

Solid Waste Management in the Caribbean

Proceedings from the Caribbean Solid Waste Conference

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Abstract

This publication looks into the Solid Waste Sector situation in nine Caribbean countries: The Bahamas, Barbados, Belize, Jamaica, Guyana, Haiti, Suriname, St Lucia and Trinidad and Tobago. These countries, which represent a population of approximately 17 million people distributed in less than 500,000 sq. km, face similar challenges in regard to solid waste management such as increasing solid waste generation, changes in waste characterization, lack of adequate disposal sites and low collection rates.

Adequate solid waste management is a particularly sensitive issue for the Caribbean countries, since their economies are mainly natural resource-based, with tourism, mining, agriculture and fisheries being the dominant sectors.

The Caribbean Solid Waste Conference (CSWC) carried out in Jamaica in September 2014 provided a unique opportunity to exchange experiences among these countries and to discuss recommendations on how to improve sector management. This publication provides a detailed overview of the institutional arrangements in these countries, describes the main challenges and recommendations for solid waste collection, treatment and disposal, and discusses topics such as the financial sustainability and the impact of climate change on the sector.



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Introduction

An adequate Solid Waste Management (SWM) is essential to protect the environment and the public health. In order to manage Solid Waste (SW) in a proper fashion adequate planning and funding coupled with clear-cut rules to define public and private stakeholders' roles are vital.

Those were some of the main recommendations made at the Caribbean Solid Waste Conference (CSWC) by government officials and specialists from nine countries who met in Jamaica in September 2014 to discuss what are the main challenges and what strategies can be used to ensure an adequate SWM in the region.

The Conference was organized by the Planning Institute of Jamaica (PIOJ) and the National Solid Waste Management Authority (NSWMA), with support from the Inter-American Development Bank (IDB).

The meeting allowed participants to share their experiences on SWM and provided a unique opportunity for discussion among public and private sector and international organisations experts about the main SWM issues faced by the Caribbean region. The participants' contributions and opinions are reflected along this document.

Analysing the complex interconnection between public health, preservation of the environment, budget constraints and social concerns, the Conference focused on:

- Examining approaches to SWM relevant to the changing dynamics of economic, social and environmental issues in the region.
- Providing guidance to stakeholders on the best practices in SWM suited for developing countries in the Caribbean, including management of special waste streams such as hazardous waste, medical waste, and e-waste.
- Establishing networks to facilitate dialogue among countries in the region and for sharing information and experiences.
- Examining the business potential of the sector, including waste to energy, recycling and other waste treatment options.

Representatives from nine countries of the Caribbean region participated in the conference: The Bahamas, Barbados, Belize, Jamaica, Guyana, Haiti, Suriname, St Lucia and Trinidad and Tobago.

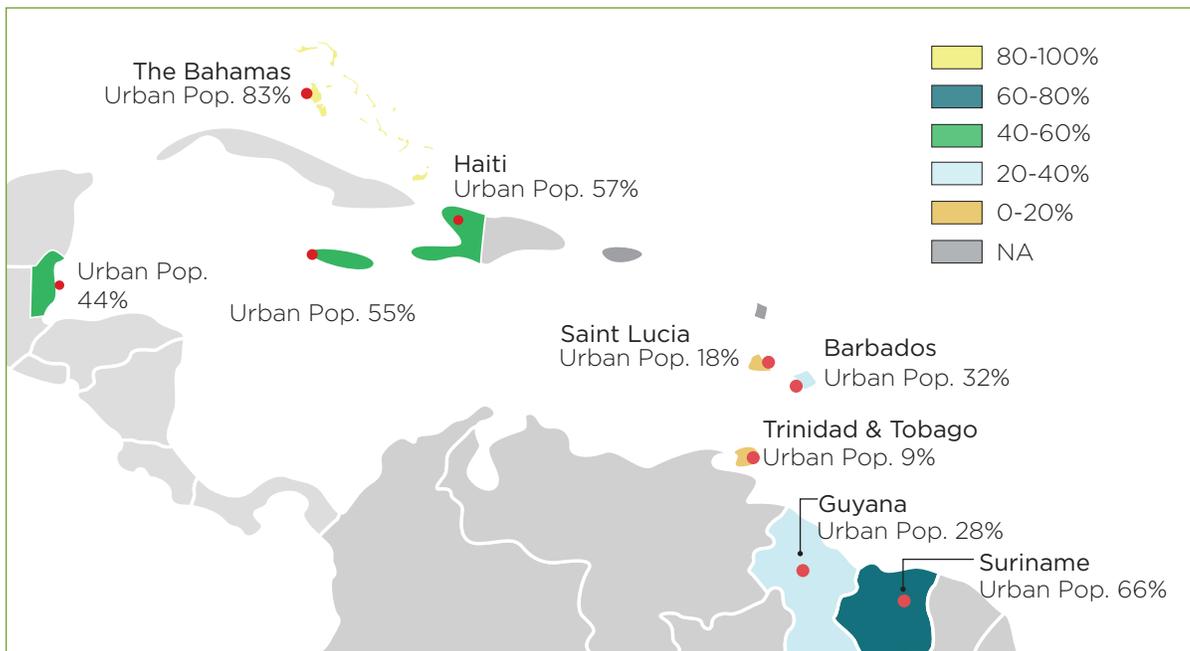
These nine countries represent a population of approximately 17 million people distributed in less than 500,000 sq. km. These countries have specific environmental, social and economic characteristics that are in many cases very different from the rest of Latin America. The most urbanized country in the Caribbean is the Bahamas, with 83 percent of its population living in urban areas, followed by Suriname, with 66 percent. But urban population is much lower in the other countries, going as low as 18 percent in

9 = 17 million people distributed in less than 500,000 sq. km.
countries of the Caribbean



St Lucia and 9 percent in Trinidad and Tobago. This contrasts with the reality of the rest of LAC, which is today the second most urbanized region in the world, with 80 percent of the population living in urban areas. (See Figure 1).

Figure 1:
Urban Population in Selected Countries of the Caribbean Region



Source: Own elaboration based on World Bank, 2015.

Even within countries in the Caribbean region, several differences are found. Table 1 shows that, according to the Atlas method, the Bahamas has a gross national income (GNI) per capita more than twice the average of the LAC region, whereas Guyana's GNI is less than half and impoverished Haiti's is less than 10 percent of the regional average. In terms of population, it is also worthy to highlight the differences within this region. Barbados, with nearly 300,000 inhabitants, has a population density that is more than 20 times higher than the density of the LAC region. The population density in Haiti -a country with more than 10 million people- is more than ten times the regional average. At the other end, Suriname's density is about one-tenth the LAC average, with only 3 people per square km, followed by Guyana, with 4 people per square km. Geographically, other differences also arise: some of these countries are one island-nations whereas the Bahamas has more than 700 islands in its territory.

Table 1:

Economic and Population Data from Selected Caribbean Countries by 2014

Country	Population	Surface area (sq. km)	Population density (people per sq. km of land area)	GNI per capita (Atlas method) current US\$	GNI per capita, PPP (current international US\$)
The Bahamas	383,054	13,880	38	20,980	22,290
Barbados	283,380	430	659	N/A	N/A
Belize	344,193	22,970	15	4,350	7,590
Guyana	761,033	214,970	4	3,940	6,940
Haiti	10,572,029	27,750	384	820	1,730
Jamaica	2,714,734	10,990	251	5,220	8,490
St Lucia	183,645	620	301	7,080	10,230
Suriname	533,450	163,820	3	9,470	16,130
T&T	1,348,240	5,130	263	15,550	26,080

N/A: Not Available

Sources: World Bank, 2015

Justification for an adequate SWM

Inadequate SWM can have negative impacts on public health and natural resources (air, land and water pollution), including impacts on marine environment. (BOX 1). A growing number of LAC governments are aware of these negative impacts and have included SWM policies in their national development strategies.

In the case of the Caribbean countries, SWM is particularly relevant since their economies are mainly natural resource-based, with tourism, mining, agriculture and fisheries being the dominant sectors¹.

1 ECLAC, United Nations, Studies and Perspectives series - The Caribbean - No. 22

Environmental impacts on public health and natural resources

Inadequate solid waste disposal can attract flies, mosquitoes and rats, which in turn, may encourage the spread of diarrhoeal diseases, as well as diseases like dengue fever, yellow fever and bubonic plague.

Some of the health risks related to the inadequate management of solid waste are linked to the cohabitation of scavengers which are attracted to garbage and humans. Some diseases transmitted between animals and human beings, such as cysticercoids, taeniasis, and trichinosis, are closely associated with swine; many times outbreaks can be traced to pigs that have eaten waste products from kitchens, restaurants, and slaughterhouses, as well as to other animals that have eaten from garbage dumps.

Air pollution due to smoke coming from fire in waste disposal areas can be a health hazard if the burning waste contains items such as plastics

or chemicals or other dangerous substances. Breathing difficulties, dermal infections and more severe symptoms can be developed due to this pollution. Indeed, studies from Argentina, Cuba, Paraguay, Uruguay and Colombia reveal that nearly half of the dioxin and furan emissions in LAC may be originating from the indiscriminate burning of household waste.

Inadequate solid waste disposal can contaminate the soil and aquifers, damaging agricultural production and affecting the flora and fauna. Even surface waters can thus be contaminated, resulting in the loss of sources of drinking water and recreation.

Marine litter affects sea animals and their ecosystems, but it can also be a risk for human health and safety and impact the economy of those areas depending on tourism.

Source: World Health Organization, 2011, IDB 2010 and UNEP 2009

Within this framework, the conference's objective was to identify the common SWM challenges faced by Caribbean countries and discuss strategies to help them implement effective programmes and policies.

The report unfolds in seven parts:

1. Legal and regulatory frameworks in the nine countries, followed by a discussion of recommendations made by the participants to overcome their main challenges.
2. Overview of the solid waste collection and disposal mechanisms used throughout the region.
3. Waste treatment (composting, recycling and Waste to Energy) options.
4. Challenges and recommendations about waste composition, including the issues related to hazardous waste management.
5. Discussion around the issue of financial sustainability.
6. Contributions and challenges that climate change will bring to the sector.
7. Conclusions and recommendations.

1 Institutional arrangements

The institutional arrangements in the Caribbean countries are heterogeneous. Each country has a different set of actors involved as well as different legal and regulatory frameworks for SWM. Few Caribbean nations have a comprehensive national solid waste management framework that includes all main challenges of SWM, i.e.

- (i) Definition of entities/authorities in charge of SWM and a clear definition of roles between the policy developer, the regulator and the operator(s).
- (ii) Clear targets for all WM phases (minimization of solid waste at source, composting, recycling, reuse, other waste treatment, collection, disposal).
- (iii) Definition of regulations and standards for all waste treatment processes, collection and disposal per waste type.
- (iv) Designation or creation of enforcement entity and appropriate penalty for offenders.

- (v) Definition of funding mechanism for all entities involved in the SWM.

The establishment of policies for the sector is a national responsibility and, contrary to what is seen in most Latin American countries, where WM is usually in hands of the municipality, the management of solid waste (collection, transport, treatment and disposal) in the Caribbean countries is a national government responsibility in almost all countries - with exception of **Trinidad and Tobago, Belize, Guyana and Haiti**. In these countries the legislation does stipulate that the responsibility for collection and disposal stays with the Municipality. Four countries in the region (**Belize, Jamaica, St Lucia, and Trinidad and Tobago**) have created an entity responsible for SW collection and disposal.

In **Jamaica** the legal framework of SWM is composed of the National Solid Waste Management Policy and the National Solid Waste Management Act, along with the Public Cleansing Regulations, the Public Health Act of the Ministry of Health and the Trade Act, which regulates the scrap metal industry (recycling initiatives).

The Ministry of Local Government and Community Development (MLGCD) has portfolio responsibility for the formulation of SWM policy in this country.

In 2001 the National Solid Waste Management Act led to the establishment of the NSWMA. This entity is responsible for collection, transport and disposal of waste island-wide and simultaneously acts as regulator of the sector. The NSWMA is led by a Board of Directors appointed by the MLGCD.

In **Trinidad and Tobago**, waste management is governed by the provisions under the Litter Act of 1973 and the Public Health Act of 1950 and their accompanying regulations. Additionally, the National Environmental Policy (NEP) of 2006 aimed at providing a comprehensive framework for environmental management issues, including those related to hazardous and non-hazardous waste management. The National Integrated Waste Management Policy (NISWMP) of 2014 establishes the plan for managing the country's waste in accordance with a hierarchy that minimizes land-filling, with an increased focus on reduction of toxicity and volume of waste, through reuse, recycling and source-separated organic waste management. (Government of the Republic of Trinidad and Tobago, 2015.)

Additionally, the Trinidad and Tobago Municipal Corporation Act (1990) establishes that the domestic solid waste disposal is the responsibility of the municipality. In 1980 the Solid Waste Management Company Limited (SWMCOL), a state-run limited liability company, was created with the purpose of managing, collecting, treating and disposing of all wastes. This company operates under the administrative authority of the Ministry of Local Government. In Tobago, the Tobago House of Assembly (THA), through the Local Health Authority, is responsible for the collection and disposal of solid waste. (Government of the Republic of Trinidad and Tobago, 2015).

In **Belize**, the legal and regulatory framework for SWM is composed of the Solid Waste Management Authority Act of 1991, the Town Councils Act, the Returnable Containers Act of 2009 and the Environmental Protection Act. The Government of Belize has already drafted a National Solid Waste Management Policy.

The Ministry of Natural Resources and Immigration (MNRI) has the responsibility of the SW national policies and legislation. The Belize Solid Waste Management Authority (BSWaMa) is a statutory body, which was formally established through the enactment of the Solid Waste Management Authority Act in 1991 to ensure that solid waste generated in the country is managed in an environmentally sound manner (Belize Solid Waste Management Authority, 2015). However, according to the Town Councils Act, the Council (city council or town council) has the responsibility to “coordinate, control, manage or regulate the timely and efficient collection and removal of all garbage material from all residential or commercial areas in its town” (Government of Belize, 2015).

In **the Bahamas**, the legal framework is composed of the Environmental Health Services Act and the Environmental Health Services Collection and Disposal of Waste Regulations (2004). The Bahamas Department of Environmental Health Services (DEHS) of the Ministry of the Environment and Housing has the regulatory oversight for SWM. The DEHS is responsible for collection and disposal of garbage in New Providence. In Freeport, as a result of the Hawksbill Creek Agreement signed with the Government in 1955, there are specific regulations for SWM.

Suriname has neither a solid waste management policy nor plan. The current legislation is composed of the Police Criminal Code (1915) and the Nuisance Act (1929), but these laws are outdated and the government does not enforce them.

Specific laws and regulations on waste discharge, collection, storage, transport, recycling and disposal are lacking. (Republic of Suriname, 2013; De Nationale Assemblée, 2015). Since 2012, two policies are being discussed: the Waste Act (*afvalstoffenraamwet*) and the Environment Act (*milieuraamwet*), which will provide a sector framework for SWM. (MOW, 2015).

The Ministry of Public Works, through its Department of Waste Collection and Disposal (VOV for its acronym in Surinamese) is responsible for collecting in Greater Paramaribo, Wanika and parts of other districts, whereas the Ministry of Regional Development has the responsibility for the collection in other areas of the country.

In **Guyana**, the Environmental Protection Act of 1996, The Public Health Ordinance of 1953, and the Municipal and District Councils Act of 1970, along with the Litter Regulation (2012), establish the framework for SWM in the country. The Environmental Protection Act provides enforcement mechanisms for environmental protection, including littering, collection and disposal of solid waste. (IDB, 2006). A Solid Waste Management Bill has been drafted and awaits to be discussed in Parliament.

The Ministry of Communities is responsible for formulating the national policy on solid waste management, whereas the regulation is mainly carried out by the Environmental Protection Agency - Guyana (EPA-Guyana. (IDB, 2006).

According to the Municipal and District Councils Act, each Council has the responsibility for solid waste collection and disposal.

In **Haiti**, there is no national waste management plan or laws. The legal and regulatory framework is composed of (i) The Reglements Sanitaires of 1919; (ii) the Decree of March 3rd 1981, which defines a framework for SWM and creates the Metropolitan Solid Waste Collection Services (SMCRS); (iii) the Arrêté Présidentiel du 1983, which defines the Truitier disposal site; and (iv) the decree of April 21st 1983, which delineates the influential area of the SMCRS.

Title III of the Decree of March 3rd 1981 establishes that the municipalities -or special organisations- are the entities responsible for waste management (collection, transport, sort and treatment and disposal) in the country. On the other hand, the decree of 1981 which creates SMCRS allows this entity to take over the responsibilities of the municipalities. Since its creation SMCRS has been responsible for collection and disposal in the metropolitan area of Port-au-Prince.

Two ministries coordinate the activities of SMCRS. The *Ministère des Travaux Publics, Transports et Communications* (MTPTC) and the *Ministère de l'Intérieur et des Collectivités territoriales*. (IDB, 2012).

In **Barbados**, the legal and regulatory SW framework is composed of: The Returnable Containers Act of 1986 and Health Services Act, the Sanitary Service Act, and the Municipal Solid Waste Tax Bill of 2014.

Often solid waste management has to compete with other pressing economic and social issues, such as fiscal and trade matters, poverty and unemployment, education and health.

The Ministry of Environment and Drainage (MED) is responsible for legislation and policy development in Barbados. The Environmental Protection Department (EPD) of the Ministry of Energy and the Environment is the primary environmental monitoring and pollution control agency.

The Sanitation Service Authority (SSA) is responsible for the street sweeping, collection, transportation and disposal of all household municipal solid waste as well as the operation of the disposal site on Barbados. The SSA is a semi-government organisation owned by the Ministry of Environment and Drainage (MED).

The Environmental Health Department (EHD) is one of 4 main public sector agencies with responsibility for SWM issues and is part of the Ministry of Health. EHD is specifically responsible for the enforcement of guidelines and regulations as it relates primarily to public health and safety. EHD also visits and inspects the landfills regularly regarding any health issues.

In **St Lucia**, the waste Management Act of 2004, which establishes the Solid Waste Authority, the Environmental Levy Order 1996, which establishes a charge to be levied by SLSWMA and to be paid by every visitor to St Lucia, and the Management of Containers Bill, which is designed to reduce littering and the amount of space occupied by plastics in landfills, are the main legal instruments that set the legal and regulatory framework in the country. (Minister for the Public Service, Sustainable Development, Energy Science & Technology, 2015; Saint

Lucia Solid Waste Management Authority, 2015).

The Saint Lucia Solid Waste Management Authority (SLSWMA) was established in 1996 under Act No. 20 of 1996 (repealed and replaced by the Waste Management Act No. 8 of 2004). The SLSWMA is responsible for coordinating and integrating systems for the collection, treatment and disposal of the island's solid waste. The SLSWMA is administered by an eleven-member Board of Directors. The Permanent Secretary, Ministry of Sustainable Development, Science and Technology is the Chairperson.

The Environmental Health Department within the Ministry of Health, Wellness, Human Services and Gender Relations is responsible for monitoring and regulating the disposal of solid waste. (PAHO, 2007).

1.1 Challenges for the Region

Throughout the Caribbean region, solid waste management is not a well-recognized public policy issue, although its relevance to the economic and environmental spheres can be clearly perceived. Often solid waste management has to compete with other pressing economic and social issues, such as fiscal and trade matters, poverty and unemployment, education and health, and many times it does not received the required priority in the political agenda.

Institutional Arrangement

An effective SWM institutional arrangement requires (i) a clear definition of entities involved in SWM and their respective roles as well as (ii) a clear set of laws and regulation that clearly define how effective and sustainable SWM services - both in technical and financial terms- are to be provided.

Although there are important differences between the countries assessed, it is possible to argue that in general, in the Caribbean countries there is still room for improvement on both aspects. In only a few countries a comprehensive national SWM legal and regulatory framework has been established and in many cases, policies and regulations in place are obsolete and require updating in order to reflect the current status of the country and the sector.

In many cases, several institutions are involved in SWM activities, without a clear definition of their roles, hindering coordination among stakeholders in detriment of the sector efficiency. In other cases, there is no clear definition of the entity responsible for policy development, regulation or enforcement. Collection and disposal activities are in some cases carried out by the regulator, which can create a loss of efficacy on the performance of the SWM services.

In the case of **Haiti**, *Dr. Claudel Noel, Head of the Department of Environment and Territorial Planning at the Henry Christophe Campus of Limonade, State University of Haiti*, called for new SWM rules and policies at all levels. He also proposed that a National Solid Waste Management Agency be created to set the national standards for an integrated and comprehensive SWM system in the country, and in particular in the Port-au-Prince Metropolitan Area.

Participants agreed that national governments need to ensure that SWM policies are integrated into national policies and given the priority they require in order to ensure sectoral sustainability.

Solid Waste Treatment Policies

Solid waste management policies should possess a comprehensive vision, with focus on preventive environmental and sanitation measures that aim to minimize waste in quantitative and qualitative terms, i.e., less waste generation and decreased environmental and health risks. (IDB, 2010). In the region, however, presently more emphasis is placed on solid waste collection and less on composting, recycling and proper disposal. Participants stressed the need to include separation at source as a clear SWM goal. Separation at source is crucial to promote reuse and recycling and thus to minimize solid waste going to the final disposal sites.

Regulation and Concession Contracts

In several countries there is a need for defining and/or updating regulation that fosters the recycling sector and provides the definition for tipping fees and licence fees in contracts.

Enforcement Capacity

Penalties, in coordination with an effective enforcement, are essential for ensuring an adequate SWM. On one hand, penalties should be used for monitoring compliance with standards for collection, treatment and disposal of solid waste but it also can play a vital role on discouraging littering and illegal dumping.

To do so, a clear legal and regulatory framework is necessary that not only sets the rights and obligations of each stakeholder, but also defines remedial actions for each subsector. The legal and regulatory framework must clearly define which authority will enforce the legislation, and

what actions are to be taken in case of offense with the appropriate funding mechanisms for those activities.

Enforcement is particularly challenging in small or dispersed communities and therefore those countries with higher rural population proportion or with many islands in their territory have an additional challenge. It was agreed that in the Caribbean countries it is necessary to strengthen the enforcement capacity.

In **Jamaica**, for instance, through the Fixed Penalty Notice (Litter Ticket), the NSWMA has the power to ticket and charge offenders with fines as high as 10,000 Jamaican dollars per violation. (NSWMA, 2015).

Financial Sustainability

The legal and regulatory framework needs to clearly define a sustainable mechanism allowing for continued funding and proper accountability of SWM core functions, meaning (i) collection, (ii) waste treatment, (iii) disposal, (iv) public awareness, and (v) monitoring and enforcement.

For instance, in the case of **Jamaica**, Ms Jennifer Edwards, Executive Director of the NSWMA, indicated that the establishment of the NSWMA and the subsequent removal of solid waste management functions from the municipalities created tension between local authorities and the NSWMA. Prior to the removal of these functions local authorities were able to determine how funds collected from property taxes (which in part fund SWM) were spent. With the change, there was uncertainty in establishing how much was made available to the local authorities for day-to-day operations.

1.2 Recommendations

Experts agreed on the importance to establish an effective institutional SWM framework to ensure that the policy objectives for the sector are achieved, meaning protecting public health and avoiding environmental pollution.

To do so, it is crucial to establish an institutional structure that clearly defines the entities involved in SMW and the roles and responsibilities of the various stakeholders (the government, the private sector and the civil society). Participants agreed that this structure should consider:

- Separation of the policy and operational levels.
- Separation of enforcement and regulatory functions from operations.
- Clarification of roles and responsibilities of central government vs. municipalities in order to minimise conflicts and overlaps.

In order to establish a workable institutional structure for SWM, it is crucial to establish a legal and regulatory framework through the promulgation or updating of the required acts, regulations and guidelines.

To achieve sectoral transformation, participants concurred that each country needs to identify a “champion” to drive the SWM agenda. Without this focused effort, this agenda often does not get the attention it deserves, especially since it impacts on all facets of development. Lastly, it is crucial to take into account that sector transformations need funds and planning.

2 Waste Collection & Disposal

2.1 Waste Collection

Solid waste collection models in the Caribbean countries range from fully public services to fully private services operating under public sector contract. (See Table 2). When the public sector takes full responsibility for collection, the investment and operations costs (fleet maintenance, fuel, etc.) are funded by the public sector either through the municipality or the national budget. In public-private mix models, the public entity in charge of collection contracts a private company that provides collection services additionally to the services provided by the public fleet. In fully private arrangements, the public sector fully outsources the services to a private player through a contract agreement.

In their presentations, participants provided a better understanding about how the region provides collection services.

In **Trinidad and Tobago** collection services are mainly provided by the private sector under contract with municipalities.

In **Belize**, the BSWaMA is not directly involved in waste collection. The SWM Project² beneficiary municipalities or the contractors to the municipalities are responsible for solid waste collection and transport to Transfer Stations. (BSWaMA, 2015).

In other countries such as **Jamaica, Haiti and Suriname** collection is conducted directly by government agencies with the support - to different degrees - of private contractors.

2 The Belize Solid Waste Management Authority (BSWaMA) along with the Ministry of Natural Resources and Agriculture are the Executing Agencies for the Solid Waste Management Project (SWMP). The objectives of the SWMP are to improve solid waste management practices in four municipalities of the Western Corridor (San Pedro Ambergris Caye, Caye Caulker, Belize City and San Ignacio/Santa Elena) that will support the goals of environmental protection, natural resource conservation, and protection of public health and safety. Source: <http://belizeswama.com/about/what-we-do/>

In the **Bahamas**, waste collection is conducted through direct government services or through government contracted services, with the exception of Freeport, which is allowed to provide its own collection and disposal, as a result of the Hawksbill Creek Agreement signed with the Government in 1955.

In **Barbados**, the SSA has the responsibility of collection island-wide and carries out the household waste collection as well as some commercial waste.

In **Guyana**, each Council has the responsibility for solid waste collection. The Georgetown Municipality's Solid Waste Department is in charge of collection in Georgetown and Neighbourhood Democratic Councils (NDC), with support of government contracted services. (Mayor and City Councillors of the City of Georgetown, 2011).

In **St Lucia**, the SLSWMA is responsible for the collection of solid waste from households and government establishments, e.g. schools, hospitals, health centres, prisons, government offices. Throughout the island, collection takes place at least twice a week using private contractors hired by the SLSWMA. In addition, a monthly bulky waste collection service is provided to every community. (SLSWMA, 2015).

Table 2:

Overview of Waste Collection Arrangement

Country	Waste Collection Arrangement/Responsibilities
The Bahamas	Direct central government services (DEHS) and government contracted services
Barbados	Direct central government services (SSA)
Belize	Municipalities or the contractors to the municipalities
Guyana	Municipality Department (Georgetown) fleet and government contracted services
Haiti	Municipal Entity (SMCRS in Port-au-Prince) and private contractors
Jamaica	Direct central government services (NSWMA) plus government contracted services
St Lucia	Central Government Entity (SLSWMA) through private contracted services
Suriname	Direct Municipal services (VOV) plus government contracted services
T&T	Municipalities outsource the collection services to private contractors

Source: Own elaboration

2.2 Waste Disposal

Adequate final disposal continues to be one of the most difficult SWM problems for the LAC region, with only 54 percent of the area's solid waste disposed in sanitary landfills (IDB, 2010). (BOX 2).

In the Caribbean countries SW adequate final disposal is also a major challenge: only a few Caribbean nations dispose their SW in sanitary landfills, and in many cases open air dumpsites -which generate serious environmental problems- are still the prevailing mechanism. In many Caribbean states, the final disposal sites are being managed by a public entity. In a few cases, such as Trinidad and Tobago and the Bahamas, private sector participation has been observed. (Table 6). In general, information regarding operational indicators of the final disposal sites is limited, which means that few countries have consistent data about the quantity and type of solid waste being disposed of.

Waste Disposal

A “Sanitary Landfill” (SL) is understood to mean the spacing, placement, and compacting of waste on an impermeable bed and its daily covering with a layer of earth or another inert material in order to control the proliferation of vectors, gas emissions and leaching so as to avoid environmental contamination and protect people’s health. A SL is the product of an engineering project, with controlled access, weighing, and no informal recyclers on site.

The term “Controlled Dumpsite” has begun to be used assiduously over the past ten years to refer to open air dumps that are controlled to some extent or to sanitary landfills that have been gradually abandoned over the years.

“Open Air Dumpsites” refer to sites where waste is dumped indiscriminately, without any care or treatment. Open air dumpsites represent one of the most highly contaminating SWM practices; they are detrimental to both the environment and public health.

Other inadequate and highly contaminating practices of SW final disposal in LAC include open air burning disposal in bodies of water (covering 1.8 percent of the LAC population), and disposal as animal feed and other practices that are not recommended.

Source: IDB 2010.



Final disposal site in the Caribbean (©Ilanthe Smith)

In **Jamaica**, the NSWMA operates eight disposal sites, none of which are designed to be sanitary landfills. It is estimated that the Riverton City disposal site, the largest in the country, receives about 60 percent of the solid waste generated, which is about 2,406 tons per day. (PIOJ, 2007).

Table 3:

Active Disposal Sites, Jamaica. 2006

Name	Disposal Site	Size (hectares)
Riverton	St Catherine	43.50
Church Corner	St Thomas	1.21
Martin's Hill	Manchester	7.82
Myersville	St. Elizabeth	3.70
Retirement	St. James	10.96
Tobolski	St. Ann	4.94
Hadden	St. Ann	3.88
Doctors Wood	Portland	n/a

Source: PIOJ, 2007

In **the Bahamas**, there are nine disposal areas and only two of them are sanitary landfills (New Providence and Abaco). Since mid-2014, the New Providence landfill has been managed by a private company. In Grand Bahama, the only existing sanitary landfill is owned by the Grand Bahama Port Authority (GBPA).

Table 4:

Disposal Sites, The Bahamas

Island	Type of Disposal
Grand Cay	D
Abaco	SL
Grand Bahama	SL
Bimini	NSL
Exuma	NSL
San Salvador	NSL
Andros	NSL
Eleuthera	NSL
The Harrold Road sanitary landfill (New Providence)	SL

*SL: Sanitary landfills

*NSL: Non Sanitary Landfills

*D: Dumpsite

Source: Adapted from Ms Thomasina Wilson presentation to the Caribbean Solid Waste Conference

In Trinidad and Tobago none of the landfills is operated as a sanitary landfill.

In **Trinidad and Tobago** the three major waste disposal sites are managed by SWMCOL: Beetham Landfill, Forres Park Landfill and Guanapo Landfill. They collectively receive approximately 2,000 tons of Municipal Solid Waste (MSW) per day. The much smaller Guapo Landfill in Point Fortin is managed by a private contractor on behalf of the Point Fortin Borough Corporation. In Tobago, the Studley Park Landfill is managed by the Tobago House of Assembly. None of the landfills in Trinidad and Tobago is operated as a sanitary landfill.

Table 5:

Disposal Sites, Trinidad and Tobago

Island	Size (Ha)	Management by
Beetham Landfill	61	SWCOL
Forres Park Landfill	8	SWCOL
Guanapo Landfill	7	SWCOL
Point Fortin	-	Private Contractor
Guapo	-	Private Contractor
Studley Park Integrated Facility	0.5	THA

Source: Adapted from Government of the Republic of Trinidad and Tobago, 2015

In **Belize** there is one sanitary landfill in the country, which is managed by BSWaMA. This SL is the final disposal location for waste originating from municipalities in the Western Corridor (Belize City, San Ignacio/ Santa Elena – Benque Viejo, San Pedro Ambergris Caye and Caye Caulker). (BSWaMA, 2015). Estimates indicate that this landfill receives 73 tons of MSW a day, and covers an area of almost 150 hectares.

In **Guyana**, a sanitary landfill was built with support of the IDB, the Haags Bosch Landfill. This facility, which was managed by a private contractor until the end of 2015 on behalf of the Ministry of Communities, is currently receiving 300 tons of solid waste daily from the Capital City Georgetown and 15 Neighbourhood Democratic Councils (NDC). The site is now operated by the Ministry.

Barbados established its first national sanitary engineered landfill in 1991: Mangrove. Today this site has four phases, all of them operated by the SSA, and receives between 300-400 tons daily.

In **Suriname**, Ornamibo, an open air dumpsite, is the main disposal site in the Great Paramaribo area. The VOV has the responsibility of managing the Ornamibo Landfill (De Nationale Assemblée van de Republiek Suriname, 2014), which has a total area of 4 hectares. (Republiek Suriname, 2012).

In **Haiti**, the main landfill is an open air dumpsite that is located at Truitier and is managed by SMCRS. It is estimated that the Truitier site receives 1,000 tons daily (IDB, 2012) in an area of 160 hectares.

In **St Lucia**, waste disposal has made significant strides within the last 18 years. The island has moved from open dumps with little environmental controls, to controlled disposal sites, and then to sanitary landfills with complex containment/controlled systems, environmental monitoring, improved operational practices, and improved regulation. The SLSWMA operates two solid waste management facilities, namely Deglos Sanitary Landfill, which serves the north of the island, and the Vieux-Fort Solid Waste Management Facility, which serves the south of the island. (SLSWMA, 2015).

The Deglos Sanitary Landfill, which opened in March 2003, was designed to receive waste for a 25-year period. This sanitary landfill occupies approximately 9.5 hectares and receives an average of 4,000 tons/month. This facility is composed of (i) a site service area (scale house, maintenance building and wheel wash); (ii) a leachate collection area; (iii) a leachate treatment system; (iv) a recycle

area; (v) a hazardous health care waste treatment facility; and (vi) a surface water management area.

The Vieux-Fort Solid Waste Management Facility covers 7.4 hectares. This site does not have a leachate collection and management system. (SLSWMA, 2015).

As part of the landfill operation, all information is recorded, such as the type, origin and amount of waste. This data has assisted the Saint Lucia Solid Waste Management Authority in (i) waste management analysis and planning; (ii) determining effectiveness/progress of waste reduction programmes; (iii) monitoring the performance of its waste collection contractors; and (iv) tracking changes in waste generation for various localities.

Table 6 presents an overview of the sub-sector in the Caribbean countries, most of which rely on public sector involvement for SW disposal management.

4 mil receives The Deglos Sanitary Landfill. It occupies approximately 9.5 hectares

tons/month

Table 6:

Overview of Disposal Mechanisms

Country	Waste Disposal Management	Waste Disposal Mechanism	Waste Disposal Quantities
	(Who manages the disposal sites?)	(How is waste being disposed?)	
Jamaica	Public entity (NSWMA)	NSWMA operates 8 disposal sites. None of these are sanitary landfills	2,406 tons daily (Riverton only)
T&T	Public entities (SWMCOL); private contractors and THA	6 Disposal sites. None of these are sanitary landfills	2,000 tons daily
The Bahamas	Not available	9 Disposal sites: <ul style="list-style-type: none"> • 3 Sanitary landfills (New Providence, Abaco and Grand Bahama) • 5 Non sanitary landfills • 1 Open dumpsite 	No data
Suriname	Public department (VOV)	Open dumpsite	No data
Haiti	Public entity (SMCRS)	Open dumpsite (Port-au Prince)	1,000 tons daily
Belize	Public entity (BSWaMA)	1 Sanitary landfill	73 tons daily
Barbados	Public entity (SSA)	One sanitary landfill located at Mangrove	300-400 tons daily
Guyana	Private Contractor on behalf of Ministry of Communities	One sanitary landfill (Haags Bosch)	300 tons daily
St Lucia	Public entity (SLSWMA)	2 disposal sites: <ul style="list-style-type: none"> • 1 sanitary landfill • 1 controlled dumpsite 	130 tons daily (Deglos only)

Source: Own elaboration

2.3 Challenges for the Region

Two of the main challenges in the region are (i) increase waste collection rate and (ii) improve existing disposal mechanism to minimize environmental and public health hazards.

Whereas in **Belize and Barbados** high collection rates of 85 percent (IDB, 2010) and 90 percent, are declared respectively (IDB, 2015), in the other countries there is still room for improvement in order to increase the solid waste collection rate. According to *Mr Jean Donald Paraison, General Director of Service Metropolitain de Collecte des Residus Solides*, in Port-au-Prince 25 percent of the waste is uncollected. *Mr Colin Bullock, PIOJ Director General* indicated that in **Jamaica** 30 percent of domestic waste is not collected.

Ms Esther Richards, consultant and former member of the Secretariat of the Pacific Regional Environment Programme, discussed that rural or remote islands often have low or no collection of waste, which results in the practice of open dumping. *Mr Colin Bullock* outlined urban-rural challenges in Jamaica, where approximately 90 percent of solid waste is collected in urban centres compared to 50 percent in rural areas. This is consistent with the challenges pointed out by *Ms Magda Correal, Consultant at MAG CONSULTORIA S.A.S.* in regard to the need to improve quality solutions for smaller municipalities in Colombia.

Finding an adequate solid waste disposal mechanism is a challenge for most countries in the region, participants agreed. In many countries there are no sanitary landfills and in some cases, waste too often is disposed of in open air dumpsites. *Ms Thomasina Wilson, Sr. Deputy Director Department of Environment Health Services, Ministry of Environment and Housing*, pointed out that a common issue in Caribbean countries is the scarcity of land, which is an additional challenge for finding and implementing a waste disposal site.

Participants emphasized the need to improve landfill technologies and eliminate illegal dumpsites. These challenges are shared by other countries in LAC, such as Colombia, where, as *Ms Magda Correal* pointed out, there are still challenges related to the improvement of landfill technologies and the elimination of illegal dumpsites. However, the transition from dumpsites to fully functional engineered sanitary landfills may take many years, as seen in the case of Belize and St Lucia.

During the conference, a site visit to the municipal disposal site outside of the City of Montego Bay was organized. During this visit, participants had the opportunity to discuss the challenges faced by this landfill, which are recurrent in inadequate landfills:

- Informal recyclers sometimes get in conflict with the heavy duty equipment that is moving the waste around at the site. Some of the informal recyclers live on the site.

The traditional engineering methods applied to collection, transportation, treatment and disposal of solid waste can be and should be adapted to the specific situations within the region such as terrain, hydrogeology, geology and the archipelagic nature of some countries.

- Fires that burn for many weeks, disrupting disposal operations and causing air pollution problems.
- Lack of sufficient cover material for the waste.
- Lack of sufficient equipment to manage the waste.

It was also highlighted that proper disposal sites require a significant investment, initially for the construction phase but also continuously during operation. In order to ensure proper operation, it is necessary to ensure access to adequate resources in a timely manner and at affordable prices. *Ms Milagros Mosteirín, Economist from Argentina* concurred with the fact that insufficient technical resources are a challenge for SWM, and mentioned two in particular: (i) absence of SWM software tools, and (ii) insufficient SWM technical staff.

Ms Esther Richards stressed that small and sparse populations limit the potential economies of scale for disposal and collection. In the same vein, *Ms Thomasina Wilson* stressed that in **the Bahamas**, due to its archipelago configuration, it is not economically feasible to build a sanitary landfill on each island.

Ms Dalsan, Operations and Landfill Manager, St Lucia Solid Waste Management Authority indicated that in **St Lucia** one of the challenges is frequent equipment breakdown due to the aged fleet of equipment and the lack of financial resources to replace it. She also discussed how frequent wet weather conditions make operation at the tipping face difficult.

2.4 Recommendations

Rapid growth of solid waste generation is a challenge for all countries in the Caribbean region. This growth impacts collection and disposal activities, generating the need for more collection capacity, meaning new infrastructure, and additional human and financial resources. Under this scenario, it is relevant to consider complementary strategies that include a scheme of incentives and disincentives to promote waste reduction, e.g. actions that encourage imported items with less packaging and less hazardous components (life cycle approach).

The traditional engineering methods applied to collection, transportation, treatment and disposal of solid waste can be and should be adapted to the specific situations within the region such as terrain, hydrogeology, geology and the archipelagic nature of some countries.

Some operational recommendations for collection activities were discussed. For instance, in the case of communities which are difficult to access, the recommendation of participants are (i) to establish mini-transfer stations with storage capacity of recyclables with limited collection frequency; and (ii) to use customised vehicles to traverse narrow, hilly and winding terrain.

The use of transfer stations was also advocated, since they often offer significant economic benefits related to the costs of operations, collection and transportation. It was also agreed that when establishing new landfills it is necessary to include a plan to formalize informal recyclers.

Attracting and retaining qualified personnel for SWM by offering competitive remuneration packages can contribute to reduce personnel turn-over and to ensure the sector's sustainability. It is necessary to ensure that material and human resources are properly planned to avoid disruption on collection and disposal activities. (Preventive and corrective fleet maintenance to reduce fleet downtime; road maintenance in disposal sites; cover material for disposal sites, etc.)

3 Waste Characteristics

3.1 Waste Composition & Quantity

There is evidence of a close connection between Urban Solid Waste (USW) generation (BOX 3) and economic and human development (Figure 2).

BOX 3

Waste Disposal

Municipal or Urban Solid Waste: Solid or semi-solid waste produced through the general activities of a population centre. Includes waste from households, commercial businesses, services, and institutions, as well as common (non-hazardous) hospital waste,

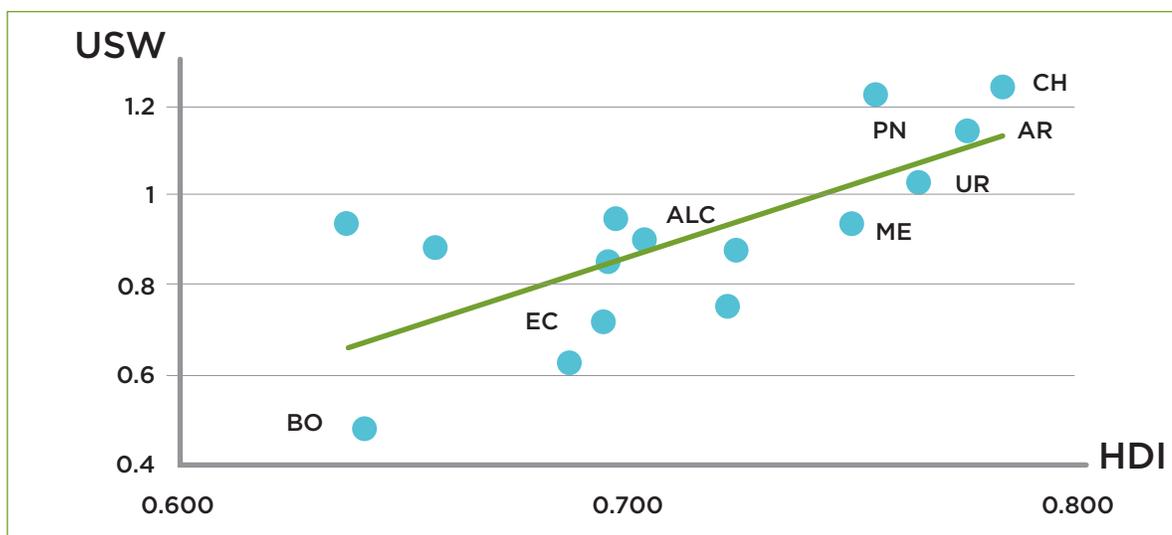
waste from industrial offices, waste collected through street sweeping, and the trimmings of plants and trees along streets and in plazas and public green spaces.

Source: IDB, 2010.



Urbanization is a relevant variable in the SW generation equation: world-wide, urban residents produce about twice as much waste as their rural counterparts. (World Bank, 2012). With growing economic development and urbanization, waste generation will continue to rise.

An increase on waste quantity generation poses a challenge to the existing collection and disposal services: the more waste is generated (quantitative and qualitative) the more resources are needed (investment in waste treatment, collection and/or disposal infrastructure) to manage SW properly.

Figure 2:**Relationship of Human Development Indicator to Per Capita USW Generation in LAC**

Source: IDB, 2010

Waste composition also varies from country to country. In the case of LAC countries, it is completely different from that of developed countries; the water content of the solid waste is nearly 50 percent, which permeates some recyclables like cardboard and paper, reducing the recycling possibilities of those materials. (IDB, 2010). (BOX 4).

The Caribbean countries face both challenges: an increasing amount of solid waste generation and changes in its composition.

In **Jamaica**, between 2000 and 2006, organic waste generation increased by 14 percentage points. (PIOJ, 2007). In this country, paper and plastic account for 25 percent of the total waste generated annually. (National Solid Waste Management Authority, 2013).

In **Barbados**, the volume of waste rose fivefold in ten years, going from 200 tons/day in 1994 to over 1,000 tons/day in 2005. According to *Mr Ricardo Marshall, Project Manager, Project Management Coordination Unit, Ministry of Environment and Drainage in Barbados*, between 1994 and 2005 the plastic component almost doubled (9 percent to 16 percent). Organics make up only 30 percent of waste.

In **Trinidad and Tobago**, it was estimated that 700,000 tons of solid waste reached the landfill in a year. However, 84 percent of the items collected are considered recyclable and could be diverted from the landfills.

In **Haiti**, organic waste represents 70 percent of the waste (IDB, 2013), whereas in **Suriname**, 40 percent of household solid waste is organic.

Waste Composition

Solid waste composition is influenced by many factors, such as level of economic development, cultural norms, geographical location, energy sources, and climate. As countries urbanize and populations become wealthier, consumption of inorganic materials increases, while the relative organic fraction decreases. Generally, low- and middle-income countries have a high percentage of organic matter in the urban waste stream, ranging from 40 to 85 percent of the total. Paper, plastic, glass, and metal elements increase in the waste stream of middle- and high-income countries.

Table 7:

Type of Waste and Their Sources

Type	Sources
Organic	Food scraps, yard (leaves, grass, brush) waste, wood, process residues
Paper	Paper scraps, cardboard, newspapers, magazines, bags, boxes, wrapping paper, telephone books, shredded paper, paper beverage cups. (Strictly speaking paper is organic but unless it is contaminated by food residue, paper is not classified as organic)
Plastic	Bottles, packaging, containers, bags, lids, cups
Glass	Bottles, broken glassware, light bulbs, coloured glass
Metal	Cans, foil, tins, non-hazardous aerosol cans, appliances (white goods), railings, bicycles
Other	Textiles, leather, rubber, multi-laminates, e-waste, appliances, ash, other inert materials

Source: World Bank.2012

In **St Lucia**, organics is the largest component of MSW, representing 45 percent of all waste, whereas plastic is the second larger component with 22 percent. (SLSWMA, 2008)

Among the reasons argued in the region for the changes are the increased use of single-use packaging containers, as well as the emergence of new materials, such as Styrofoam and e-waste. These changes add a new layer of complexity to the sector, forcing countries to design and implement new strategies. In **Barbados**, the Returnable Container Act introduced of refundable deposit (10-20 ¢) on beverage containers which encourages the return of empty containers by consumers. In **Guyana** the recently published amendment to the Environmental Protection Act prohibits the importation, manufacture and sale of Styrofoam (expanded polystyrene) products in the country.

Only a few Caribbean countries have enacted legislation defining what specifically is hazardous waste and how it should be managed

3.2 Hazardous Waste and Medical Waste

During the conference, the challenges of managing hazardous waste in the Caribbean region were highlighted and technologies and approaches for its management were presented. Only a few Caribbean countries have enacted legislation defining what specifically is hazardous waste and how it should be managed (Table 8).

Gillian Guthrie, Senior Director, Ministry of Water, Land, Environment and Climate Change of Jamaica provided a definition of ‘Hazardous Waste’ as waste that (i) possesses specific characteristics (e.g., toxic [delayed or chronic], ecotoxic, corrosive, infectious, flammable, explosive, oxidizing, or poisonous); (ii) contains specific constituents (e.g., mercury or mercury compounds); or (iii) is considered ‘hazardous’ based on its origin (e.g., ashes from the incineration of insulated copper wire).

In **Jamaica** there is no single, ad-hoc legislation so far. The policy and legislation frameworks governing hazardous waste management consist of: (i) the Public Health Act; (ii) the National Solid Waste Management Authority Act; (iii) the Precursor Chemicals Act; (iv) the Pesticides Control Authority Act; and (v) the Natural Resources Conservation Authority Act. In addition, two major policies are being drafted, namely, the National Policy for the environmentally sound management of hazardous wastes and the Medical Wastes Management Policy.

In **Trinidad and Tobago**, the Environmental Management Authority (EMA) has drafted the Waste Management (Hazardous Waste) Rules. (Parliament T&T, 2014).

In **Guyana**, the environmental act of 1996 provides a framework for managing hazardous waste.

In **the Bahamas**, hazardous waste treatment, storage and disposal are regulated under the Environmental Planning and Protection Act of 2000.

In **Barbados** there is no single legislation that encompasses hazardous waste management. Neither are there any hazardous waste treatment or disposal facilities. The EPD’s role is to offer advice on the most suitable method of hazardous waste disposal.

In **Belize** the Hazardous Waste Regulations adopted in 2009 define this type of waste and regulate its storage, transportation, treatment and land disposal. The existing regulation forms a solid groundwork which adequately implements the Basel Convention requirements (BSWaMA, 2011).

Table 8:

Hazardous Waste Regulations/ Policies in the Caribbean Countries

Country	Hazardous Waste Regulations
Jamaica	(i)The National Policy for the environmentally sound management of hazardous wastes and (ii) Medical Wastes Management Policy. (Draft)
T&T	Waste Management (Hazardous Waste) Rules (Draft)
The Bahamas	The Environmental Planning and Protection Act of 2000
Suriname	No legislation
Haiti	No legislation
Belize	Hazardous Waste Regulations, 2009
Barbados	No single legislation
Guyana	Environmental Protection (Hazardous Wastes Management) Regulations 2000

Source: Own elaboration

Ms Marie Dalsan explained that in **St Lucia** the Deglos Sanitary Landfill has a Hazardous Health Care Waste Treatment Facility. Once treated, the biomedical and hazardous health care waste is deep-buried in demarcated pits on the landfill.

The case of medical waste in **Jamaica** was presented by Navarine Hylton, Waste Management Unit Director in the Ministry of Health (MoH), who described some of the historical issues of medical waste in the country: (i) no single legislation; (ii) inadequate training of healthcare workers; (iii) limited budget; (iv) inconsistent procurement of supplies; (v) lack of designated/dedicated waste management personnel at health facilities; and (vi) challenges with separation of waste types, storage, transportation, treatment and disposal.

Jamaica has implemented a Waste Management Unit in the MoH and also established an autoclaving facility to safely treat medical waste in the Kingston Metropolitan Area (shredding, sterilising and disposing of medical waste). (BOX5).

Ms Regine Sainte-Croix, Owner/Manager of RS Caribbean, pointed out that incineration was traditionally the way to treat medical waste. But due to the 2004 Stockholm Convention on Persistent Organic Pollutants, more technologies came about for treating medical waste. Among alternative technologies, steam sterilization in autoclaves became the most common method. In the early 2000s a second generation of advanced steam-based (autoclaving) systems, combining steam treatment with internal shredding became an efficient and cost effective solution.

Autoclaving

Definition

Steam autoclave treatment combines moisture, heat and pressure to inactivate microorganisms. This process has been used for sterilizing medical instruments in hospitals and in the treatment of waste in laboratories for many years. Medical waste may contain many of the same pathogens as those associated with used medical instruments and supplies; however,

medical waste may contain a much higher concentration of organisms in a more complex matrix. These differences make it necessary to have a unique test method specifically for the assessment of steam autoclaving as an effective medical waste treatment technology.

Source: EPA, 1993.

3.3 Challenges

Countries have acknowledged that waste characterization is evolving. On one hand volumes are steadily increasing and on the other, the waste composition is changing. These issues impact collection and disposal activities, increasing the infrastructure as well as the human and financial resources needed to manage them. As discussed previously, in almost all cases, collection and disposal services are managed and financed by the public sector, with resources from the national budget. Moreover, many countries cannot ensure an appropriate disposal of all collected waste for lack of sufficient facilities – land scarcity is a characteristic of islands configuration and therefore it is extremely difficult to find adequate locations for new disposal sites.

Participants pointed out the importance of including new procedures and strategies to cope with new waste types, such as construction and demolition waste, e-waste and ship-generated waste. *Ms Dalsan* highlighted that in **St Lucia**, stockpiles of tyres are a fire hazard and a disease vector problem.

In order to manage solid waste, information on generation rates for all types of waste streams (domestic, industrial, hazardous and medical) should be readily available. However there has been inadequate data collection and waste characterization studies to provide the input needed to implement an efficient SWM system.

3.4 Recommendations

Participants agreed that increased waste generation is challenging SWM. Countries should also contemplate in their policies incentives for recycling, reuse and waste minimization. Increasing tipping fees according to the volume discarded at the landfill or charging different tipping fees according to the waste type have been implemented in other countries as a tool to encourage waste minimization.

The need for data collection is particularly relevant in the case of hazardous waste, for which no historical data is available.

Only a few countries have conducted waste characterization studies. These studies provide valuable information on the type and volumes of waste being generated and therefore allow countries to better design their treatment policies (compost, recycling, reuse, etc.). The need for data collection is particularly relevant in the case of hazardous waste, for which no historical data is available. It is important to ensure that methods are well defined and structured to ensure accurate results which allow comparison over time.

Additionally, technical and financial assistance is required to build the physical infrastructure (including the requisite equipment) at the national level for the interim storage, treatment and disposal of specific categories of hazardous wastes.

4 Waste as a Resource

The main alternatives for treating SW prior to final disposal include reuse, recycling and composting. It is also possible to treat SW thermally with techniques to generate energy from waste (IDB, 2010). (BOX 6).

Waste Treatment, Definitions

Reuse. using a waste product again for the same or a different purpose without further manufacture.

Composting. Compost and humus is obtained through controlled decomposition of organic waste. It reduces the amount of solid waste deposited in sanitary landfills and, thus, the leachate produced, while at the same time providing organic material to prepare soil for agricultural production and to landscape parks and green spaces in cities.

Recycling is an activity through which certain USW products are collected, classified and processed in order to re-enter the used cycle in households, commercial businesses, or industry.

Thermal Processing is any process that uses heat to reduce the volume and decompose or change the physical, chemical, or biological composition of solid, liquid, or gas waste. This definition includes incineration, pyrolysis, gasification, and plasma.

Source: IDB,2010; EPA, 2009.

BOX 6

Waste should be seen as a resource: Organic solid waste can be used as input for the production of biogas or can be transformed in fertiliser and soil conditioner through composting. Waste can also be an input for the production of energy, through Waste to Energy (WTE) plants. (BOX 7).

An example of how organics can be used as a resource to produce energy was presented by *Julia Brown, from the Scientific Research Council (SRC) presented Organic Waste Recovery and Recycling – Waste Treatment Technologies*. She provided insight into the opportunities to use organic solid waste, processed in biodigesters to generate fuels. She explained how dairy and pig farms in **Jamaica** are generating electricity using biogas plants and fertilizers from their organic waste.

Some Caribbean countries, such as **Barbados** (Ministry of Finance and Economic Affairs, 2013) and the **Bahamas**, are looking at WTE as a policy option for waste management and energy production. In the case of the **Bahamas** (Ministry of the Environment and Housing & Ministry of Works and Urban Development, 2013), the Government is currently drafting a Request for Proposal (RFP) for provision of WTE Services.

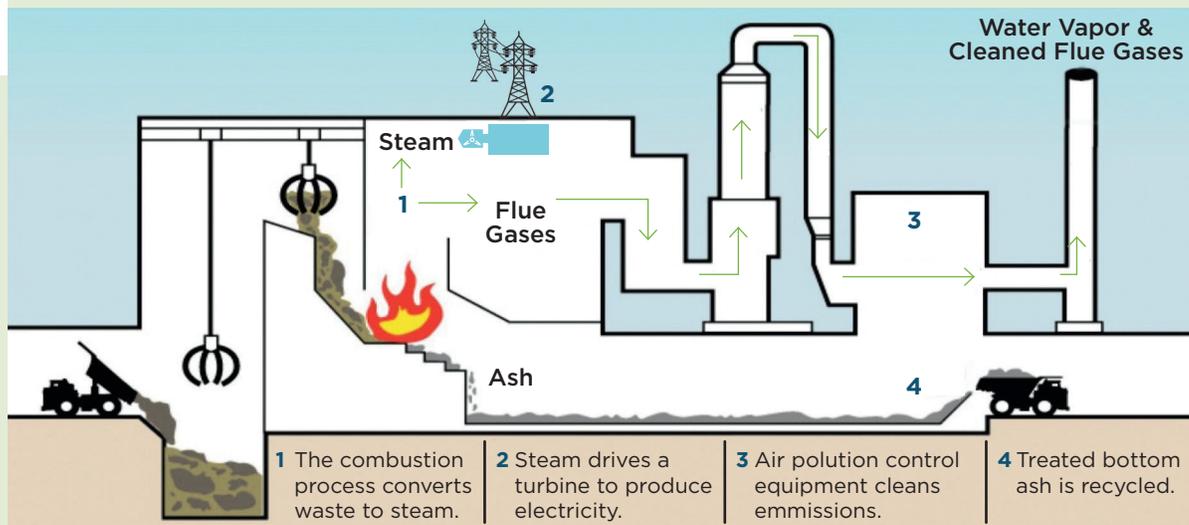
WTE is in place in some French Caribbean islands such as **Martinique** and **St Barthelemy**. In **Martinique** a WTE plant of 115,000 tons/year is operational since 2002 and uses SW to produce electricity (14,496 MWh/year in 2011). In **St Barthelemy** a WTE plant is operational since 2001 with a capacity of 8,900 tons/year which produces thermal energy (23,470 MWh/year). (Ademe, 2015; SVDU, 2015).

Waste to Energy Description

Waste to Energy is the process of creating energy in the form of electricity or heat from the incineration of a waste source. WTE is a form of ener-

gy recovery, and most processes produce electricity directly through combustion or produce a combustible fuel commodity.

BOX 7



Source: Asian Development Bank, 2015

Dr Nickolas Themelis, from Columbia University, gave insight to the selection of appropriate WTE options. He pointed out that today, several countries such as Austria, Switzerland, Germany, the Netherlands, and Singapore use WTE as the main process for treating post-recycling MSW.

Dr Themelis also indicated that there are several WTE technologies but that the most dominant technology, by far, is “combustion of as-received” MSW on a moving grate. This is due to its simplicity of operation, low personnel requirements and high availability.

New processes (e.g. “thermal plasma”) need to be less capital intensive per ton of annual capacity in order to be competitive with moving grate combustion.

He also pointed out that the main WTE advantages are that (i) it reduces the land space required for landfilling, (ii) generates energy and (iii) is often aesthetically more acceptable to host communities.

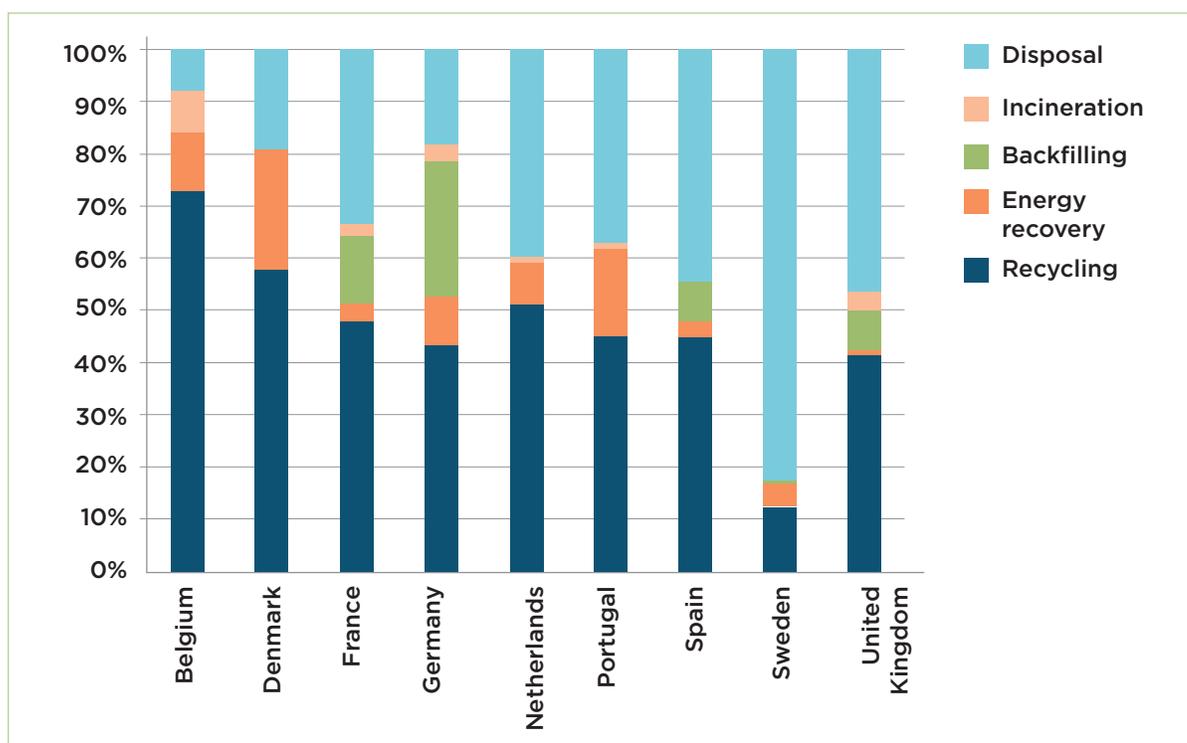
Participants debated about the need to assess the real costs of sanitary landfills in order to establish a valid comparison among technologies. All costs shall be considered, including negative externalities associated with the disposal site, which might require conducting an environmental assessment of the site. If the country operates a sanitary landfill with low negative externalities, it might be less costly for the country to operate a sanitary landfill than building a WTE facility.

Recycling was an important topic discussed at the conference. In the LAC region the separation and recovery of recyclable materials is not practiced on a large scale and there are very few countries that have formally introduced recycling initiatives. (IDB, 2010).

This contrasts with the situation in Europe, where countries such as Belgium, Denmark and the Netherlands have achieved recycling rates close to 50 percent of the total waste treated nationally. (See Figure 3).

Figure 3:

Waste Treatment. Selected European Countries. 2012



Source: Own elaboration based on Eurostat 2012

In the Caribbean, Jamaica, Barbados and Belize have implemented regulations in regard to recycling activities.

Ricardo Valencia, Executive Director of CEMPRE explained that recycling in Europe is different from Latin America due to several reasons: (i) waste composition is different (dry waste mainly); (ii) there are few (or no) informal recyclers; (iii) a long term experience of over 40 years; (iv) incentives for recycling and specific policies for different types of waste; and (v) high levels of WTE technologies.

The recent trends in Latin America have been a thrust to develop/adapt the legal and regulatory framework for improving waste management. There are renowned examples of inclusive recycling in Buenos Aires, Santa Cruz and Bogotá. In Brazil, Chile, Colombia and Mexico sectorial agreements have been developed to increase recycling and their focus has shifted from philanthropy to cost-based initiatives. An example in the region is the case of **Colombia**, which according to *Ms Magda Correal* has a recycling rate close to 13 percent.

In the Caribbean, **Jamaica, Barbados and Belize** have implemented regulations in regard to recycling activities.

In **Jamaica** the Trade Regulations of 2013 regulate the scrap metal industry, requiring a license to operate a scrap metal facility and for dealing or exporting scrap metal. (The Jamaica Gazette Supplement, 2013).

In **Barbados** the Returnable Containers Act (1986) provides for the control of the sale of beverages in beverage containers, the payment of a deposit on beverage containers, a refund for the return of those containers and the final disposal of unused or unusable containers. This Act has been instrumental in the way in which recyclables are treated today in the country and the growth of the recycling industry in Barbados.

In **Belize**, the Returnable Containers Act of 2009 states that a deposit on beverage containers shall be collected by all distrib-

utors and dealers at the time of sale or distribution. “Beverage” is defined in the Act as carbonated soft drinks, beer and other malt products. (Government of Belize, 2015).

In **Trinidad and Tobago** a National Waste Recycling Policy was approved by the Cabinet in February 2015, which will result in the establishment of a Waste Recycling Management Authority. The Policy takes into consideration existing overarching policies such as the National Integrated Waste Management Policy and the National Environmental Policy.

As a result of the activities and promotion of recycling, many initiatives are currently taking place in Caribbean countries, mainly for plastics, scrap metal, paper, cardboard and electronic waste. These waste materials are exported to international markets under attractive price conditions.

In the **Bahamas**, a Materials Recycling Facility (MRF) was inaugurated in 2015. The recycling plant will process up to 80 tons of residential and commercial waste per hour (Government of the Bahamas, 2015).

In **Belize**, the recovery rate of recyclables in the National Sanitary Landfill is 2 percent, which represents almost 40 tons of recycled waste monthly (BSWaMA, 2015).

In **Barbados**, the Sustainable Barbados Recycling Centre (SBRC) came into operation in 2009, with the main objective of diverting waste from the Sanitary Landfill. The SBRC is a Public Private Partnership that operates under contract with the government and was formed as a Transfer Station and Materials Recovery Facility. Its implementation resulted in 70 percent diversion of waste from the landfill. Approximately 1,000 to 1,300 tons per day (tpd) go to the SBRC and 300 to 400 tpd to the landfill. Currently, diverse recyclables are exported bringing in foreign exchange and increasing employment.

In **Jamaica** existing initiatives to collect and export recyclables have been led primarily by the private sector: **(i)** Recycle Now Jamaica, which is a public private partnership (PPP) between Wisynco, PepsiCo and the Government of Jamaica. The initiative will initially focus on reclaimed post-consumer polyethylene terephthalate (otherwise known as PET) bottles. (Ministry of Transport, Works and Housing, 2015).

(ii) Jamaica Recycles, which is a private entity that collects plastics, cardboard, and paper for export. Jamaica Recycles is a subsidiary of an international company that identifies markets all over the world for the recyclables. The Jamaica Recycles Depot collects recyclable materials from hotels, other business establishments, the Retirement Disposal site and community groups. At this site the materials are baled utilising two baling machines and they are temporarily stored until they are collected for transportation to Kingston to be exported to markets overseas. Some of the hotels have been provided with balers by Jamaica Recycles so that the volume of the recyclables is reduced at source, thereby reducing the storage space on site and facilitating easier transportation.

In **Trinidad and Tobago**, SWMCOL has the Port of Spain Recycling Depot to recycle glass bottles and jars, plastic beverage bottles, beverage cans and milk and juice tetra-pak cartons. In 2015, SWMCOL launched a Beverage Container Recycling Facility, which will process post-consumer beverage containers into high quality material for producing new products. (SWMCOL, 2015). In addition, the private initiative PlastiKeep provides special bins for plastics which can be dropped off at their facility.

Intimately linked to the recycling activities and as mentioned previously, in many disposal sites, informal recyclers are to be found collecting and sorting materials from urban solid waste, which commer-

cialized become their primary means of income. (BOX 8).

Typically living in very precarious socio-economic conditions, informal recyclers are repeatedly seen in disposal sites in the Caribbean.

In **Haiti**, estimates indicate that close to 300 families depend on the commercialization of waste from Truitier (IDB, 2012).

Ms Jennifer Edwards indicated that in **Jamaica**, most of the over 300 workers in the sector are from poor socio-economic status, earning minimum wages. Some of them work on the site and live in close proximity to the facilities. As an example, the Riverton City disposal site, approximately 130 acres in size, has over 150 informal recyclers operating daily. There are no welfare facilities for workers at the disposal sites and there is high worker turnover.

Mr Peter Cohen, a Consultant with high expertise in Involuntary Resettlement, presented a case study on the relocation of informal recyclers from a disposal site in **Guyana** that was closed in order to establish a sanitary landfill at a new location. With the establishment of the new landfill the existing operations of informal recyclers were disrupted. Some persons resisted the change but the organisation and improvement in working conditions led to restoration of and improvement in their income.

Eighty-six recyclers who had been identified in a census conducted at the old disposal site were incorporated into the new facility. For this process, a continuous consultation was needed and as a result, the recyclers improved their living conditions and received a package of benefits.

Informal Recyclers

The term “informal recycler” refers to persons engaged in the recovery and sale of recyclable materials in the municipal waste stream. Informal recyclers may operate at any point in the waste stream, but may generally be divided into four categories:

1. Itinerant waste buyers (mobile recyclers who go door-to-door, collecting, buying or bartering for materials, before they have entered the official waste stream)
2. Street recyclers (mobile recyclers who recover materials from private trash-cans or public bins prior to formal collection)
3. Truck recyclers (mobile recyclers – often formal municipal or private-sector employees – who informally collect resalable materials with trucks along collection routes)
4. Dump recyclers (stationary recyclers based at specific disposal sites who recover recyclables brought in by trucks for final disposal)

Informal recyclers are referred to by several different local names, including cirujas, pepenadores, cachureros, cartoneros, catadores, gancheros, and buzos, among others.

Source: IDB, 2010; IDB 2013

More information:
Visit the Regional Initiative for Inclusive Recycling. <http://www.inclusiverecycling.com/>.

4.1 Challenges

Waste treatment generates by-products that can be reused and that can even generate new jobs and economic opportunities. Along the conference, the need to promote recycling and reuse as well as the need to introduce new technologies for using waste as a resource was continuously highlighted.

Before being treated, waste must be sorted. This should be done as early as possible in order to minimize waste handling costs. This is a clear challenge for the Caribbean countries, which need to introduce policies that not only foster recycling or composting, but also provide adequate waste-separation infrastructure.

On the other hand, countries typically have a large number of informal players within the sector, particularly at disposal sites as informal recyclers and informal collectors of recyclables. While many of these persons make a living off the disposal sites, they tend to work in unsanitary and dangerous conditions, sometimes coming into conflict with heavy duty equipment on the sites. The displacement of informal recyclers when a new disposal site comes in operation is a challenge that has to be addressed in all countries. A social inclusion plan needs to be prepared in order to avoid social conflicts and to ensure the protection of informal recyclers' rights.

In many countries the existing legal and regulatory framework would need to be adapted in order to provide the necessary regulation for WTE activities.

In regard to **Waste to Energy**, one of the main challenges has to do with the associated cost of these facilities –both in terms of initial investment and operating costs–, for which traditional and non-traditional funding options (PPPs; Carbon Funds, etc.) should be explored. Likewise, it is crucial to establish contracts with suppliers to guarantee a sustainable supply of feedstock. In the same way, contracts with utilities (Power Purchase Agreements) need to be in place to secure financial flows for the project.

Additionally, it is necessary to assess the readiness of countries to implement WTE solutions. There might be political and cultural barriers that need to be evaluated and understood from the beginning. The lack of information on similar projects worldwide can be a disadvantage during the awareness process. Equally important is to ensure that there is local expertise to implement, regulate and operate this type of facilities.

In order to assess the feasibility of the WTE plant, up-to-date information about waste volume and composition is needed. As previously mentioned, in many countries organic waste is predominant and in this regard **Ms Richards** stated that in the case of the Pacific Region, WTE is not feasible partly due to the high wet organic waste content and harsh environments which would lead to rapid corrosion of equipment.

Other elements to take into consideration include a WTE plant's environmental impact, such as emissions and ash, as well as the impact that waste reduction may have on other waste stream end users, including the eventual displacement of informal recyclers.

Lastly, in many countries the existing legal and regulatory framework would need to be adapted in order to provide the necessary regulation for WTE activities.

4.2 Recommendations

UNEP's Programme Officer Christopher Corbin highlighted that waste is a resource that can be recovered and put to productive and profitable use. Participants concurred on the need to see solid waste as a resource.

In order to divert recyclable and reusable components from the municipal disposal site, it is crucial to give waste a value. Many alternatives for increasing recycling rates were discussed, including higher tariffs (tipping fees) for the commercial sector in order to encourage recycling and waste minimization.

Other options considered included a differentiated tariff: persons should pay differently for the collection of recyclables.

In the Caribbean countries, recycled materials are exposed to price fluctuations and recycling might not be sustainable over time. Some of the recommendations to reduce this vulnerability are:

- Organize informal recyclers into cooperatives so they can have more efficient and effective operations and develop contingencies to mitigate eventual drops in world recyclables prices.

- Industries should reuse and recycle wastes as much as possible within their industrial processes. Industries can be offered incentives to promote greater levels of reuse/recycling.
- Develop new products and markets. A new product from recycled plastic can be for instance: benches, yam sticks, roofing. New markets (internal/regional) which can utilize these waste products include tyres used as an energy source for cement and bauxite plants. Participants indicated that a cost-benefit analysis is required to determine the best waste material to recycle.
- Implement greater levels of public education to promote material reuse.
- Engage CARICOM to facilitate trade in waste products (waste vs. resource).

Participants also indicated that in addition to the technical and financial aspects, social issues also need to be addressed when designing and implementing SWM solutions, taking for example into consideration that informal recyclers are usually to be found in disposal sites and in some cases they may even live on the site.

Ms Magda Correal mentioned that in Colombia, during the sector reform the status of the informal recyclers was recognized so that they could form organized groups and be a formal part of the SWM value chain.

It was unanimously agreed that waste management has a big business potential.

And the example of Jamaica was highlighted: this country has benefitted from scrap metal and plastic bottle collection and overseas sales.

In regard to the use of new technologies for waste treatment, *Ms Julia Brown* said experience has shown that there is still quite a bit of resistance to their adoption, so it is important to have key organisations (public and private sector) and individuals recognise the need for cost-effective and sustainable solutions. She stressed that a public relations and marketing campaign could help overcome some of that resistance.

With respect to **Waste to Energy**, several assessments need to be conducted to determine a WTE plant's feasibility, including environmental, health and social impacts. In addition, institutional and governance analyses would be required to determine a country's policy readiness and technical capabilities, while a financial analysis can help define the plant's investment and operating costs. It is recommended to look for case studies in similar environments.

In order to develop domestic expertise, local and regional educational institutions should launch programmes to train future professionals. Lastly, Caribbean countries need to examine the long-term effects of international agreements and conventions that have the potential to protect vulnerable states from illegal activities and also facilitate their growth and development.

5 Financial Sustainability

While LAC nations tend to recognise the importance of SWM's environmental sustainability, they typically overlook the significance of its financial sustainability. (IDB, 2010). Financial problems related to SWM are not confined only to the Caribbean. Rather, they are a challenge to all of Latin America.

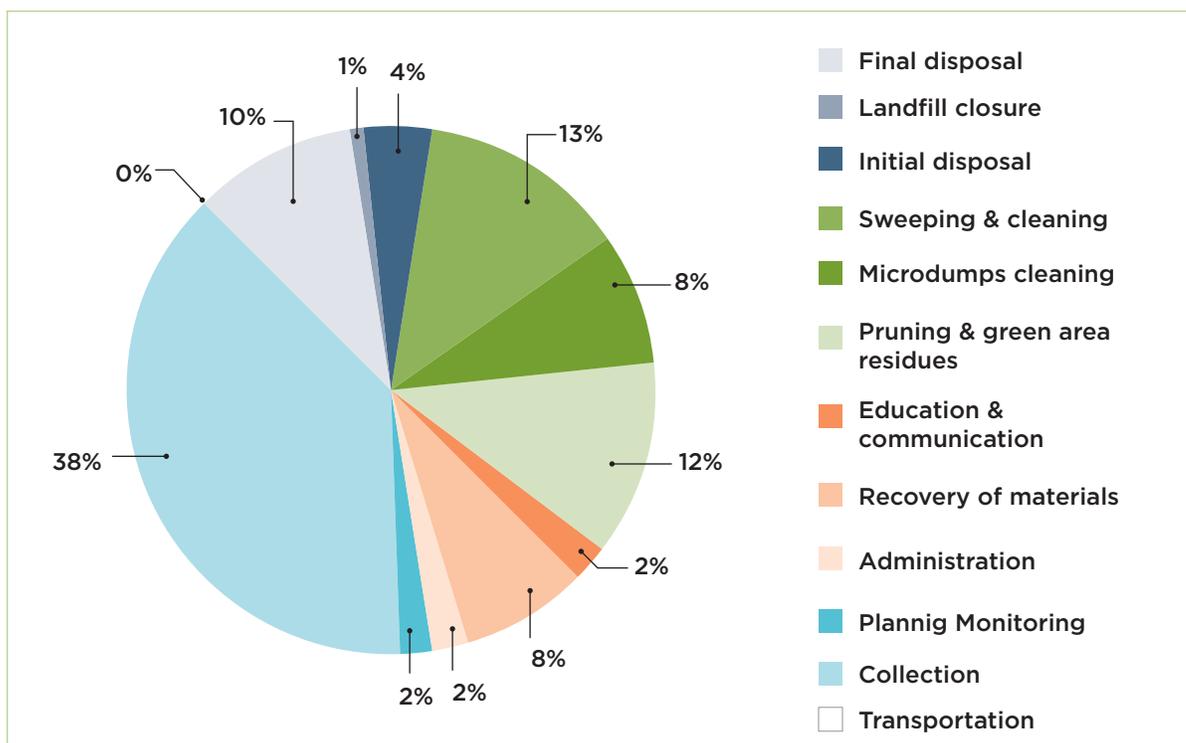
Ms Mosteirín, an Economist from Argentina, highlighted some of these problems, which include:

- Insufficient financial resources to cover the SWM cost.
- Absence of specific SWM fees (street lighting, cleaning and sweeping).
- No specific SWM spending and budgeting accounts.
- SWM Revenue and Costs are not clearly known.
- Absence of a SWM Cost Calculation methodology.

- Absence of SWM economic and financial Performance Indicators.

Ms Mosteirín also said that in Argentina, as a result of these challenges a simple matrix was developed to calculate SWM costs, financial sustainability and performance indicators. An economic and financial analysis was conducted at municipal level over a year. As a result, a clear distribution of cost was developed, which showed that the cost of collecting and cleaning represents 71 percent of total SWM costs, whereas final disposal represents only 10 percent. She also highlighted that there is low investment in education & communication (2 percent) and in planning & control (2 percent). (See Figure 4).

Figure 4:
Distribution of Municipal SWM Costs. Argentina



Source: Ms Mosteirín presentation

Ms Mosteirín pointed out that when conducting cost analysis, all phases must be considered, e.g. collection, transportation, landfilling, illegal dumping cleaning, administration, composting, education, etc.

Ms Mosteirín concluded that this tool provided municipal authorities with accurate information to take SW Management, Economic and Financial decisions.

With regard to fees, two recurrent challenges are: (i) fees do not cover all real SWM costs and/or; (ii) the entity is not able to collect fees, therefore there are low collectability levels.

Different schemes have been used in LAC to charge and collect fees, with property taxes being one of the most popular. Other schemes used for billing SW services include SW fees in the electricity or water bill or billing the customer directly the SW fees. (IDB, 2015b).

In the Caribbean countries very often, the central government directly or indirectly provides the funds required for the SWM services.

In the Caribbean countries, there are different tariff and collection schemes. Very often, the central government directly or indirectly provides the funds required for the SWM services.

In **Jamaica**, funds for SWM come from property taxes (public cleansing) plus a central government subvention. Tipping fees at disposal sites are not being enforced.

In **Belize**, all municipalities rely on the property tax to bill. (IDB, 2010).

In **Barbados**, SSA generates revenue through renting out of equipment and collection of dead animals. However, the revenue generated by SSA is not enough to fully fund operational costs of SSA. The SSA receives US\$50M/year from MED to pay SBRC for its services as well as to fund its own operations.

In the **Bahamas**, *Ms Thomasina Wilson* indicated that in the case of Grand Bahama, the residential collection is attached to the water bill. This utility company is owned by GBPA. In Family Islands, there is no fee for collection and collection is done through private contractors and paid for by the local government. Similarly, in New Providence, residential collection is conducted primarily by private contractors paid for by the government.

In **Trinidad and Tobago** collection services are entirely financed by the government. In this country more than 55 percent of municipal recurrent expenditure is spent on waste collection annually.

In **Haiti** and **Suriname** the activities of the agency (SMCRS and VOV, respectively) are funded by the national budget.

In **Guyana**, municipalities receive an annual subvention from the Ministry of Local Government & Regional Development. This is in accordance to budgetary allocations approved by Parliament and meant to execute developmental works.

However, the collection of rates and taxes is the main source of revenue for these councils. (Ministry of Local Government and Regional Development, 2015).

5.1 Challenges

The major obstacles to achieving self-sustaining SW services are insufficient cost recovery and the lack of a management system based on an adequate cost accounting scheme. (IDB 2010).

Ms Magda Correal noted in her presentation that in most LAC countries, SWM services are supported by a municipal tax. However, this tax is used to pay not only for SWM, but also for street lighting and other services. As a result, tax revenues end up covering only about half the real SWM cost.

Ms Beverly Haywood, Planning Officer, Ministry of Local Government, Trinidad and Tobago highlighted that in **Trinidad and Tobago** the cost of waste collection services is high and is entirely funded by the government.

Ms Edwards mentioned that in **Jamaica** the MLGCD, which has responsibility for the Fire Brigade, the Infirmaries, Markets, community roads, small water supply systems, street lighting, community development and for waste management, is challenged to prioritize limited funds. She also noted that waste management is funded by property tax which is designated by law to the Parish Councils. The ambiguous definition of the Property tax distribution is a point of conflict between the primary representatives of the people who generate waste and the NSWMA that manages the waste.

In **Jamaica** only 60 percent of home owners were paying property taxes, which undermines the SWM revenue base. Along this line, *Ms Deniesha Darling, Legal Officer at the National Solid Waste Management Authority (NSWMA)*, pointed out that in **Jamaica** some of the challenges are related to the need for regulations for tipping fees and licence fees as well as an increase in taxes to fund solid waste activities.

It was agreed that fees collected for solid waste management should be kept separate from funds of other services and should be used only for the development of the sector.

5.2 Recommendations

Countries need to ensure that there is accountability and transparency in the implementation of SWM programmes. It was also agreed that fees collected for solid waste management should be kept separate from funds of other services and should be used only for the development of the sector.

The definition of tariffs is not an easy task, and in many cases lack of information prevents authorities from determining the real SWM costs and from fixing the pay to be paid for collection and disposal services.

Mr Gilroy Lewis, Director BSWaMA/Project Director explained that in **Belize**, a Cost Recovery Mechanism Study and Willingness to Pay Survey was conducted where costs were disaggregated to the household level with varying rates for Belize City, rural areas and a social rate for the indigent and elderly.

Participants agreed to the need to improve data availability by ensuring access and development of real-time data for planning, research, policy development and decision making.

Finally, participants concurred that regulations are required to support the financial mechanisms to be instituted. They also agreed that an independent authority should establish tariffs.

6 Climate Change

Vulnerability to climate change was widely recognized as a common challenge for all Caribbean countries, and the conference provided an opportunity to discuss how SWM can contribute to mitigation and adaptation (BOX 9).

Dr Michael Taylor from the University of the West Indies, Mona Campus, Jamaica, made a presentation on Climate Change, Solid Waste Management & the Caribbean, in which he established a link between SWM and climate change. *Dr Taylor* noted that there were three points of intersection – mitigation, adaptation and resilience.

Mitigation and Adaptation

Mitigation [of climate change]: “A human intervention to reduce the sources or enhance the sinks of greenhouse gases.”

Adaptation [to climate change]: Refers to a process of adjustment to actual or expected climate and its effects. Adaptation cannot be instantaneous, so it is implemented in phases, starting with the opportunities for adaptation. By its nature, adaptation must be a continuous, repetitive, and inclusive process and must actively

involve various levels of government. In practical terms, for the prioritization of specific actions, it is suggested that those measures for immediate implementation fulfil one or more of the following characteristics: (i) respond to irreversible or very expensive impacts; (ii) be urgent; or (iii) respond to long-term objectives, such as infrastructure investments.

Source: IDB, 2015c

Mitigation

SWM is responsible for Greenhouse Gas (GHG) emissions throughout all SWM activities:

- Emissions of methane from the landfilling of biodegradable wastes (mainly paper and food and garden wastes – the latter known collectively as putrescible waste).
- Emissions of fossil-derived carbon dioxide from the combustion of plastics and some textiles in incinerators.
- Emissions of nitrous oxide during incineration of wastes.
- Emissions of fossil-derived carbon dioxide from the collection, transportation and processing of wastes, from the fuel used in these operations.
- Emissions of halogenated compounds with high global warming potential from electronic and electrical equipment (such as refrigerants and insulating foam in refrigerators and freezers) waste.

A number of processes can lead to negative GHG fluxes, i.e. to mitigation. These are as follows:

- Recycling avoids emissions associated with producing materials recovered from the waste from primary resources.
- Avoidance of emissions that would have been produced by other processes – for example: energy recovered from incineration (WTE), landfill gas recovery and utilisation, and use of anaerobic digester biogas can play important roles in reducing fossil fuel consumption elsewhere in the energy system and GHG emissions.
- Composting avoids methane production from degradation of organic waste in landfills and emissions associated with the use of fertiliser that it displaces. It has the potential for carbon sequestration through increasing the level of soil organic matter.

Adaptation

Waste Management Options may offer expanded adaptation options. For example, a greater energy demand is an inevitable consequence of a warmer climate. Within this context, WTE is an adaptation option that potentially addresses this concern in a sustainable manner, i.e., without a reliance on fossil fuels, while at the same time addressing issues associated with waste disposal.

Dr Michael Taylor also indicated that the Waste Management Sector must contend with its own need for adaptation options because climate change will directly impact waste management in several ways:

- Increased disruption to supporting infrastructure, such as roads from increased flooding. This can affect several things, including waste transport.
- Increased damage to site buildings from storms.

- Changes in site hydrology and temperature which can affect waste management processes, e.g. leachate production and composition, and landfill degradation rates.
- Reduced worker comfort on account of increased temperatures, etc.
- Increased site “unpleasantness” from odour, dust, etc.
- Inundation and/or erosion of low lying coastal facilities.
- Increased fire potential in dry, hot conditions.
- Generation of more waste, e.g. after a disaster or after prolonged drought conditions. This can also result in increased financial burden on the waste sector to deal with additional waste and also poses a financial burden on consumers.

Dr Taylor stressed that waste management policies should be seen as powerful tools for building climate resilient societies.

7 Conclusions and Recommendations

Nearly all countries in the Caribbean region face similar challenges related to solid waste management, and as such, the application of these lessons can assist in the development of the solid waste management sector within each country.

It was apparent that most countries faced similar issues related to the need to:

- strengthen policy, legislative and institutional frameworks for solid waste management
- establish a sustainable financing mechanism
- consider waste also as a resource
- improve technologies and capacities for SW management
- ensure all relevant stakeholders get involved

Strengthen Policy, Legislative and Institutional Frameworks for SWM

It was apparent from the discussions that most participants who were primarily from public sector agencies and Ministries understood the necessary approaches and strategies to improve SWM, but were being hindered by the lack of political will and the low priority that in many countries SWM received. To recognize SWM as a national development imperative and priority is the first step towards the holistic development of the sector.

An effective SWM institutional arrangement requires (i) a clear definition of entities involved in SWM and their respective roles as well as (ii) a clear set of laws and regulations that clearly define how SWM services are to be provided. Within this framework, a SW national policy defining the medium and long term goals is certainly to support the development of actions and programmes that are coordinated and comprehensive.

All stakeholders (private and public sectors as well as civil society) should have an opportunity to be involved in the development of policy, legislation, strategies and plans for SWM. It is crucial that changes to any aspect of the solid waste management system are made in an inclusive manner to ensure the buy-in of all stakeholders.

Public-private partnerships are another important component of a solid waste management system, as the Government cannot successfully implement and operate such a system on its own. The involvement of the private sector must be facilitated by way of the policy, legal and institutional frameworks. It is paramount to review or establish frameworks for public private sector partnerships to stimulate investments in the sector.

It is important to rethink the strategies, whether they include waste-to-energy or waste minimization or other considerations, and to ensure that climate change adaptation strategies and activities are also taken into account so that present and future generations can enjoy a fulfilling quality of life.

Establish a sustainable financing mechanism

To ensure sustainability of the sector, countries need to define financing mechanisms for waste management, be it through taxes, tariffs, pay-for-service or other modalities.

In order to charge the right fee, it is imperative that countries determine the true cost of SWM activities, including those related to public and key stakeholders education. Once the true cost is determined, strategies to recover the costs from waste generators should be instituted, as this is one of the pillars for a sustainable system.

A sustainable financing mechanism needs to be transparent and should include an accountability scheme to provide confidence to all stakeholders.

Waste as a Resource

Re-use, recycling and waste minimization should be promoted systematically through policies and regulations. Within this framework, it is important to recognize that waste is a resource. This would encourage more people to look for opportunities to invest in waste management initiatives. This new vision would result in savings from the avoided cost of landfilling some types

of waste, increased employment from new manufacturing processes, and increased economic activity based on useful products sold locally and even overseas.

When developing plans for solid waste recycling, treatment and disposal, SWM strategies must consider the organisation and formalisation of informal recyclers at disposal sites. These informal workers should not be displaced, as they are an important asset of the solid waste value chain.

WTE initiatives must fit within the context of other solid waste management strategies, which also include waste minimisation and recycling. They must be driven by a solid waste management plan, rather than by an energy plan. WTE initiatives must also be analysed from an economic and financial perspective to ensure their feasibility in the local context. Experiences elsewhere indicate that it can take many years before these initiatives can be implemented, if found to be suitable for the particular territory.

Improve Technologies and Capacities for Solid Waste Collection and Disposal

It is imperative to realise that SWM is a business and its resources (technical, human and financial) need to be planned accordingly.

Investments need to be planned in advance and should be based on the policies and strategies the country has developed. Within the human resource field, competitive remuneration packages should be provided that reflect personnel qualifications. There should also be room for staff growth and development through training and partnerships with other similar, more experienced agencies.

Engagement of all Relevant Stakeholders

Participation of all stakeholders, strong intra-governmental relations and inter-governmental relations (both horizontal and vertical) are critical to promote actions.

Public education is essential to ensure SWM policies translate into actions and strategies. It is crucial to ensure that a continuous, properly funded public awareness programme as well as community programmes and educational programmes are implemented in schools and elsewhere.

Promoting partnerships to engage private players while at the same time including the informal waste recyclers in the process can be critical to enable the sector's transformation and development.

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Glossary

BSWaMA	Belize Solid Waste Management Authority
CCB	IDB's Caribbean region
CSWC	Caribbean Solid Waste Conference
DEHS	Department of Environmental Health Services (The Bahamas)
EHD	Environmental Health Department (Barbados)
EMA	Environmental Management Authority (Trinidad and Tobago)
EPD	Environmental Protection Department (Barbados)
EPA	Environmental Protection Agency - Australia
US-EPA	Environmental Protection Agency - United States of America
EPA Guyana	Environmental Protection Agency - Guyana
GBPA	Grand Bahama Port Authority
GNI	Gross national income
GHG	Greenhouse Gas
IDB	Inter-American Development Bank
ISWM	Integrated Sustainable (Solid) Waste Management
LAC	Latin America and Caribbean
MED	Ministry of Environment and Drainage (Barbados)
MLGCD	Ministry of Local Government and Community Development (Jamaica)
MoH	Ministry of Health (Jamaica)
MNRI	Ministry of Natural Resources and Immigration (Belize)
MSW	Municipal Solid Waste
MSWMD	Municipal Solid Waste Management Department (Guyana)
MTPTC	Ministère des Travaux Publics, Transports et Communications
NDC	Neighbourhood Democratic Councils
NEP	National Environmental Policy
NISWMP	National Integrated Waste Management Policy
NSWMA	National Solid Waste Management Authority (Jamaica)
PAHO	Pan American Health Organization
PIOJ	Planning Institute of Jamaica
PPP	Public private partnerships
RSWMP	Regional Solid Waste Management Programme
SBRC	Sustainable Barbados Recycling Centre
SLSWMA	Saint Lucia Solid Waste Management Authority

SMCRS	Metropolitan Solid Waste Collection Services (Haiti)
SSA	Sanitation Service Authority (Barbados)
SWM	Solid Waste Management
SWMCOL	Solid Waste Management Company Limited (Trinidad and Tobago)
SWMP	Solid Waste Management Project
SVDU	Syndicat National du Traitement et de la Valorisation des Déchets Urbains et Assimilés
THA	Tobago House of Assembly
Tpd	Tons per day
USW	Urban Solid Waste
VOV	Department of Waste Collection and Disposal (Suriname)
WTE	Waste to energy

Appendix 1

Caribbean Solid Waste Conference Participants

Participant/Speaker	Organisation	Country
Ms Milagros Mosteirín, Economist	University of San Andrés	Argentina
Mr Ricardo Marshall, Head of the Project Management Coordination Unit	Ministry of Environment and Drainage	Barbados
Mr Gilroy Lewis, Head	Solid Waste Management Authority	Belize
Ms Magda Correal, Waste Management Specialist	Consultant	Colombia
Mr Ricardo Valencia, Executive Director	CEMPRE	Colombia
Mr Colin Croal, Permanent Secretary	Ministry of Local Government and Regional Development	Guyana
Mr Peter Cohen, Involuntary Resettlement Expert	Consultant	Guyana
Mr Jean Donald Paraison, Director General	Service Metropolitain de Collecte des Residus Solides	Haiti
Dr Claudel Noel, Head of the Department of Environment and Territorial Planning	Henry Christophe Campus of Limonade of the State University of Haiti	Haiti

Dr Alex Padilla, Consultant	Consultant	Honduras
Mr Colin Bullock, Director General	Planning Institute of Jamaica (PIOJ)	Jamaica
Ms Deniesha Darling, Legal Officer	National Solid Waste Management Authority (NSWMA)	Jamaica
Ms Julia Brown, Manager Process Development Division	Scientific Research Council (SRC)	Jamaica
Dr Michael Taylor, Head Department of Physics & The Climate Studies Group Mona	University of the West Indies	Jamaica
Ms Jennifer Edwards, Executive Director	NSWMA	Jamaica
Ms Navarine Hylton, Director of the Waste Management Unit	Ministry of Health	Jamaica
Ms Gillian Guthrie, Senior Director, Environment and Risk Management Division	Ministry of Water, Land, Environment & Climate Change	Jamaica
Mr Christopher Corbin, Programme Officer, Division of Environmental Policy Implementation (DEPI)	UNEP Caribbean Regional Seas Programme (CEP)	Jamaica
Mr Kenji Tobita, Resident Representative	JICA	Jamaica
Regine Sainte-Croix, Owner/Manager	Reliable Solutions Caribbean	Martinique

Ms Esther Richards, Consultant	Consultant	Samoa
Mr Santosh Soman, Acting Permanent Secretary	Ministry of Public Works	Suriname
Ms Thomasina Wilson, Sr. Deputy Director	Department of Environment Health Services, Ministry of Environment and Housing	The Bahamas
Ms Julia Ramirez-Modeste, Planning Officer	Ministry of Local Government	Trinidad and Tobago
Ms Beverly Haywood, Planning Officer	Ministry of Local Government	Trinidad and Tobago
Dr Nickolas Themelis, Founder and Chairman	Waste to Energy Research and Technology Council	United States of America
Mr Paul Reusch, Federal On-Scene Coordinator with the Superfund Division	United States Environmental Protection Agency (EPA)	United States of America
Mr Rodrigo Riquelme, Water and Sanitation Senior Specialist	IDB	United States of America

