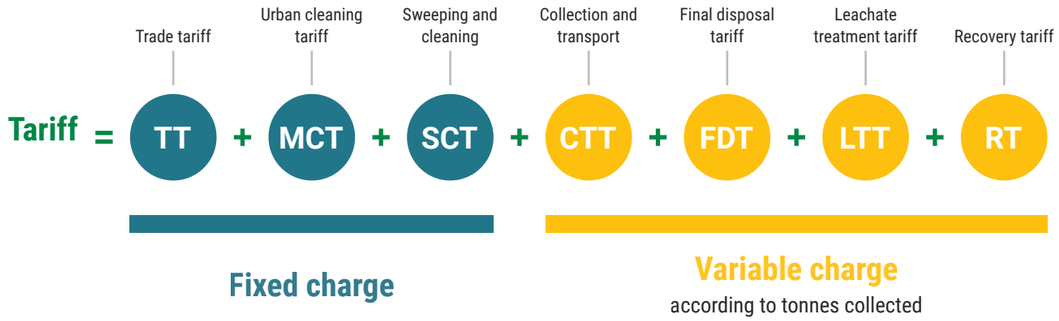
Colombia's tariff methodology



Colombia has a successful model of cost recovery to finance solid waste management in place. The National Government, through the Water and Regulation Commission (CRA), issues tariff methodologies based on which service providers must establish the value to be charged to users. This tariff methodology employs a ceiling price approach, meaning that service providers must charge values that do not exceed benchmark costs established by the regulator. These benchmark costs are defined based on information fed by service providers for a given period of time and on the theoretical construction of a model company, which considers criteria of efficiency, quality, continuity, economies of scale, and incentives to regionalization and management.

Benchmark costs are established for each component of the service activities, i.e. sweeping and cleaning of roads and public areas, collection and transport, final disposal, leachate treatment, trade (e.g. billing, collection, handling of requests and complaints, information campaigns) and waste management.

The latest methodology was issued by Resolution CRA 720 of 2015, which came into force in April 2016. The following formula summarizes this ceiling price methodology through which the value to be charged to each household or non-residential user, which in turn depends on the total amount of waste weighed at the final disposal site, at the management sites, on the kilometers of public roads swept amongst other similar variables.



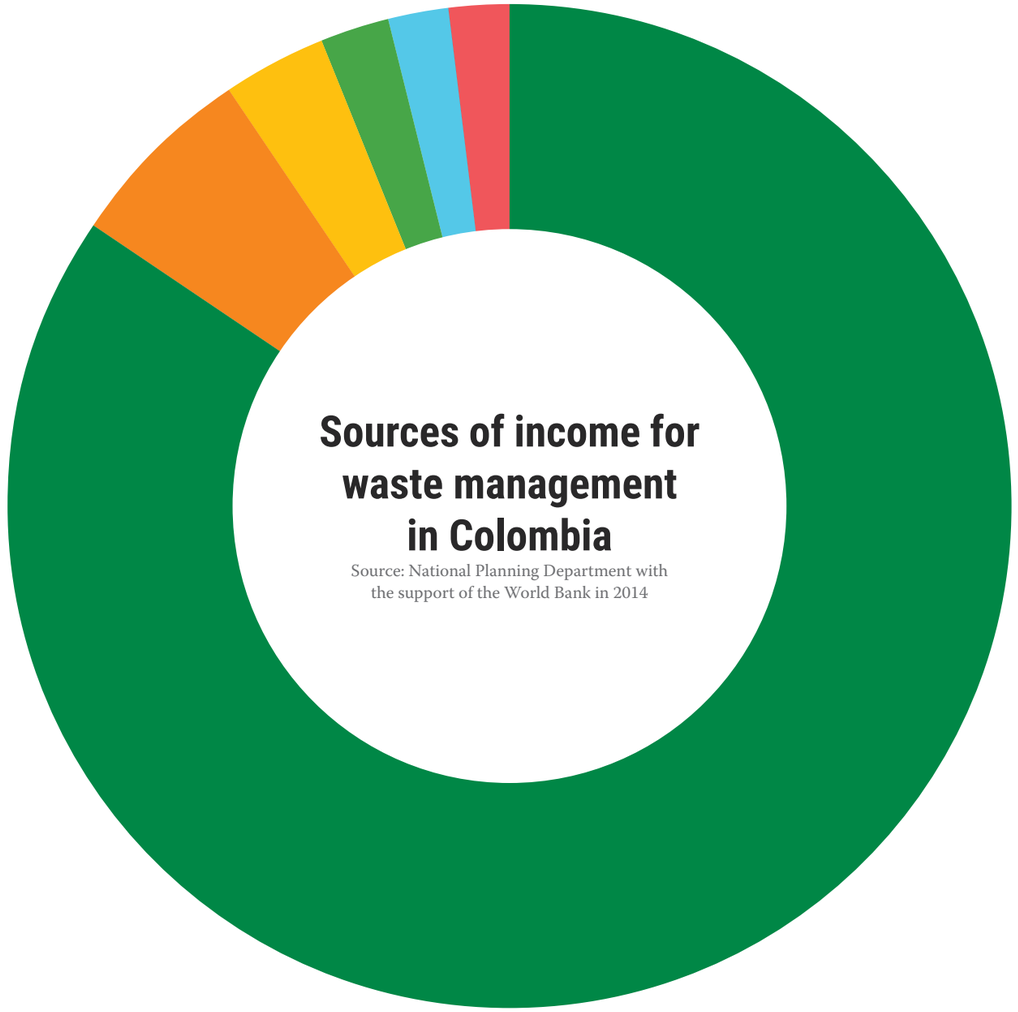
The basics of each tariff component are described below:

- **Sweeping and cleaning (SCT):** Includes costs associated with the activity, such as operator wages, sweeping equipment, supplies, etc.
- **Municipal cleaning (MCT):** Takes into account the costs for lawn cutting, tree pruning, washing of public areas (wages, supplies, etc.).
- **Collection and transport (CTT):** Covers the costs associated with the mobilization of waste from its generation to the final disposal or treatment site, such as investments in vehicles, fuel and maintenance costs, personnel and administration expenses and respective financial costs.
- **Final disposal (FDT):** Covers the costs related to the final disposal of the sanitary landfill waste, such as the value of the land, the adaptation works for the construction of final disposal cells, bottom waterproofing, the collection of biogas and leachate, daily coverage, personnel costs, weighing systems at the entrance and all costs associated with environmental monitoring, amongst others. Under this component, a provision for the closure of the facility at the end of its life cycle is billed.
- **Leachate treatment (LTT):** Pays for the investment and operation and maintenance cost of the facilities where the treatment of the leachate is carried out, in accordance with leachate discharge specifications set forth by the environmental authority in each site.
- **Trade and management collection (TC):** Pays for the costs associated with billing, collection, portfolio recovery management, permanent updating of the user base, information campaigns and customer service (e.g. office, website, call center, etc.)
- **Waste recovery (RT):** This benchmark cost pays for the collection, transportation, sorting and weighing activities of recyclable waste. This cost is assumed to be equal to the cost of collecting, transporting and disposing of non-recyclable waste. This component of the tariff is accessible to organizations of scavengers which have been formalized as providers of the recovery activity of the public cleaning service, as provided for in Law 142 of 1994, Decree 596 of 2016 and Resolution 276 of 2016.

According to the analysis of the waste sector in Colombia performed by the National Planning Department with the support of the World Bank in 2014, the main source of income are the tariffs charged to users, which represent 85% of the sector revenues. That is to say that the State, through the municipalities and the national government, currently contributes up to 15% of the income, which is used mainly to grant subsidies to the lower income population and exceptionally to finance some investments.

This methodology is based on a solidarity and redistribution approach in that it seeks to guarantee the coverage of the street cleaning and waste management service for the entire population by subsidizing the lower income users. The source of resources for granting these subsidies comes from a higher value paid by the population with higher income, business and industry and from the contributions made by municipal administrations to guarantee the balance between subsidies and contributions.

The implementation of this scheme was possible thanks to a legal reform of public services provided to households in Colombia through Law 142 of 1994, which has been in force ever since and has been amended through decrees and resolutions issued by the Ministry of Housing, City and Territory and the CRA economic regulation. In 1997, when the first tariff methodology was issued, it was necessary to implement a stepwise scheme that lasted until 2005 whereby the value payable by the population was gradually adjusted until reaching the values calculated based on the tariff formulas.

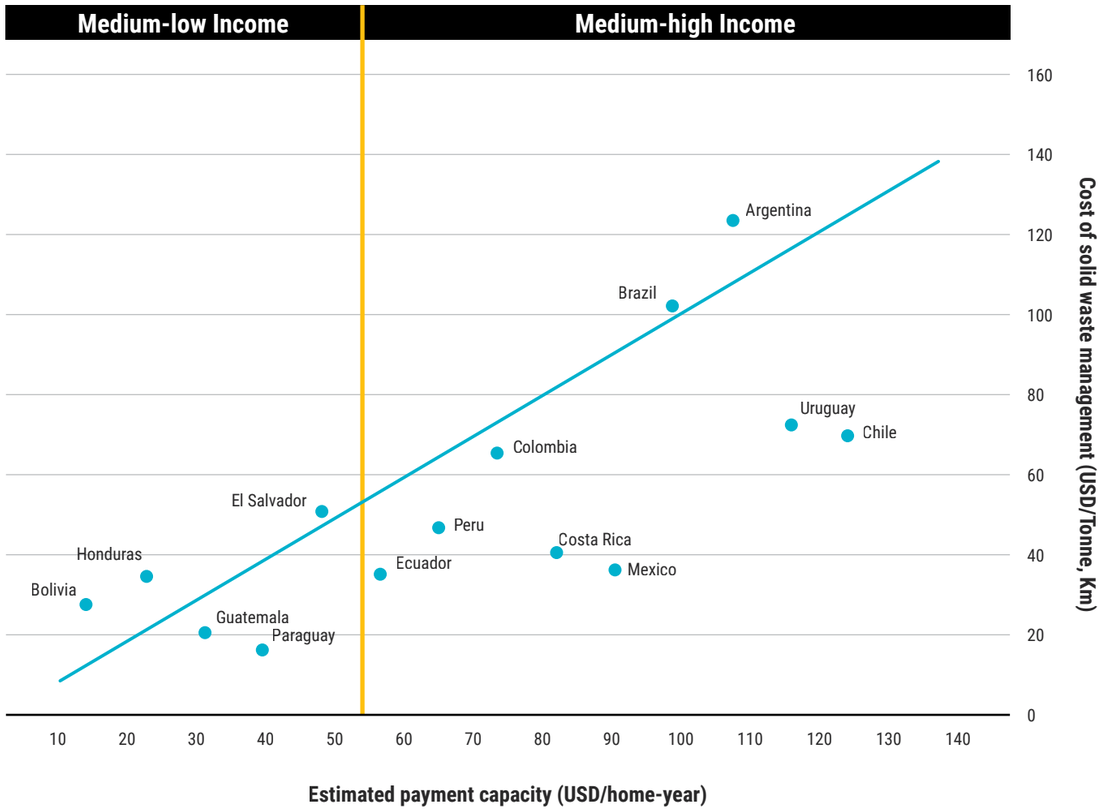


In short, this charging system is based on costs and efficient investment, which is billed jointly with other public utility services such as electricity or water and with a specific destination of resources has allowed to: i) substantially improve the quality of the service, ii) encourage private sector participation in service delivery and financing, and iii) reduce the need for public contributions.

FIGURE 5.5

Comparison of payment capacity vs. solid waste management costs in Latin America and the Caribbean

Note: The green line in the graph illustrates the division between what is considered medium-low and medium-high income.
Estimated payment capacity = 1% of GDP per capita



Source: Based on information from the World Bank (data.bancomundial.org) and IDB, AIDIS, PAHO (2010, confirmed by the present study.

However, in order to establish the sum to be charged to users, it is necessary to know their payment capacity, which is directly linked to their level of income. According to the information available, most of the countries in the region are ranked as medium-high and medium-low income countries, with the exception of Haiti (low income) and Chile, Uruguay, Argentina and some islands of the Caribbean that are classified as high income countries.

According to UNEP, the integrated waste management costs should be close to 1% of gross domestic product per capita (UNEP-ISWA, 2015). The following graph shows the comparison between total estimated cost of service delivery for countries on which information is available (BID-AIDIS-OPS, 2011) and 1% of GDP per capita[99]; in general, it is observed that the service costs (USD/tonne) in Bolivia, Honduras, El Salvador and Argentina seem to exceed the payment capacity of the population estimated this year, which may generate a higher tax burden as it indicates that the State must finance the part of the costs that the population is not able to bear. Nevertheless, it should be borne in mind that this is an estimate suggested by the GWMO and each case should actually be analysed in detail before drawing any conclusions.

Although evidence suggests that people are willing to pay for responsible waste management, as benefits are not equally perceived by the entire population, it is difficult to convince people of the need to increase such payments.

99. Nominal GDP is used in this comparison, since service costs are expressed in dollars according to the information provided by the countries, without any conversion or comparability factor.

5.5.3 Cost recovery and its challenges

The main collection schemes for solid waste management in use across Latin America and the Caribbean countries are summarized in the following map which clearly demonstrates different collection mechanisms. For more details on the information used to draw the maps please see the annexes 3.2 and 3.7.

In the countries of the region, national or municipal authorities are generally responsible for establishing the tariffs or fees to be charged for the provision of the service as well as the criteria for providing some subsidies to certain population groups; such charges are often insufficient due to a lack of detailed information or studies and the lack of political will of local authorities to adjust charges to actual values (BID-AIDIS-OPS, 2011).

Cost recovery is a challenge for most countries in the region. For example, the National Strategy for Solid Waste Management in Argentina (published in 2005) estimated that the tariffs and fees collected by municipalities only covered on average 18% of total expenditures (World Bank, 2015). In some cases, this difficulty is culture-related as citizens believe that waste management is an essential public service and should be covered by the general taxes they pay.

Whatever the collection mechanism of choice, it must be gradually implemented allowing for traditions and culture of citizens, as well as their view regarding waste management.

In low- or lower-middle income countries as most Latin American and Caribbean countries are developing specific schemes with different components for cost recovery and different sources of income to improve the sustainability of the service are needed.

5.5.4 Other revenue sources

There are alternative ways to raise revenues from sources other than direct user charges such as the sale of resources recovered from waste (e.g. recyclable materials, energy, soil conditioners, etc.), extended producer responsibility (EPR), profit sharing, green taxes, carbon credits or other economic regulatory mechanisms.

EPR schemes should be promoted in the region, in order to generate resources for waste recovery financing, to reduce the amount of waste generated or to create products with more sustainable environmental standards and to improve the demand for recyclable materials.

Cities with high levels of collection and transportation coverage, and which have been able to improve final disposal through sanitary landfills, are prepared to begin implementation of recycling, treatment and valuation of waste activities. To this end, the legislation and regulations must incorporate the necessary regulatory and financial instruments in order to ensure these alternatives have visibility, taking into account that even though they generate revenue through the sale of by-products (e.g., energy, recycled raw materials, compost, etc.), the resources are not enough to cover the investment and operation costs of most technologies. Therefore, mechanisms such as taxes for final disposal, income from extended responsibility schemes, tax incentives and government contributions, aside from public cleaning fees, will make it financially viable.

FIGURE 5.6
Main revenue collection mechanisms for solid waste management in Latin America and the Caribbean

Note: A model is considered to prevail in a country if the percentage of participation is higher than 60%, i.e. when the presence of a type of revenue collection mechanism is higher than 60% that mechanism is considered to be the predominant one; if the percentage varies between 40% and 50% the model is considered to be mixed.

Source: Based on the IDB, AIDIS, PAHO (2010) Regional Evaluation on Urban Solid Waste Management in Latin America and the Caribbean. According to this report, the aggregate variables of the modality of service provision are presented according to the population covered.

5.6 Financing sources

In Latin America and the Caribbean, waste collection and final disposal activities have received the most funding. At present, although there are no accurate figures available regarding investment needs in the solid waste management sector for the different countries of the region, there is a clear need for enhancing and increasing infrastructure capacity in order to improve waste management as open dumpsites predominate and there is no infrastructure for waste treatment and recovery, except for some mechanized separation systems that are being promoted in Buenos Aires, Santiago de Chile and Sao Paulo. Investments in the sector require the use of resources from both national and local governments, private sector participation, as well as requesting loans and technical cooperation from multilateral agencies.

As far as public finance sources are concerned, it should be taken into account that except in certain exceptions the smallest municipalities are generally where the lowest income population is located, which is why public resources should be allocated primarily to those areas. In the principal cities and places with more economic activity and greater payment capacity, priority should be given revenue collection mechanisms for households which enable cost and investment recovery and encourage private sector participation as financing mechanisms.

The private sector will be willing to participate as long as the revenues raised are sufficient to finance costs and contractual schemes provide regulatory stability to contracts. According to a study (The Economist Intelligence Unit, 2014) on the possibilities of advancing public-private partnerships (PPPs) in 19 countries in Latin America and the Caribbean, the environment for executing such agreements in the region has improved since 2012. Countries that have shown a better performance in this regard have struck a balance in technical and economic aspects in their project selection processes. Additionally, many countries are including PPPs in their national development plans evidencing increasing political support for such programs.

In the past few years, Brazil and Mexico increased their investments under PPP schemes to meet their infrastructure needs; likewise, Chile, Colombia and Peru, will do so in the near future. The aforementioned study presented a ranking that shows how prepared the countries of the region are to participate in PPPs; Chile, Brazil, Peru, Mexico and Colombia, were the countries with the best scores at the "Developed" category ranking, while Uruguay, Guatemala, Jamaica, El Salvador, Costa Rica, Honduras, Paraguay, Trinidad and Tobago ranked in the Emerging category. As for the Dominican Republic, Ecuador, Nicaragua, Argentina and Venezuela are at the bottom of the ranking in the Nascent category. It should be noted that none of the countries is in the "Mature" category (scores between 80 and 100). The category scores were evaluated by EIU (2014) in consideration of the following aspects: regulatory framework, institutional framework, operational maturity, investment climate, financial facilities and adjustments at the subnational level[100].

Available figures from UNEP (2015) show that most of the investment resources obtained in developing countries have been received as a loan to improve the provision of the waste collection service and to build the final disposal infrastructure through sanitary landfills (UNEP-ISWA, 2015). One of the recent experiences, completed

100. For more details on the study and the methodology used, review the full document.

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in 2015, was the credit granted to the National Project for the Management of Municipal Solid Waste in Argentina for an amount equivalent to 40 million USD dollars (The World Bank, 2015), whose objective was to improve public health and population quality of life, reducing their exposure to contaminants and disease vectors from solid waste. More than 3.5 million people residing in different provinces of the country benefited from this development. Final disposal of waste was improved as 98% of waste disposed of in the beneficiary municipalities are taken to sanitary landfills in 2015, with 11 facilities were built for the final disposal or waste treatment: namely, three sanitary landfills, four transfer stations, three separation plants and a composting plant. Likewise, projects developed within the framework of this program had a social component that facilitated the formalization of waste pickers and institutional strengthening, improving the capacities of people involved in waste management in the different municipalities, achieving improvements in technical, environmental, social and/or financial aspects.

5.7 Deciding on the appropriate financing model

5.7.1 The urgency of adopting measures for the management of solid waste

The effects of inadequate waste management have been well studied and explored. Moreover, in the Latin America and the Caribbean, where failures in environmentally sound waste management are evident, some specific cases have been reported in which municipal authorities were forced to pay high compensation costs to affected people and also for the damages caused to the environment, which in many cases are beyond repair.

Landslides inside sanitary landfills contribute to the spread of diseases associated with inadequate waste treatment, fires at final disposal sites, greenhouse gas emissions, pollution of groundwater are just a few examples of events that have occurred in the region. The existence of such events demonstrates the need for taking action now and proving this sector with greater investment resources and improving efforts to achieve financially sustainable schemes.

5.7.2 When is business-to-business appropriate?

The business-to-business financing model in which a large waste generator contracts directly with a private- sector waste company to provide a service, depends to a great extent on environmental regulations compliance requirements of each and the way in which waste management service is delivered to those waste generators.

In general, large-scale generators will seek the best way to reduce waste management costs as long as they meet the minimum environmental requirements for their management and comply with the company's own environmental policies. Nevertheless, the incorporation of these users into the municipal scheme and, accordingly, charging an amount proportional to the amount and quality of the waste produced can be of help regarding coverage of management costs of low-income users.

5.7.3 Know where you stand in terms of MSWM finances

In order to identify the appropriate financing model at the local level and to be able to improve waste management and ensure the sustainability of the service, it is vital to know the municipality's current situation in terms of costs and revenues and to embrace a culture of reporting, collecting and ongoing analysis of information.

5.7.4 Private sector participation in MSWM

While private sector participation in waste management has improved the financial sustainability of delivery schemes in some countries of the region, this solution is not applicable in all cases, nor is it the only possible solution to improve waste management while ensuring its sustainability.

There are different ways to engage the private sector in solid waste management, either through service contracts or schemes in which the private sector finances investments, which means that having cost recovery plans to provide the necessary guarantees is essential.

In addition, a strong institutional framework is needed so that governments can ensure delivery of services, assuming roles related to regulation, control, financing, and the collection and analysis of information at the municipal and national levels.

Step 1

Establish the framework conditions

Examine the current political, legal, institutional, economic, and cultural structures and constraints

Investigate potential for economies of scale, the regional/municipal nexus and institutional constraints.

Clarify the sources and availability of investment

Define the role and scope of the informal sector

Step 2

Define the objectives for improvements in the waste management system

Define the improvement needed in order of priority within the service chain

Define the scope and desirability for introducing valorization and recovery systems

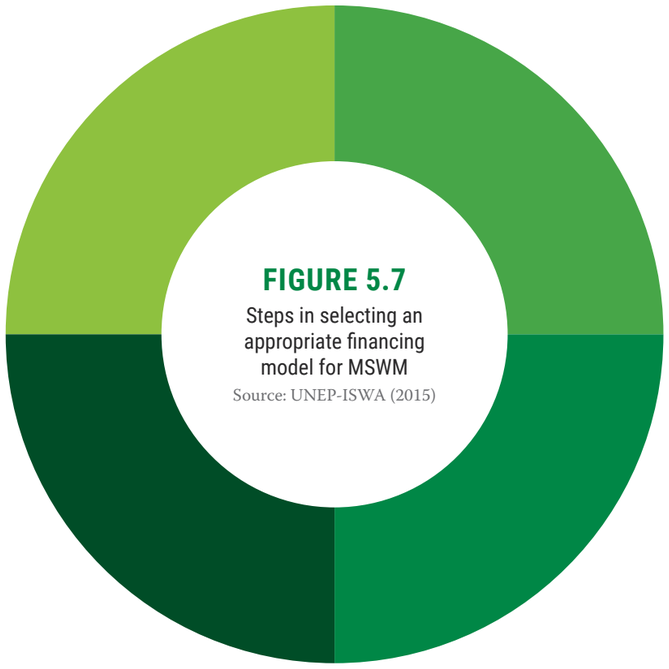


FIGURE 5.7
Steps in selecting an appropriate financing model for MSWM
Source: UNEP-ISWA (2015)

Step 3

Assess conditions and capacities

Examine the capacities and experience of the public authority, operator, and the revenue collector with different operator models

Examine institutional, economic and policy conditions that influence the choice of models

Step 4

Seleccione el modelo

Assess advantages and drawbacks

Examine the potential role of and constraints on contracting with the private sector

Examine the inherent advantages and disadvantages of possible financing models

Establish revenue requirements, tariffing policy and revenue collection methods

5.7.5 Selecting a financing model

The GWMO suggests taking the following steps to define the most appropriate funding model at the local level:

1. Establish local objectives.

2. Identify the conditions and capacities that are suitable for different contract types, financing types, revenue options and costs.

3. Select the operator model that best fits the particular local conditions. For selecting the model, the recommendation is to navigate amongst some options that appear in the literature.

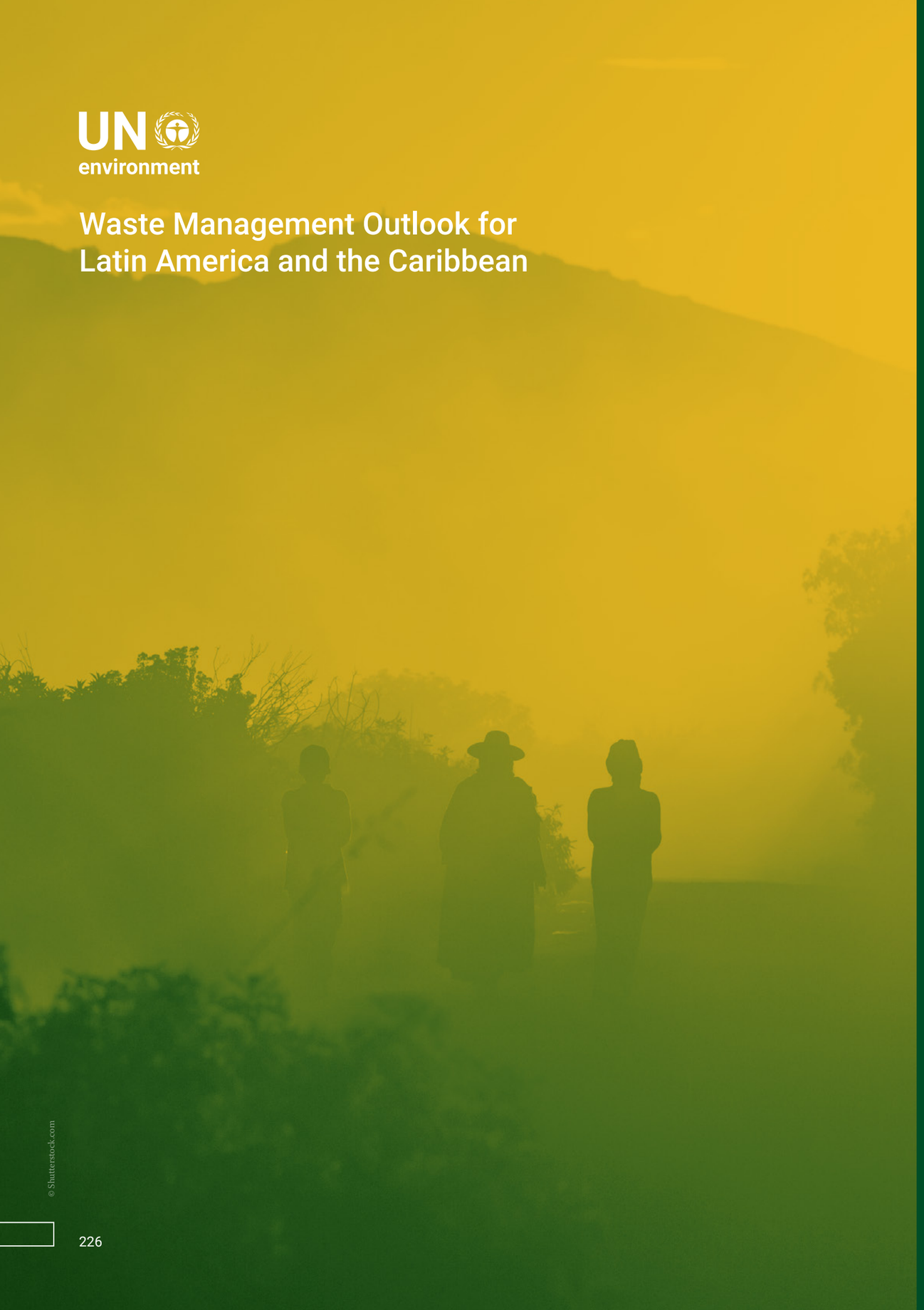
FIGURE 5.4 outlines the proposal put forward in the GWMO (2015).

5.7.6 What is an appropriate level of cost recovery in solid waste management?

The level of recovery of costs from the tariffs or rates charged is limited by the population payment capacity, so full cost recovery through direct charges made to users is not always possible. As a result, countries should explore different possibilities for financing waste management, including investment aids, extended producer responsibility schemes, regulatory incentives, etc.

5.7.7 Selecting the appropriate sources of investment finance

Choosing the sources of financing for waste management is not a simple task, especially for countries in the region where resources are scarce and investment priorities are focused on other sectors. However, there are a number of possibilities that municipalities can evaluate to make projects viable, which will depend on local objectives, economic and policy conditions, and local capacities to access resources available at the international level, while providing a favorable environment for private investors.



6

Waste management in the region

The way forward

This final chapter pulls together the main findings of the Waste Management Outlook for Latin America and the Caribbean and its intrinsic challenges (6.1), and then, according to that, presents the kind of transition necessary towards a system based on resource management (6.2), followed by a series of recommendations (6.3).

6.1 Main findings of the Waste Management Outlook for Latin America and the Caribbean

6.1.1 Regional status

Growing waste generation. In a future scenario in which consumption and production patterns, the extraction of natural resources and upward social mobility remain the same with a population growth which will bring the regions' population to 691 million by 2025. With 567 million people living in cities, the generation of waste will increase steadily. According to the information collected, it is currently estimated that *urban waste generation in Latin America and the Caribbean is 541,000 tonnes per day.* This number could reach at least *671,000 tonnes per day by the year 2050 (25% increase).*

Improved but insufficient collection coverage. The collection rate is estimated at 93.4% of the waste generated, an average which shows significant progress in the collection system of the region, even though it can vary greatly amongst the countries and according to the size of the cities. On the other hand, based on the same estimates, *35,000 tonnes per day remain uncollected,* affecting *41 million people.* It should be noted, of course, that those who are not served by collection services are the most vulnerable people in the region, or those who live in rural or remote areas.

Persistence of inadequate final disposal practises. Despite the improvements achieved in the last few years, approximately a third of the waste generated, equivalent to *145,000 tonnes per day, is sent to open dumpsites (including 17.000 t/d of plastic waste),* leaving 1*70 million people* in the region exposed to its consequences. This causes enormous damage to people's health as a negative environmental impact that deteriorates the quality of soils, the air and water, constitutes an assault on biodiversity and inflicts serious harm on productive activities, such as tourism, agriculture or fishing.

The organic fraction dominates the composition of waste. The composition of waste reflects the different income levels, so the organic fraction is still significant in three of the four economic statuses assessed. Thus, there is 75% of organic matter in low-income countries, versus 36% in high-income countries, where the waste composition tends to be more complex. The percentage for lower-middle income countries is 56%, whereas for upper-middle income it is 52%. Broadly speaking, *organic waste represents a little more than half of the waste.* The remaining fraction is comprised of so-called dry waste, such as metals, papers, cardboard, plastics, glass, textiles, amongst others. It is common to find waste with hazardous qualities in household waste, such as cells and batteries, electrical and electronic equipment and peripherals, expired medicines, etc.

Apparently low recycling rates. Recycling rates of both streams are very low in the region, where they exceptionally reach 20% but remain well below that percentage in most of the countries, therefore about 90% of waste generated in the region is not recovered. These *rates are probably higher thanks to the contribution of the informal sector,* which is not recorded adequately. Recycling rates also vary according to waste streams, with the rates for metals, cardboard and papers being generally higher than for plastics, which have clearly been affected by oil price fluctuations.

Progressive incorporation of technological options. The technology transfer process is still very slow, with some small advances of note such as the introduction of mechanical biological treatment, anaerobic digesters, co-processing of waste in cement kilns, and the beginning of processes conducive to the installation of incineration and energy production plants. Progress was made in capturing gas in more than fifteen sanitary landfills in the region, and utilizing it in energy recovery. The transfer of technologies, however, has not always been carried out in proper consideration of the local conditions.

Inadequate treatment of the different waste streams. There have been significant advances, especially in the legislation, regarding the consideration of other waste streams such as hazardous waste, waste from healthcare facilities, construction and demolition waste, waste electrical and electronic equipment, tires, so that several countries have instruments such as plans and programs to improve their management. Due to the lack of control or the lack of treatment plants suitable for said wastes, an undetermined fraction of the streams mentioned above is not adequately handled, with the final destination frequently being dumpsites or unauthorized sites, or incorrect handling processes, all of which entail risks.

Lack of robust information systems. Although the information available on the generation and collection of MSW is acceptable, the absence of adequate data collection, processing and analysis systems that build reliability is typical in the region, which, in turn, affects decision-making processes. In general, there is no consistency in the definitions at the source of data between the different national and local levels, which complicates their integration and comparison. Naturally, this difficulty is also present in the diversity of criteria used in each country to define the components of management indicators. In summary, *the difficulty of systematizing data results in unreliable indicators which are difficult to compare.* This is even more serious for the consideration of waste streams such as hazardous waste, waste from healthcare facilities, construction and demolition waste, food waste or waste electrical and electronic equipment.

6.1.2 Governance

Challenges to the institutions and legislation enforcement. Even though practically all of the countries in the region have legal norms that contain the provisions for compliance by waste generators and handlers as well as penalties for noncompliance, the institutional framework is weak. This situation has led to unclearly defined or overlapping competencies, which create a vacuum of government responsibilities with few follow-up and monitoring action resulting in, amongst other things, a deficient enforcement of the law, both in the public and private sectors. As a consequence, the most serious problem is the effective enforcement and compliance with the law and, in addition to that, the fact that outcomes are not assessed.

Limited citizen participation. While the need to apply Principle 10 of the Rio Declaration, according to which the best way to approach environmental issues is by guaranteeing access to information and full participation in the public decision-making, reality shows a limited participation of citizens in such processes. This is despite this principle being taken into account by the legislation of most countries in the region.

Extended Producer Responsibility is being increasingly adopted. Extended Producer Responsibility is an issue that deserves the region's full attention. The guiding principles behind

it are the duty of preventing pollution, the life cycle concept, the polluter-pays principle and the adequate internalization of costs. LAC legislation introduces examples in which the EPR principle is expressly included, either in the general waste law or in specific regulations for a specific stream. The legislations analysed tend towards the so-called Shared Responsibility or Shared and Differentiated Responsibility Principle. Approximately a third of LAC countries take this principle into account in some manner or for some waste streams. Efforts are still needed for it to be included into their legislations. Often the accession process to the OECD is the only thing that leads to its inclusion.

Significant presence and contribution of the informal sector. A trait all countries in the region share is the extended presence of the so-called informal "scavengers" (*recuperadores,* in Spanish) who, on occasion, appear as a result of the economic and political crises, which are commonplace in the different countries in LAC and force a multitude of people into poverty. Scavengers have thus become a typical element of the sector and have also given it a certain dynamism. Their main contribution is the generation of resources through the separation and collection of the streams of recyclable wastes. Because they are informal workers, there are usually no formal data attesting to their participation, but, thanks to their contribution, recycling rates in the region are undoubtedly higher than those officially disclosed. Some countries in LAC have included the activity of scavengers as part of the urban public service of hygiene in their regulations. Nevertheless, there are no measures aimed at ensuring their health, the protection of the environment, access to dignified work and child protection in place.

Environmental education and communication: key elements to be consolidated. There is widespread consensus that environmental education and communication are relevant aspects, which need to be taken into account in working to raise awareness about the importance of properly managing waste, and generating the cultural change necessary for transitioning to a new paradigm. However, in general it has not been possible to articulate the national solid waste management policy with the national environmental education policy. Communication efforts are generally isolated and, in the absence of a supporting trustworthy information system, are not substantiated. In this regard it is worth stressing the significant cooperation of non-governmental organizations which often step in where the actions of government are limited.

6.1.3 Financing

Persistence of financially unsustainable management mechanisms. Financing is a key issue for the improvement and sustainability of waste management mechanisms, especially in Latin America and the Caribbean, where models directly financed by municipalities prevail and in many cases the costs of the service are not recovered, while the investments necessary for improving the quality, continuity and coverage of the service are not executed.

The direct and indirect costs of waste management are unknown. As a general rule, there is no clear knowledge of the financial and economic costs associated with waste management which makes the sustainability of the mechanisms used difficult. In general, there is no clear awareness of the fact that the economic cost of the negative impacts on public health, the environment and the economic development caused by the lack of an adequate management of waste (the cost of inaction) is higher than the financial cost of an adequate management system.

Diversification of the service delivery models. Public models prevail in the region, with some creating high tax burdens which are barriers to the sustainability of these schemes and limit the possibilities for improvement. The participation of the private sector in these services, however, is growing. There is a variety of options for public-private partnerships or private sector participation in solid waste management. The methods being used are contracting, concession, lease, franchise and open competition.

Towards regionalization. It should be noted that there are numerous examples of regional solutions achieved through the association of several municipalities into different types of operating organizations. Regionalization in service delivery is the most common way of achieving economies of scale in management and accessing financing sources, amongst other advantages. Another benefit is that the cumulative environmental impact is reduced, while being a clear example of institutional enrichment as the sensitive process of reaching those solutions involves a practise of dialogue and consensus that is essential for their realization and operation.

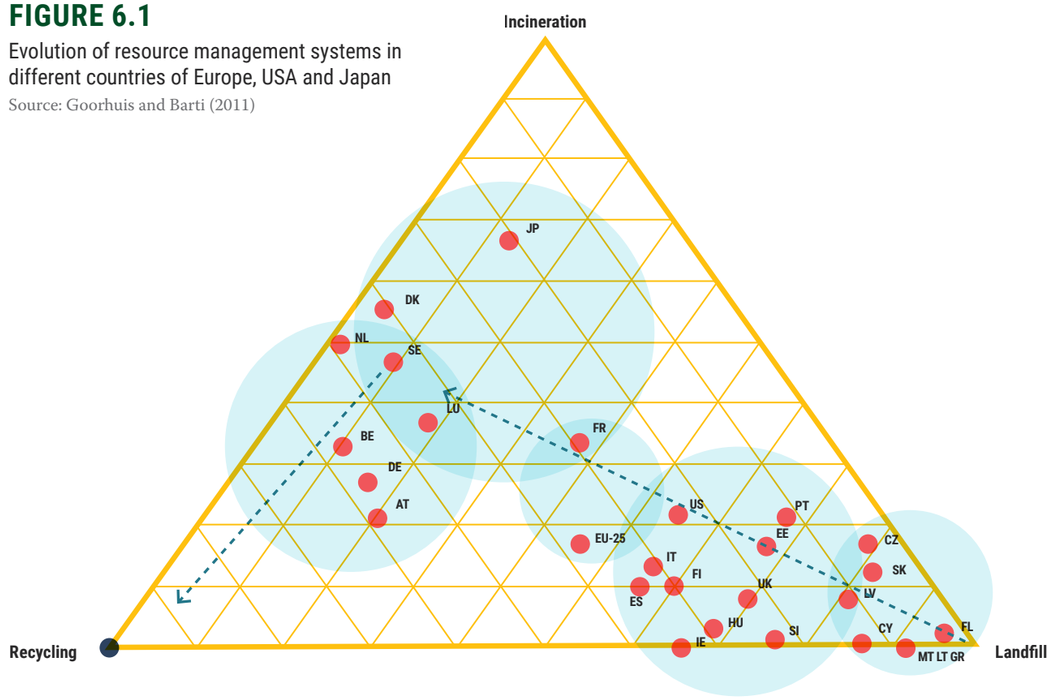
Effective collection of the service fees, a key element. There are many different revenue collection mechanisms for waste management services. It is generally performed via water and sewerage or electricity bills, or through property taxes and, to a lesser extent, by charging a direct fee to consumers. There are also examples of mixed systems. However, many municipalities of the region frequently lack service fee collection mechanisms or, sometimes, part of the funds get diverted to pay for other kinds of services.

Insufficient investment levels. Current levels of public and private investment are not enough to fund the infrastructure necessary for mitigating the main deficiencies mentioned above (variable collection coverage, low recycling rates, inadequate final disposal).

FIGURE 6.1

Evolution of resource management systems in different countries of Europe, USA and Japan

Source: Goorhuis and Barti (2011)



6.2

The transition towards a resource management system

In view of the global characteristics mentioned before (population increase, urbanization, demographic transition, unsustainable patterns of production and consumption) and threats (natural resource scarcity, climate change), the response of the international community was unanimous. In the United Nations, member countries undertook to achieve in an Agenda by 2030 the commitments contained in the Sustainable Development Goals (SDGs).

Working towards sustainable development requires a global response that leaves the traditional way of thinking of a linear economy (extract - make - discard) to one side in order to develop a circular economy intended for the design of products that become resources for new productive processes or for the generation of renewable energy.

The region then faces the challenge of moving towards a transition process which, while gradually overcoming the existing problems in the sector, builds the path to the new paradigm. In other words, to go from a waste management system to a resource management system.

Selecting the decisions that will make that path possible is an added challenge. That is to ponder what the actual system be like. The trend in the initiator countries of the European Union was for systems to move away from the use of sanitary landfills over time by incorporating other treatment and final disposal technologies through incineration, and, finally, to favor recycling. A similar trend is currently taking place in the US and China.

Will we replicate this trend or will we be able to skip the alternative? **FIGURE 6.1** shows the evolution of the systems in different European countries, the US and Japan, which progressed from a strong presence of sanitary landfills towards incineration processes, and then towards a substantial increase in recycling.

6.3

Recommendations for action

A real Sustainable Development Agenda must necessarily include an adequate management of waste. Given the characteristics of the region mentioned above and the complexity of the task at hand, this section recommends a set of priorities for actions.

1. The sound management of waste must be considered as an urgent priority in the region. This political decision must contribute to the development and implementation of appropriate policies, strategies, institutional support and regulatory frameworks, taking into account available technologies, social inclusion and participation, financing, management indicators, and forms of education and communication, that lead to the ultimate goal of achieving a resource based system.

2. There must be a general imperative conducive to **ensuring public health and environmental protection** locally, and protect the planet globally. For such purposes, proper waste management must be extended to all citizens. This requires:

- *To proceed with the progressive closure of dumpsites*
- *A regular and reliable waste collection service that serves 100% of the population*
- *Identification and proper treatment of all waste streams*

3. Promoting a circular economy in order to move from waste management to resource management. Traditionally, waste management systems dealt with them once they had been generated. An approach which includes the life cycle concept suggests that the focus must be shifted and be placed on the beginning of the process in order to prevent the generation of waste through an appropriate design, employing sustainable production and consumption practises, identifying and reducing hazardous substances, reusing and recycling and, where residuals do occur, proceed to a safe final disposal or utilize them for energy recovery.

4. Strengthen information systems. According to a United Nations report (United Nations Statistics Division, 2013), "Data are the lifeblood of decision-making and the raw material for accountability. Without high-quality data providing the right information on the right things at the right time; designing, monitoring and evaluating effective policies becomes almost impossible." For such purposes it is, therefore, recommended to:

- Generate information systems with reliable and timely data, and prepare suitable management indicators, for the different waste streams.
- Design the system on the basis of the information generated by *local governments* and consolidate it at the national level.
- Take steps regionally through existing institutions (such as UN Environment, intergovernmental networks, the Basel Convention, regional representative NGOs such as AIDIS, ISWA) to develop tools and mechanisms for the assessment of technologies, kinds of wastes included in certain categories, methodologies for the generation of indicators for the purpose of carrying out effective comparisons between the systems in the region.

5. Tackle the management of organic waste. In general terms, it can be said that 50% of the generated waste is organic waste, understood as the waste that is capable of undergoing aerobic or anaerobic decomposition process, such as food and garden waste, or paper and paperboard which, during the decomposition process, produce leachate liquids and greenhouse gases (EU Landfill Directive 99/31 EC). It is, therefore, recommended to:

- Promote the *separation at the source and differentiated collection* of dry and organic waste.
- Contribute to food security by *reducing the amount of food waste* through public or private programs (Food Banks), the appropriate legislation for suitable labelling and the understanding of terms such as "use by" or "expiration date", or rules such as the Good Samaritan law which limits the liability of donors for any harm caused to consumers by the redistribution of food.
- *Gradually ban the disposal of biodegradable waste in sanitary landfills.*
- *Draw up rules that determine the quality level of the composted material* for it to be used as support for infrastructure, a soil improver or as an alternative for chemical fertilizers.

6. Ensure the adequate control and treatment of hazardous waste. Throughout the outlook it has been emphasized that public health and environmental protection need to be ensured as they are seriously threatened by the illegal disposal of hazardous waste in open dumps or by burying it with household waste. Even though it is true that most countries in the region have adhered to the international conventions which regulate the treatment and transport of hazardous waste and have adopted national regulations for the regulation and control of this waste, it is still necessary to:

- *Reinforce control of hazardous waste and improve the enforcement of laws.*
- *Promote the installation of suitable treatment plants, attempting to provide regional solutions.*

7. Select the best available technologies. It is essential to note that whether we can rate a system as successful is the choice of technology used. As the technology transfer process has already began, it is advisable to ensure that the best technologies are properly selected. An essential requirement for identifying them is:

- To substantiate that they have been tested, that is, successfully used on a large scale and repeatedly in other contexts, and for certain periods of time.
- To properly determine their size as those of a high degree of development and number of tonnes to be treated a day need to be repaid in the the long term.
- To ensure the availability of providers for the installation and provision of spare parts.
- To clearly determine the operation and maintenance costs, as well as the proper training local operators should receive.
- To promote, during the selection, extensive public participation.

8. Establish specific programs for the different waste streams. There are also other waste streams which merit consideration, consequently, it is recommended to:

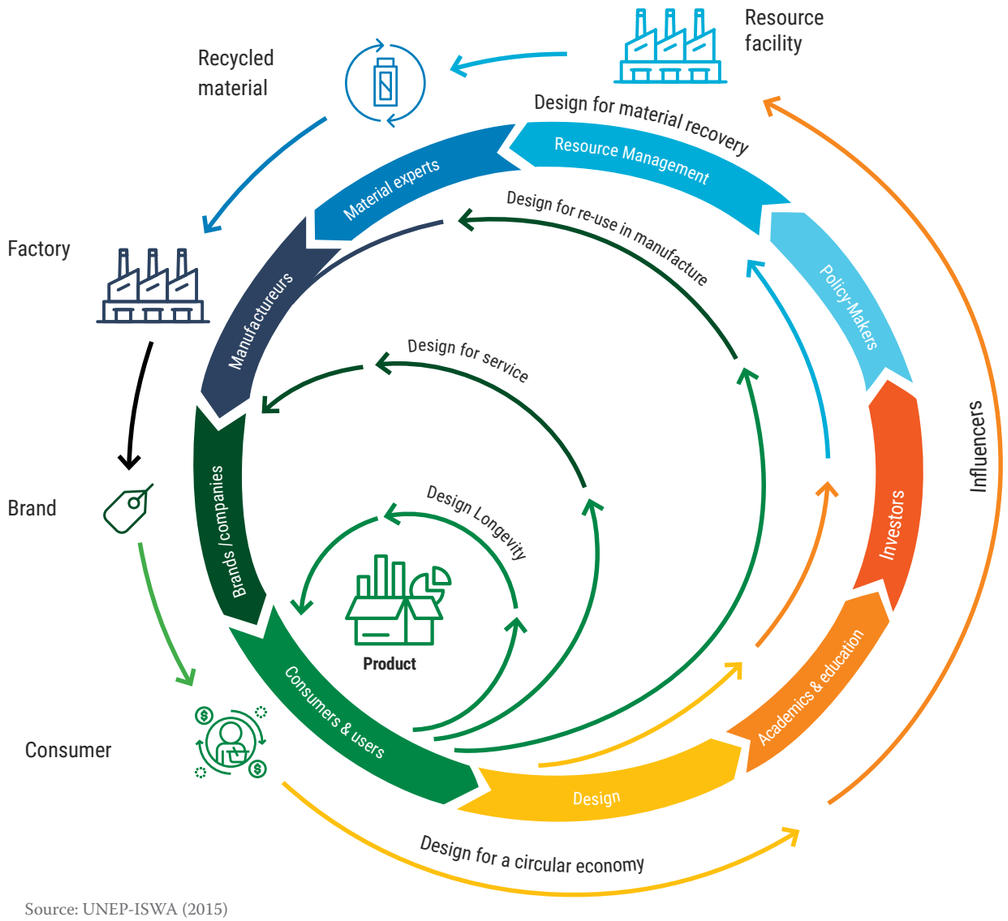
- Reduce, recycle and adequately dispose of *construction and demolition* waste.
- Generate plans and programs for *vehicles at the end of their useful life* to maximize reusing and recycling of its components.
- Develop specific programs for the proper treatment of *tires* through recycling or as a possible alternative to traditional fuels.
- Progressively emphasize so-called *household hazardous wastes.*
- Implement prevention programs for the management of *waste generated by natural disasters* according to the vulnerability of each geographical area.
- Develop strategies for the prevention of *marine litter,* especially emphasizing the management of the entire value chain of *plastics.*
- Promote the identification, prevention, or lines of research and development for the effective treatment of so-called *emerging wastes* (nano-waste, bio-polymers, composite materials, wind turbine generators).

9. Close the recycling cycle for every material. Once this has been achieved, implement safe final disposal or use the waste for energy recovery. It has been determined that one of the challenges the region faces is how to transition towards a circular economy. The brains of this process are the design of new products, but its heart is recycling. Stress has already been placed on the importance of segregation at source to keep materials clean and separate. Finally, recycling is only possible if there is a market in which materials can be traded. Some markets are strictly local, such as the markets of compost or soil improvers, while others can be national or regional, such as the market for glass. Other markets are plainly commodities with the fluctuations and variations that are typical of these markets (e.g., oil barrel price and plastics).The cost of transport from the place where materials are collected the processing site, and from there to the points of distribution, trade and use, an not insignificant matter, also needs to be considered. Finally, acknowledge the second law of thermodynamics, which sets a limit on recycling.

10. Promote a suitable set of policies, regulations and economic instruments. Aside from markets, adequate policy can create the necessary conditions for recycling to be possible. Therefore, it is recommended to:

- *Draw up the necessary regulations* with the participation of interested stakeholders, taking into account the fact that adapting to them is a gradual process, and that adequate foresight is necessary in order to provide legal security and trustworthiness to the different stakeholders. The economic instruments provided for in the regulations must be adequately valued and aim to clearly encourage or discourage certain actions.
- *Pass laws in which the Extended Producer Responsibility (EPR) is enshrined.* These reg-

FIGURE 6.2
The four designs model



Source: UNEP-ISWA (2015)

ulations allow for the internalization of the costs of reverse logistics mechanisms, as well as for the financing of the highest collection costs, when properly implemented.
- Establish significant *penalties* for cases of noncompliance with the regulations and work so that they are effectively enforced.
- Include *systems of indicators* in the regulations, for it to be possible to assess the outcomes of implementing the law.
- Strengthen and improve the effectiveness of the *systems for the follow-up, surveillance and control* of those responsible for the management and operation of solid waste management systems.

Some economic incentives could be implemented simultaneously, such as:

- *Implement economic instruments such as fees for services provided, taxes on the final disposal of waste in sanitary landfills and fees for advanced recycling*
- *Reduction of indirect taxes on recycled products*
- *State procurement of recycled products*

Finally, in order to favor the process, the EPR law itself must require:

- *Design for fulfilling its intended purpose*
- *Labelling rules so that all components are identified.*

11. Ensure a consistent and effective governance model. The effective governance of the system will depend heavily on the institutional and legal framework in force. Therefore, it is advisable:

- For a government agency with exclusive competence at the national level to lead during the preparation and coordination of the waste management policy, in order to avoid overlaps and contradictions.
- To have a similar mechanism at the local level.
- To have a national waste rule at a higher level in the hierarchy (law), which sets forth the common frameworks for the country and enables the harmonization of local regulations.

12. Promote an effective communication and participation. The success of waste management system often depends on whether the behavior of the different actors has changed. For example, separation at source involves an additional educational and communication effort aimed at including the message into consented daily practises as well as other actors who are part of these mechanisms. Participation will then be guaranteed on the basis of the information supplied and the clarity of the communication message. The following is recommended for the message to be effective:

- To combine and coordinate environmental education and waste management policies
- To provide a clear message that is easy to put into practise
- To engage through knowledge and participation
- To promote participation with incentives and penalties
- To show examples using pilot programs

13. Formalize and recognize the informal phase of recycling. The depth of the political crises and their economic-social consequences have impoverished a multitude of the region's citizens, causing them to them to look for means of survival and foods for themselves, their families or animals, and collect certain materials which would create an income when sold. Open dumps or semi-controlled disposal sites, and even sanitary landfill were the targets of this search, and the streets have filled with modern-day hunters and gatherers who found their livelihood. This reality has been slowly acknowledged and internalized, either explicitly or implicitl: implicitly through the market which, due to the lack of transparency, favored buyers or stockpilers who are often on the edge of the law; explicitly, because several countries passed legislation which recognizes the sector as an integral and necessary part of the collection systems intended for recycling. There are also successful experiences of team-work promotion, through the creation of work co-operatives. In this framework, it is recommended to:

- Promote the *formalization* of scavengers in the region through the appropriate institutional mechanisms.
- Favor the *equipment and infrastructure conditions,* as well as the professionalization of scavengers, so that they can fulfil their duties in an effective and competitive manner.
- Guarantee *dignified work, social and healthcare coverage,* and *child protection.*

14. Charge fees for the waste management service to the population and ensure the availability of financial resources. In the countries in the region the waste sector has been historically left behind when compared to other public health and environmental quality priorities. As a consequence, drinking water and other kinds of infrastructure have been dealt with before waste management, despite the close connection between waste management and health, the environment and economic development. Acknowledging this priority should go hand in hand with:

- The determination of the financial and economic costs associated with waste management.
- The design of alternatives for recovery (methodologies for calculating rates or fees).
- Such alternatives must be in keeping with the ability to pay of the population.
- The creation of incentives or financial penalties.
- Favoring the regionalization and, thus, the economy of scale of ventures.
- The promotion of public-private partnerships as a way of attracting private financing.

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References, abbreviations, acronyms and annexes

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Abbreviations and acronyms

A	**AIDIS**	Asociación Interamericana de Ingeniería Sanitaria y Ambiental.
	ALC	América Latina y el Caribe.
	APP	Asociaciones público-privadas.
B	**BID**	Banco Interamericano de Desarrollo.
C	**CCAC**	Coalición de Clima y Aire Limpio.
	CCVC	Contaminantes climáticos de vida corta.
	CEPAL	Comisión Económica para América Latina y el Caribe.
	CMNUCC	Convención Marco de las Naciones Unidas sobre Cambio Climático.
	COP	Compuestos orgánicos persistentes.
	CPS	Consumo y producción sostenible.
D	**DA**	Digestión anaerobia.
E	**EIA**	Evaluación de Impacto Ambiental.
F	**FAO**	Organización de las Naciones Unidas para la Alimentación y la Agricultura.
G	**GEI**	Gases de efecto invernadero.
	GEO	*Global Environmental Outlook* (Perspectiva del medio ambiente mundial).
	GIZ	Agencia Alemana de Cooperación Técnica.
	GWMO	*Global Waste Management Outlook* (Perspectiva mundial de la gestión de residuos).
I	**IETC**	Centro Internacional de Tecnología Ambiental.
	IPCC	Panel Intergubernamental sobre Cambio Climático.
	IRR	Iniciativa Regional para el Reciclaje Inclusivo.
	ISWA	International *Solid Waste Association* (Asociación Internacional de Residuos Sólidos).
M	**MDL**	Mecanismo de Desarrollo Limpio.
N	**NAMA**	*Nationally Appropriate Mitigation Action* (Acciones de mitigación nacionalmente apropiadas).
	NDC	*Nationally Determined Contributions* (Contribuciones nacionalmente determinadas).
	NIMBY	*Not in My Back Yard* (No en mi patio trasero).
O	**OCDE**	Organización para la Cooperación y el Desarrollo Económico.
	ODS	Objetivos de Desarrollo Sostenible.
	OPS	Organización Panamericana de la Salud.
R	**RES**	Residuos de establecimientos de salud.
	RP	Residuos peligrosos.
	RPD	Residuos peligrosos domésticos.
P	**PCDD/PCDF**	Dioxinas/furanos.
	PET	Tereftalato de polietileno.
	PGIRS	Plan de Gestión Integral de Residuos Sólidos.
	PNUMA	Programa de las Naciones Unidas para el Medio Ambiente.
R	**RAEE**	Residuos de aparatos eléctricos y electrónicos.
	RCD	Residuos de la construcción y demolición.
	REP	Responsabilidad extendida del productor.
	RI	Recuperadores informales.
	RSU	Residuos sólidos urbanos.
S	**SIGRS**	Sistema Integral de Gestión de Residuos Sólidos.
T	**TMB**	Tratamiento mecánico biológico.
U	**UE**	Unión Europea.
	UNEA	Asamblea de las Naciones Unidas para el Medio Ambiente.
V	**VFVU**	Vehículos al fin de su vida útil.
W	**WIEGO**	*Women in Informal Employment: Globalizing and Organizing* (Mujeres en empleo informal: globalización y organización).

Annex 1

Classification of the final disposal facilities[101]

ANNEX 1.1

Differences between open dumps, controlled dumps and sanitary landfills (UNEP, 2005)

Criteria	Open dumpsites	Controlled dump	Sanitary landfill
Sitting of facility	Unplanned and often improperly sited.	Hydrogeological conditions are considered	Site chosen is based on environmental, community and costs factors
Capacity	The site's capacity is unknown	Planned capacity	Planned capacity
Planificación de celdas	There is no cell planning Wastes are thrown indiscriminately The work is not controlled	There is no cell planning, but the work area is minimized. Disposal only takes place in certain areas.	Development of design cell by cell The work area is drawn based on the smallest practical space Disposal only takes place in the designated cells
Site preparation	Little or no site preparation	Grading of bottom of the disposal site. Drainage and surface waters control along periphery of the site	Extensive site preparation
Leachate management	No leachate management	Partial leachate management	Full leachate management
Gas management	No gas management	Partial or no gas management	Full gas management
Application of soil cover	Occasional or no cover of waste	Covering of waste implemented regularly but not necessarily daily	Daily, intermediate and final soil cover applied
Waste compaction	No compaction	Compaction in some cases	Waste compaction
Access road maintenance	Poor maintenance of the access road	Limited maintenance of the access road	Full development and maintenance of the access road
Fencing	No fence	With fence	Safe fence with gate
Waste inputs	There is no control on the quality and/or composition of incoming waste	Partial or no control o waste quantity, but waste accepted for disposal is limited to MSW	Full control over quantity and composition of incoming waste Special provisions for certain types of waste
Record keeping	No record keeping	Basic record keeping	Complete record of waste volumes, types sources, and site activities/ events
Waste picking	Waste picking by informal collectors	Controlled waste picking and trading	No site waste picking and trading
Closure	No proper closing of the site after cease of operations	Closure activities limited to covering with loose or partially compacted soil and replanting of vegetation	Full closure and post-closure management
Cost	Low initial cost, high long-term cost	Low to moderate initial cost, high long-term cost	Increased initial, operational and maintenance costs, moderate long-term cost
Environmental and health impacts	High potential for fires and adverse environment and health impact	Lesser risk of adverse environmental and health impacts compared to an open dump	Minimum risk of adverse environmental and health impacts

101. The following table has been taken from ISWA (2015).

Annex 2

Indicators and MSW generation data in LAC countries

Other sources used: BID-AIDIS-OPS (2011), BID (2015), ONU HABITAT (2012), Waste Atlas: [http://www.atlas.d-waste.com] and World Bank (2012).

Country	Population 2014	MSW Generation (Ton/day)	MSW Per capita generation (Kg/hab-day)[b]	Source of generation data	Source of population data[c]	Remarks
Antigua & Barbuda	90.000	157,50	1,75	ONU Habitat (2012)	http://populationpyramid.net	The sources references to OPS 2005
Argentina	42.874.000	49.305,10	1,15	Country Questionnaire 2015[d]	CEPAL	The questionnaire provides the data but also makes reference to a World Bank study with more recent data
Bahamas	383.000	1.244,75	3,25	The World Bank (2012)	http://populationpyramid.net	Bahamas is not included in Waste Atlas
Barbados	283.000	254,70	0,90	BID (2015)	http://populationpyramid.net	The source references Waste Atlas, which in turn quotes WaW as data source. However, the latter do not match (WaW is 4,75k/h-d vs. 0,95 of Waste Atlas)
Belize	333.600	333,60	1,00	BID (2015)	http://populationpyramid.net	BID 2015 refers to BID 2012 as data source; the base data is 1 kg/h-d
Bolivia	10.571.000	5.285,50	0,50	Country Questionnaire 2015	CEPAL	
Brazil	205.960.000	176.400,00	0.86	Country Questionnaire 2015	CEPAL	The figure refers to collected tones, not generated.
Chile	17.899.000	20.317,91	1,14	Country Questionnaire 2015	CEPAL	
Colombia	47.793.000	33.288,00	0,70	BID (2012)	CEPAL	
Costa Rica	4.770.000	4.000,00	0,84	Country Questionnaire 2015	CEPAL	The questionnaire only reports the value of 4.000 t/d, which is the base data considered.
Cuba	11.411.000	9.242,91	0,81	The World Bank (2012)	CEPAL	
Dominica	72.341	65,83	0,91	ONU Habitat (2012)	http://worldpopulationreview.com/countries/dominica-population/	The source references to OPS 2005. Dominica not included in http://populationpyramid.net
Ecuador	15.903.000	11.768,22	0,74	Country Questionnaire 2015	CEPAL	
El Salvador	6.273.000	5.582,97	0,89	BID-AIDIS-OPS (2011) and BID (2015)	CEPAL	
Grenada	106.000	82.46	0,85	Country Questionnaire 2015	http://populationpyramid.net	The source refers to tons disposed of in sanitary landfill.
Guatemala	16.059.000	9.795,99	0,61	BID-AIDIS-OPS (2011) and BID (2015)	CEPAL	

Country	Population 2014	MSW Generation (Ton/day)	MSW Per capita generation (Kg/hab-day)[b]	Source of generation data	Source of population data[c]	Remarks
Guyana	763.000	1.167,39	1,53	D-Waste (2014)	http://populationpyramid.net	Waste Atlas reports 558,5 k/h-year (equivalent to 1,53k/h-d) and refers to source What a Waste. However this reports 5,33 k/h-d
Haiti	10.608.000	7.319,52	0,69	BID 2015	CEPAL	The source quotes as reference Waste Atlas.
Honduras	7.965.000	5.841,00	0,65	Baseline report on integrated solid waste management in Honduras (2017)	CEPAL	The source is under process of publication
Jamaica	2.720.554	2.198,00	0,81	Country Questionnaire 2015	http://populationpyramid.net	
Mexico	122.978.000	117.258,00	0,85	Country Questionnaire 2015	CEPAL	Data from the questionnaire is taken, 117.258 t/d. The figures of population considered in the questionnaire are not consistent.
Nicaragua	6.018.000	5.416,20	0,90	BID (2015)	CEPAL	Considering national data are not available, the average value of the LAC region is taken.
Panama	3.867.000	4.717,74	1,22	BID-AIDIS-OPS (2011) and BID (2015)	CEPAL	
Paraguay	6.554.000	6.160,76	0,94	BID-AIDIS-OPS (2011) and BID (2015)	CEPAL	
Peru	30.983.000	20.541,05	0,66	Country Questionnaire / Planres 2016	CEPAL	
Dominican Republic	10.408.000	11.448,80	1,1	BID-AIDIS-OPS (2011)	CEPAL	The questionnaire does not include the direct figure, either the documents quoted in the questionnaire.
Saint Kitts & Nevis	51.538	92,77	1,80	ONU Habitat (2012)	http://www.indexmundi.com/es/san_cristobal_y_nieves/poblacion.html	The source provides generation data separated for S. Kitts and for Neves. The average value is considered.
Saint Vincent & the Grenadines	109.000	86,11	0,79	ONU Habitat (2012)	http://populationpyramid.net	The source refers to OPS 2005
Saint Lucia	183.645	196.75	1.07	Country Questionnaire 2015	http://populationpyramid.net	The figure refers tonnes disposed of in sanitary landfill
Suriname	538.000	731,68	1,36	The World Bank (2012)	http://populationpyramid.net	
Trinidad & Tobago	1.354.000	1.917.81	1.42	Country Questionnaire 2015	http://populationpyramid.net	The questionnaire report data disposed of in sanitary landfill. Data only referred to Trinidad (~95% of population)
Uruguay	3.418.000	3.076,20	0,90	Country Questionnaire 2015	CEPAL	
Venezuela	30.166.000	25.942,76	0,86	BID-AIDIS-OPS (2011) and BID (2015)	CEPAL	
Total LAC	619.465.678	541.437,96				

a. Population data from CEPAL (2015). Figures referred to are from mid 2014.

b. The entry data preferably considered has been per capita generation, excepting some countries where total national generation was provided (daily or annual).

c. In all cases the MSW generation data obtained is taken to 2014, which is the most recent year for CEPAL's Demographic Observatory, and also the year for which several countries provided the data.

d. Country Questionnaire 2015: for the purposes of the information provided in this report, the focal points of the countries of the region were asked to respond to a questionnaire designed for that purpose.

Annex 3

Data and information on the financing of waste in Latin America and the Caribbean

ANNEX 3.1

Main modalities of revenue collection of solid waste management in Latin America and the Caribbean

Country	Main revenue collection mechanism for solid waste management
Argentina	Property tax
Belize	Property tax
Bolivia	Electricity bill
Brazil	Property tax
Chile	Property tax or Direct waste bill
Colombia	Water or electricity bill
Costa Rica	Direct waste bill
Dominican Republic	Direct waste bill
Ecuador	Electricity bill
El Salvador	Electricity bill or Direct waste bill
Guatemala	Direct waste bill
Honduras	Property tax
Nicaragua	Direct waste bill
Panama	Water bill
Paraguay	Direct waste bill
Peru	Property tax
Trinidad and Tobago	Government
Uruguay	Property tax
Venezuela	Electricity bill

Source: Based on BID-AIDIS-OPS (2011).
Note: the information corresponds to the percentage of the billed population.

ANNEX 3.2

Main mode in which sweeping services of public streets and areas are provided

Country	Share of the population covered / type of service			Prevailing mode
	Direct Municipal Service	Other mode	No service	
Argentina	55.1	44.9	0	Mixed
Barbados	0	100	0	Direct service provided by National Government
Belize	N/A	N/A	0	No information
Bolivia	53.4	26.6	20	Mixed
Brazil	94.1	5.9	0	Direct Municipal Service
Colombia	12.7	87.3	0	Other mode
Costa Rica	92.4	7.6	0	Direct Municipal Service
Chile	35.6	64.4	0	Other mode
Ecuador	82.7	17.3	0	Direct Municipal Service
El Salvador	97.2	2.8	0	Direct Municipal Service
Grenada	N/A	N/A	0	No information
Guatemala	74.4	25.6	0	Direct Municipal Service
Guyana	N/A	N/A	0	No information
Haiti	N/A	N/A	0	No information
Honduras	93	7	0	Direct Municipal Service
Jamaica	0	100	0	Other mode
Mexico	81.3	18.7	0	Direct Municipal Service
Nicaragua	68.9	31.1	0	Direct Municipal Service
Panama	64.4	35.6	0	Direct Municipal Service
Paraguay	95.4	4.6	0	Direct Municipal Service
Peru	71.9	28.1	0	Direct Municipal Service
Dominican Republic	94.5	5.5	0	Direct Municipal Service
Saint Lucia	0	100	0	Other mode
Suriname	N/A	N/A	0	No information
Trinidad and Tobago	100	0	0	Direct service provided by National Government
Uruguay	69.2	30.8	0	Direct Municipal Service
Venezuela	70.1	29.9	0	Direct Municipal Service

Source: Based on IDB, AIDIS, PAHO (2011) and this study.

ANNEX 3.3

Main mode in which collection and transport services are provided

Country	Share of the population covered / type of service (%)					Total coverage	Prevailing mode
	Direct Mun. Service	Serv. Contract	Cooperat.	Central Gov.	No service		
Argentina	45,5	54,2	0,1	0	0,2	99,8	Mixed - Direct Municipal Service and Service Contracts
Barbados	0	0	0	100	0	N/A	Direct service provided by National Government
Belize	30,6	54,6	0	0	14,8	85,2	Service Contracts
Bolivia	45	35	0	0	20,0	80,0	Mixed - Direct Municipal Service and Service Contracts
Brazil	27,7	68,4	1,3	0	2,6	95,9	Mixed - Direct Municipal Service and Service Contracts
Colombia	30,3	68,3	0,4	0	1,0	99,0	Service Contracts
Costa Rica	65,4	25	0	0	9,6	90,4	Direct Municipal Service
Chile	18,4	79,4	0	0	2,2	97,8	Service Contracts
Ecuador	67,3	16,7	0	0,1	15,9	84,1	Direct Municipal Service
El Salvador	62,6	16,2	0	0	21,2	78,8	Direct Municipal Service
Granada	N/A	N/A	N/A	N/A	N/A	0,0	No information
Guatemala	43,2	19,6	14,9	0	22,2	77,7	Direct Municipal Service
Guyana	N/A	N/A	N/A	N/A	0	0,0	No information
Haiti	N/A	N/A	N/A	N/A	0	0,0	No information
Honduras	22,9	41,7	0	0	35,4	64,6	Service Contracts
Jamaica	0	0	0	62	38,0	62,0	Delivered by the central government
Mexico	62	23,6	7,6	0	6,8	93,2	Direct Municipal Service
Nicaragua	68	20,4	3,9	0	7,7	92,3	Direct Municipal Service
Panama	44,5	40,4	0	0	15,1	84,9	Mixed - Direct Municipal Service and Service Contracts
Paraguay	33,6	23,4	0	0	43,0	57,0	Mixed - Direct Municipal Service and Service Contracts
Peru	55,5	28,5	0	0	16,0	84,0	Direct Municipal Service
Dominican Republic	74,9	22,1	0	0	3,0	97,0	Direct Municipal Service
Saint Lucia	0	100	0	0	0	100	Service Contracts
Trinidad & Tobago	0	0	0	100	0	100	Delivered by the central government
Uruguay	76,9	20,8	0,5	0	1,8	98,2	Direct Municipal Service
Venezuela	59,8	24,2	12	4	0	100,0	Direct Municipal Service

Source: Prepared based on IDB, AIDIS, PAHO (2010), and confirmation of this study.

ANNEX 3.4

Main mode in which final disposal services are provided

Country	Share of the population covered / type of service				Prevailing mode
	Direct Mun. Service	Serv. Contract	Cooperat.	Central Gov.	
Argentina	45.2	24.1	0	30.7	Mixed - Direct Municipal Service and Central Government
Barbados	0	0	0	100	Direct service provided by National Government
Belize	0	39	0	0	Mixed - Direct Municipal Service and Service Contracts
Bolivia	70.8	29.2	0	0	Direct Municipal Service
Brazil	69.7	30.3	0	0	Mixed - Direct Municipal Service and Service Contracts
Colombia	17.3	82.3	0.3	0	Service Contracts
Costa Rica	35	67.5	0	0	Service Contracts
Chile	17.1	82.9	0	0	Service Contracts
Ecuador	74.8	25.2	0	0	Direct Municipal Service
El Salvador	8.1	91.1	0.8	0	Service Contracts
Guatemala	80.8	1	0	18.2	Direct Municipal Service
Guyana	N/A	N/A	N/A	N/A	No information
Honduras	72.9	27.1	0	0	Direct Municipal Service
Jamaica	0	0	0	62	Delivered by the central government
Mexico	65.7	22.2	0.3	11.7	Direct Municipal Service
Nicaragua	63	36.4	0.6	0	Direct Municipal Service
Panama	37.9	62.1	0	0	Service Contracts
Paraguay	48.5	51.5	0	0	Mixed - Direct Municipal Service and Service Contracts
Peru	67.4	32.6	0	0	Direct Municipal Service
Dominican Republic	90	10	0	0	Direct Municipal Service
Trinidad and Tobago	0	0	0	100	Delivered by the central government
Uruguay	96.2	3.8	0	0	Direct Municipal Service
Venezuela	66.1	22.1	2.5	9.4	Direct Municipal Service

Source: Based on IDB, AIDIS, PAHO (2011)

ANNEX 3.5

Costs of the management of solid waste per tonne or kilometer

Country	Sweeping (USD/km)	Collection (USD/Tonne)	Transfer (USD/Tonne)	Final disposal (USD/Tonne)	Total per unit (USD/Tonne)
Argentina	38.93	54.02	15.09	17.63	125.67
Belize	N/A	N/A	21	12.5	33.5
Bolivia	13.04	32.22	N/A	16.43	61.69
Brazil	26.44	46.2	N/A	31.48	104.12
Colombia	9.41	34.12	N/A	9.0	52.53
Costa Rica	N/A	22.65	N/A	18.81	41.46
Chile	31.68	23.34	4.63	11.43	71.08
Ecuador	N/A	30.05	N/A	5.61	35.66
El Salvador	N/A	30.42	N/A	21.02	51.44
Guatemala	9.94	10.84	N/A	N/A	20.78
Honduras	6.62	20.81	N/A	8.16	35.59
Mexico	1.8 – 25.5	6.8 – 139.9	N/A	1.1 – 39.4	9.7 – 204.8
Paraguay	4.92	6.59	N/A	5.88	17.39
Peru	26.35	15.02	N/A	5.98	47.35
Saint Lucia	N/A	10.72	N/A	23.27	33.99
Trinidad and Tobago	N/A	N/A	N/A	16.4	16.4
Uruguay	16.73	47.85	N/A	29	93.58

Source: BID-AIDIS-OPS (2011); Semarnat-INECC (2012)

ANNEX 3.6

Main revenue collection mechanisms

Country	Forms of revenue collection (% of population covered)					Prevailing mode
	Property tax	Electricity bill	Drinking water and sewers	Direct waste bill	Other	
Argentina	68.2	3.9	0	27.9	0	Property tax
Belize	100	0	0	0	0	Property tax
Bolivia	0	95.6	0	4.4	0	Electricity bill
Brazil	90.1	0	08.5	0.3	1.0	Property tax
Colombia	0	34.5	65.5	0	0	Drinking water and sewers
Costa Rica	31.8	0	0	68.2	0	Direct waste bill
Chile	58.6	0	0	41.4	0	Mixed - Property tax and Direct waste bill
Ecuador	7.1	75.9	16.3	0.8	0	Electricity bill
El Salvador	0	40.9	0	59.1	0	Mixed - Electricity bill and Direct waste bill
Guatemala	0	0	0	100	0	Direct waste bill
Guyana	N/A	N/A	N/A	N/A	N/A	No information
Honduras	62.6	0	10.5	26.9	0	Property tax
Jamaica	N/A	N/A	N/A	N/A	N/A	No information
Mexico	N/A	N/A	N/A	N/A	N/A	No information
Nicaragua	0	0	0	100	0	Direct waste bill
Panama	3	0	69.4	27.7	0	Drinking water and sewers
Paraguay	15.1	0	4.1	80.8	0	Direct waste bill
Peru	85.1	0	0.2	14.7	0	Property tax
Dominican Republic	0	0	8.8	91.2	0	Direct waste bill
Santa Lucía	0	0	0	0	0	None
Uruguay	100	0	0	0	0	Property tax
Venezuela	0	90.9	0	9.1	0	Electricity bill

Source: Based on IDB, AIDIS, PAHO (2011)

ANNEX 3.7

Amount of the average billing a house pays in different countries of the region

Country	Home billing amounts (US$/month)
Argentina	5,45
Bahamas	N/A
Barbados	N/A
Belize	N/A
Bolivia	1,56
Brazil	N/A
Colombia	5,74
Costa Rica	3,45
Cuba	N/A
Chile	8,65
Dominica	N/A
Ecuador	5,97
El Salvador	3,34
Granada	N/A
Guatemala	3,46
Guyana	N/A
Haiti	N/A
Honduras	1,97
Jamaica	N/A
Mexico	N/A
Nicaragua	2,72
Panama	4,88
Paraguay	3,44
Peru	2,14
Dominican Republic	N/A
Saint Kitts & Nevis	N/A
Saint Vincent & the Grenadines	N/A
Saint Lucia	0
Suriname	N/A
Trinidad & Tobago	N/A
Uruguay	N/A
Venezuela	1,34

Source: Based on BID-AIDIS-OPS (2011)

ANNEX 3.8

Benefits to society and the economy from sustainable waste management

No.	Category of benefit	Explanatory comments
1	**Broader benefits of a clean city**	Effective and environmentally sound waste management contributes to a clean city and a pleasant and healthy living environment, which is attractive to residents, tourists and visitors, as well as to businesses and inward investors.
2	**Social and political consensus and community cohesion**	Good waste management is a visible sign of good governance. When local authorities have failed to tackle waste management they often are not re-elected, but authorities that do tackle waste issues have a greater chance of being re-elected. An example of this took place in Comayagua, Honduras, which was the first municipal government in the country to close its open dumpsite to establish the first sanitary landfill in the country. This was promoted and implemented by the municipal administration, which was elected for the fifth time and had one of the most important waste management achievements attributed to it. Similarly, cities and communities that work together to segregate waste and reduce littering tend to also reduce crime, vandalism and social deprivation and enhance community cohesion. Good waste and resource management promotes a greater sense of community and security, of belonging and well-being.
3	**Business benefits of resource efficiency and waste prevention**	These have been quantified in a number of authoritative recent reports as in excess of 1 trillion dollars per annum worldwide. Waste prevention avoids end-of-pipe waste management costs, but also saves the much larger raw material, energy and labor costs that are embedded in wasted products.
4	**Public benefits of resource efficiency and waste prevention**	Lower waste generation and higher resource efficiency reduces the municipal cost (and therefore the per-citizen cost) of providing municipal waste management services. Reducing waste can save municipalities anywhere between 35 and 400 dollars per tonne of waste depending on where the prevention occurs and what sort of technologies would be used for handling waste.
5	**Increased resource security**	After a century of steady decline, resource prices in real terms doubled between 2000 and 2010. So despite continued price volatility, developing local supplies of raw materials from recycling makes good sense, particularly in rapidly industrializing countries. E-waste comprises a richer 'ore' for many scarce and critical metals than the natural ores mined for virgin raw materials.
6	**Green jobs**	Environmentally sound waste management, the recycling of dry materials, organic materials recycling, energy recovery from waste, and the development of the circular economy, all represent a new green industrial sector with the potential for substantial job creation.

Source: UNEP-ISWA (2015)

No.	Category of benefit	Explanatory comments
7	**Improved livelihoods and cleaner working conditions for the informal sector**	The transformation of a city's informal sector to a more formalized part of the mainstream waste and resource management system is a win-win situation. The recyclers can work under cleaner conditions, earn a better livelihood and educate their children. City recycling rates can potentially increase and in addition, the transition can facilitate environmental control, reducing littering and dumping of residual waste as well as bringing the 'informal' sector inside the legal and tax systems. The result can be more and better jobs, and a reduced burden on the city's already stretched waste management budget.
8	**Reduction in greenhouse gas (GHG) emissions from waste disposal**	The Intergovernmental Panel for Climate Change (IPCC) reported that in 2010 municipal solid waste (MSW) accounted for around 3% of total worldwide GHG emissions, mainly as methane from landfills. However, this is a significant underestimate of the potential of better waste management to mitigate GHG emissions.
9	**Reduction in GHG emissions from recycling and waste prevention**	Using a life cycle approach, it has been estimated that the global reduction of greenhouse gas emission could be achieved, improving the management of municipal solid waste, including landfill diversion, energy from waste and recycling. If the reduction of emissions associated with the reduction in the generation of waste is taken into account, this percentage may increase as a result of savings in the use of virgin raw materials and production of products in different sectors of the economy.
10	**Reducing food waste – improving food security**	The direct economic cost of food waste is estimated at 750 billion USD. It is estimated that more edible food is wasted than what is needed to feed all of the malnourished people in the world. It is convenient to analyse the possibility of generating bionutrients and reducing the demand for fertilizers, as a result of the valorization of foods that are not consumed.
11	**Reduction in air and water pollution by transfer of contaminants to solid waste for proper management**	The huge progress made over the last 50 years in cleaning up urban air and water pollution around the world has concentrated contaminants into and wastewater treatment sludge, which is now managed as solid waste. So environmentally sound waste management underpins clean air and clean water.
12	**Energy recovery by using waste to generate energy**	Energy is recovered through conventional and advanced energy-from-waste and anaerobic digestion. Energy recovered from the biogenic fraction of waste is considered to be renewable energy.

Waste Management Outlook for Latin America and the Caribbean

The Waste Management Outlook for Latin America and the Caribbean provides a regional overview of the main trends and challenges relating to waste management, thus serving as a guide for the design and implementation of policies and programs in the countries of the region. The document, which answers to the mandate of the Forum of Ministers of Environment of Latin America and the Caribbean, as well as the United Nations Environment Assembly, gathers the necessary elements to understand the current situation in the region, while also analyzing the models and trends in the governance and financing of waste management. To this end, information provided by the countries of the region was compiled and analyzed, including a set of case studies. This document includes a summary of the main findings and key messages of the report, for consideration of decision-makers.

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