

Current Condition of Solid Waste Management and JICA Support in Sri Lanka

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Abstract

Sri Lanka, facing economic challenges exacerbated by COVID-19, is grappling with significant issues including poverty, income inequality and environmental concerns, particularly poor solid waste management (SWM). Projections indicate a sharp increase in national waste generation, exceeding 10,000 tonnes per day by 2020. Waste collection rates vary between provinces, with higher rates in the most populous ones, Western and Eastern provinces. The research methodology includes a literature review and observations to ascertain the current state of SWM in Sri Lanka. International and national policies, influenced by global conventions, shape Sri Lanka's waste management strategy, with a focus on circular-economy practices, biodegradable waste management, energy recovery and sustainable landfill practices. JICA has played a key role in supporting Sri Lanka's SWM initiatives, including the Clean City Initiative (JCCI) and historical assistance dating back to 2000. Projects such as the Western Province Solid Waste Management Master Plan aim to address challenges, with JICA's involvement extending to the promotion of composting policies supported by Japanese technology. Notable achievements include the introduction of mechanised composting facilities and the development of a waste management database system. Efforts also extend to strengthening plastic management capacity, as outlined in the National Action Plan for Plastic Waste Management 2021–2030. JICA's ongoing support includes capacity building for the newly established Plastic Management Centre. Overall, these initiatives reflect a commitment to sustainable waste management, environmental protection and the pursuit of a cleaner and healthier future for Sri Lanka.

Key words: environmental policy, JICA, material cycle, solid waste management, Sri Lanka

1. Introduction

Sri Lanka is an island nation in the northern Indian Ocean, covering an area of approximately 65,000 km². The population has been growing gradually, reaching 21,919,000 in 2020, from 20,668,000 in 2010 with a growth rate of 0.5 to 0.9%. Sri Lanka emerged as a middle-income country with an average growth rate of 5%–7% in recent years. Its GDP per capita was US\$2,837 in 2010, and US\$3,852 in 2020. However, Sri Lanka's average growth rate has declined to –5.1% since the mid-2010s due to COVID-19 and a severe economic crisis. General background information is provided in

Table 1.

There are still significant issues related to poverty, income inequality and social inequality in terms of the Sustainable Development Goals (SDGs) in Sri Lanka, and environmental issues between Western Province and the other provinces. One environmental issue is the poor solid waste management (SWM) in Sri Lanka. It is estimated that the amount of waste discharged nationally will exceed 10,000 tons per day by 2020, compared to 6,000 tons per day in 2000. Waste generation per capita was estimated at 0.2 to 0.9 kg/capita day in 2001 (Zurbrugg, 2003). Waste generation (tons/day) presented in Table 2 was estimated based on the projected population, source

Table 1 Background Information on Sri Lanka.

Item	2010	2015	2020
Population, total (millions) ¹⁾	20.668	21.336	21.919
Population density (people/km ²) ¹⁾	330	345	354
Population growth (annual %) ¹⁾	0.90	0.50	0.50
Life expectancy at birth, total (years) ¹⁾	73	75	76
GDP per capita (current US\$) ¹⁾	2,837	3,990	3,852
GDP per capita growth (annual %) ¹⁾	7	3.7	-5.1
Total number of local authorities (LA) ²⁾	330	335	341
Municipal councils (MC)	18	23	24
Urban councils (UC)	42	41	41
Pradeshiya Sabha authorities (PS)	270	271	278

Source:

1) The World Bank: <https://data.worldbank.org/country/sri-lanka>

2) Based on the responses and data from a direct interview with the staff of the Ministry of Local Government and Provincial Council.

Table 2 Municipal solid waste management in Sri Lanka in 2020¹⁾.

Province	Population	Estimated waste generation (tons/day)	Waste collection amount (tons/day)	Waste collection coverage (%)
1. Central	2,745,977	1,297	343	26.4
2. Eastern	905,935	453	245	54.0
3. North Central	1,312,952	613	84	13.7
4. North Western	2,274,388	1,043	209	20.1
5. Northern	1,206,943	583	193	33.2
6. Sabaragamuwa	2,184,684	1,008	182	18.0
7. Southern	2,551,156	1,214	261	21.5
8. Uva	2,185,168	1,034	336	32.5
9. Western	5,767,2440	3,019	1,873	62.1
Total	21,134,447	10,263	3,725	36.3

1) Based on the responses and data from a direct interview with the staff of the Ministry of Local Government and Provincial Council.



Kalutara



Karadiyana



Kerawalapitiya

Fig. 1 Illegal dumping sites in Kalutara, Karadiyana and Kerawalapitiya.

waste generation and economic growth rate. Most of the waste collected is still dumped in an uncontrolled manner in illegal dumping sites. Waste collection rates exceed 50% in Western and Eastern provinces, while other provinces have lower rates ranging from 10% to 30%. The condition of illegal dumping sites is shown in Fig.1.

Sri Lanka's National Communications to the United Nations Framework Convention on Climate Change highlight the waste sector as a significant contributor to the country's greenhouse gas (GHG) emissions. In particular, the waste sector contributed 28% of Sri Lanka's total GHG emissions in 2011. The country's updated Nationally Determined Contributions (NDCs) include targets to reduce GHG emissions by 14.5% unconditionally and up to 30% conditionally by 2030 compared to business as usual scenarios. While there is no direct reference to landfill gas recovery projects in the Act

itself, Sri Lanka's broader environmental and climate change strategies recognize the importance of landfill gas management as part of its efforts to meet emission reduction targets.

2. Methodology

The research methodology in this study consists of literature reviews and observations. The purpose of the literature reviews is to understand the current status of solid waste management (SWM) in Sri Lanka by analysing central and local government documents, previous research studies and donor oriented project documents, particularly from the Japanese government and the Japan International Cooperation Agency (JICA). JICA has been promoting international technical cooperation assistance to solve solid waste management

problems in Sri Lanka since the 1990s. The objective of the observations is to gather data on SWM from the provincial councils (PCs) and local authorities (LAs), to comprehend the opinions of stakeholders regarding SWM in selected LAs, and to identify social issues.

3. International Policy, National Policy, Regulations, Strategies and Official Documents related to SWM in Sri Lanka

Several international conventions and national policies have influenced Sri Lanka's waste management policy. In particular, the 2030 Agenda for Sustainable Development (2015) influenced the formulation of the SDGs, which are the basis of Sri Lanka's Sustainable Development Act (2017) and the establishment of the Council responsible for the implementation and formulation of the SDGs. The Paris Agreement (2019) influenced Sri Lanka to have the five following nationally determined contributions in the area of waste management. By implementing these, Sri Lanka aims to reduce greenhouse gas emissions by 11%.

- Circular-economy practices
- Management of biodegradable fractions of waste through biological treatment
- Energy recovery from non-recyclable waste
- Use of sanitary landfills for residual waste disposal
- General enabling activities such as systematisation of waste management, implementation of the polluter pays principle, public-private partnerships and capacity building.

In recent years, Sri Lanka has implemented a number of material recycling policies. The National Policy on Waste Management (2019) provides a vision, mission, goals, eight objectives, eight guiding principles and a set of policy statements for each category of waste and each area of intervention. The National Policy on Sustainable Consumption and Production (SCP) for Sri Lanka (2019) mentions a very relevant policy for a material cycle approach to waste management. The Sri Lanka Sustainable Development Act (2017) mentions the establishment of a council responsible for the implementation of the 2030 Agenda for Sustainable Development in Sri Lanka.

Since the 2010s many regulations on environmental protection and material cycles have been enacted. The Official Gazette Extraordinary 2255/50 of 21 January 2021 mentions the National Environmental Regulations (Plastic Material Identification Standards). The Official Gazette Extraordinary 2235/54 of 8 July 2021 mentions the planning, distribution and management of land, with particular reference to the management of solid waste, and specifies requirements for the management of solid waste in residential and non-residential establishments. In particular, it emphasises the creation of facilities for the smooth separation and collection of waste. The Cabinet

Paper presented by the President in 2021 emphasised reduction in the use of plastics. Official Gazette Extraordinary 2264/18 of 22 January 2022 provides a list of establishments to be licensed, including waste treatment/management facilities, composting facilities and solid waste recycling facilities of various sizes. The policies related to plastic waste management are shown in Table 3.

4. JICA's Support for Solid Waste Management in Sri Lanka

4.1 JICA Clean City Initiative (JCCI)

JICA has set 20 cooperation strategies on global issues (i.e., JICA Global Agenda), under which JICA collaborates with governments and individuals in partner countries, as well as engaging with various partners in Japan and abroad, to address global issues and to realize a free, peaceful and prosperous world where people can believe in a bright future and pursue diverse possibilities. JCCI is one part of the Agenda, where JICA contributes to achieving sound environmental quality for the development of a sustainable society to protect people's health and living environment in partner countries, thereby promoting the creation of "clean cities."

JCCI has identified a Development Scenario on "Promotion of healthy environment through appropriate environmental regulations and pollution control" to clarify the common logic of socio-economic development process across countries and deliver development impacts/outcomes as a "Cluster" beyond individual projects. The Scenario classifies the relevant initiatives and JICA's inputs in three stages as shown in Table 4. While taking into consideration that partner countries need to address these issues simultaneously and in parallel, JICA provides tailor-made supports developed and implemented based on respective circumstances under the Scenario.

4.2 History with JICA for Improving Solid Waste Management in Sri Lanka

JICA has assisted Sri Lanka in improving its solid waste management since shortly after the introduction of the first national policy on solid waste management in 2000. The first assistance, namely "Study on the Solid Waste Management for Secondary Cities in Sri Lanka (2002–2003)" supported the Government of Sri Lanka (GoSL) in formulating plans based on the identified waste management flows at each site and conducted pilot projects to improve its management. It also recommended the establishment of the NSWMSC to perform the function of providing central governmental support to LAs. After its establishment, JICA developed on the NSWMSC's capacity through "The Capacity Upgrading Project for the National Solid Waste Management Support Center" (2007–2011). In parallel, the Pilisaru Program

Table 3 List of policies related to plastic waste management.

Year	Title	Category	Summary
1988	Sri Lanka National Conservation Strategy	Environmental protection	Policies This is a comprehensive policy that mentions some key matters with regards to waste management as follows: 1. The dumping of waste materials disfiguring the landscape and adversely affecting the soil. These materials include coir dust, paddy husks, discarded tires and plastic waste. 2. Cleaner, low waste technologies should be used in setting up a technology transfer center that could also assist in the selection of such technologies 3. Recycling of materials should be promoted
1996	National Health Policy	Sanitation	A policy mainly concerning health with a general connection to waste management: "12. Strengthen integrated approaches with other governmental/non-governmental agencies to facilitate greater coordination for better health care. 1C. Focus on promoting positive health behavior"
2003	National Environmental Policies and Strategies (2003)	Sanitation	In the Health and Sanitation section, point 12 mentions: "Provide for the proper collection and disposal of solid waste, including hazardous waste, by sanitary land-fill or other suitable means"
2005	National Policy and Strategy for Cleaner Production	Material cycles	Introduces the concept of cleaner production with general relevance to waste management: "4.3 Apply lifecycle thinking to reduce eliminate overuse of raw materials and wastage and eliminate/reduce quantity and toxicity of emissions and discharges in production process and services in order to reduce/eliminate air water and land pollution 4.5 Create disincentives for production and use of environmentally harmful products and incentives for production and use of environmentally beneficial products by awareness campaigns, increased product information and also changing of consumers' behavioral patterns"
2006	National Wetland Policy and Strategy	Environmental protection	Specific mention of waste management: "3.5.3 Ensure WMCs are vigilant that wetlands are not used for illegal dumping of any kind of industrial waste and for discharging untreated effluent"
2007	National Policy and Strategy on Cleaner Production for Health Sector	Material cycles	Specific mention of waste management with a focus on reduce. "Healthcare institutions to establish and implement waste management systems prioritizing waste prevention strategies"
2007	National Policy on Solid Waste Management	Environmental protection/Material cycles	Comprehensive waste management policy. "5.1 Solid waste be managed in accordance with the 3R principle with special emphasis on waste preventive approaches 5.2 Hazardous biomedical/ Health care waste will be managed so as to prevent environmental contamination and minimize the risk to public and ecosystems"
2008	National Policy and Strategy on Cleaner Production for the Tourism Sector	Material cycles	General relevance to waste management. "Strategies 7.5 Apply lifecycle management to reduce/eliminate the overuse of natural resources by adopting the ecologically sound practice. Strategies 7.12: Established performance indicators and benchmarks to access and monitor the performance of the CP activities in the tourism sector."
2008	National Policy and Strategy on Cleaner Production for the Fisheries Sector	Material cycles	Specific mention of waste management. "Strategies: 7.9: Prevent disposal of hazardous waste including waste oil and untreated effluent into aquatic environment by improving existing waste management systems and developing new systems. Strategies: 7.8: Develop/introduce environmentally friendly and economically viable fish waste disposal systems"
2011	National climate Change Policy of Sri Lanka	Environmental protection	Specific relevance to waste management. Under (c) mitigation 13. Adopt integrated waste management systems for all types of waste assigning priority for prevention of waste generation with nationally appropriate low greenhouse gas emission technologies
2012	National Policy and Strategy on Cleaner Production for the Agriculture Sector	Material cycles	Specific mention of waste management with particular focus on reduce as well as integrated waste management practices. "Policy Statements: 6.5 Apply life cycle approach to reduce overuse/misuse of resources/ raw material and waste generation. Strategies: 7.2 Promote integrated water management practices"
2019	National Policy on Waste Management	Material cycles	The National Policy on Waste Management provides the specific and comprehensive policy framework for the sector (MoE&WR, 2019). This policy provides a vision, a mission, a goal, eight objectives, eight guiding principles and a series of policy statements for each category of waste and each area of intervention. Further, it details stakeholder responsibilities and relationships to waste management. 8.2.1 (2) focuses on packaging waste (including plastics).
2019	National Policy on Sustainable Consumption and Production (SCP) for Sri Lanka	Material cycles	A very relevant policy to material cycles approach to waste management. "4.1.2. by 2030, reduce waste generation through prevention, reduction, recycling, and reuse. Section 4: -create a database, -Waste resource exchange program, -Including WfE, -Sanitary landfill with recovery and recycling facilities established; rules and regulations for open burning strengthened and enforced., -Financial mechanism, -Technical assistance"
Acts			
1980	National Environmental Act No.47 of 1980	Sanitation	Establishment of the Central Environmental Authority
1981	Coast Conservation and coastal resource management Act No.57	Environmental protection	Established in point 12 b (v) that a coastal zone management plan must be submitted including appropriate waste disposal facilities. 25(1) mentions taking measures necessary to counter the negative effect of wastes/foreign bodies if such effect is found.
1987	Pradeshya Sabha Act No.15 of 1987	Sanitation	Specifies the duties and roles of the Pradeshya Sabha (local rural authorities)
1987	Provincial Councils Act No.42 of 1987	Sanitation	LAs contain provisions for waste management
1996	Fisheries and Aquatic Resources Act 2	Environmental protection	"37. No person shall, except upon a permit obtained from the Director or any person authorized by the director...(b)...discharge or deposit waste or any other polluting matter..." Offences related to aquaculture operations: "49A. (b) being a licensee discharges, dumps, deposits, releases or permits the discharging, dumping, depositing or releasing of any poisonous, noxious or harmful material or substance or waste water to any inland waters or to any land in such a manner as will affect the environmental quality of that land;" "61. The ministry may make regulations for and in respect of... the prevention of the disposal of industrial and domestic waste in Sri Lanka waters, and the prevention of the filling of Sri Lanka waters, in a manner detrimental to fish and aquatic resources in such waters;"
1998	Biodiversity Conservation Act, A Framework for Action	Environmental protection	In the Recommended Action section, point 26 mentions
2007	Prevention of Mosquitoes Breeding Act No.11 of 2007	Environmental protection	"Develop and apply feasible methods for waste disposal from industries, tourist hotels and households in the coastal zone, through surveys, research and community projects." Prohibition of creating conditions favorable to the breeding of mosquitoes.
2017	Sri Lanka Sustainable Development Act	Material cycles	Established council in charge of implementing 2030 Agenda for sustainable development in Sri Lanka
Ordinances			
1939	Urban Council Ordinance No. 61 of 1939	Sanitation	Specifies waste management responsibilities of UCs
1946	Nuisance Ordinance No. 62 of 1939 and No. 57 of 1946	Sanitation	Section 1-12
1946	Irrigation Ordinance No.48	Sanitation	Under the ordinance, regulations may be made for the prevention of entry of waste into water supplied from the irrigation projects.
1947	Municipal Councils Ordinances No. 16 of 1947	Sanitation	-Section 129: Duty of council as to conservancy and scavenging. -Section 130: All waste collected to be property of council. -Section 131: Places for disposal of waste and keeping equipment

Year	Title	Category	Regulations	Summary
1993	Government Notification 772/22 dated 18 th June, 1993	Environmental protection	Under The National Environmental Act, No. 47 OF 1980. Specifies requirement of waste management plan.	Under The National Environmental Act, No. 47 OF 1980. Specifies requirement of waste management plan.
1999	Waste Management Statute No: 9 of 1999	Environmental protection	Western Province Waste Management Authority established	"Each EIA project proponent must submit a waste management plan as a section of the EIA document"
2005	Gazette Extraordinary No. 1420/4 dated November 21 st , 2005	Material cycles	Regulations on packaging and labelling	Regulations on packaging and labelling
2006	Gazette Notification No. 1466/5 dated October 10 th , 2006	Environmental protection	Under The National Environmental Act, No. 47 OF 1980 Order under Section 23 W Regulation on Prohibition of Manufacture of Polythene or Any Product of 20 micron or below thickness	Under The National Environmental Act, No. 47 OF 1980 Order under Section 23 W Regulation on Prohibition of Manufacture of Polythene or Any Product of 20 micron or below thickness
2008	Gazette Extraordinary 1534/18 dated February 1 st , 2008	Environmental protection	Under Section 32 read with Section 23A and 23 B of the National Environmental Act, No. 47 of 1980. Guidelines on discharging waste and wastewater into the environment: "2. No person shall, discharge, deposit or emit waste into the environment or carry on any prescribed activity determined by an Order made under Section 23A of the National Environmental Act, No. 47 of 1980 in circumstances which cause or are likely to cause pollution, or noise pollution" "35. Every person who carries on any activity which generates or produces waste ... shall inform the Authority- (a) on or before the July 31 and January 31, respectively of each year, the quantity and characteristics of scheduled waste generated ... in the previous six months." "Tolerance limits are also set for different types of wastes.	Under Section 32 read with Section 23A and 23 B of the National Environmental Act, No. 47 of 1980. Guidelines on discharging waste and wastewater into the environment: "2. No person shall, discharge, deposit or emit waste into the environment or carry on any prescribed activity determined by an Order made under Section 23A of the National Environmental Act, No. 47 of 1980 in circumstances which cause or are likely to cause pollution, or noise pollution" "35. Every person who carries on any activity which generates or produces waste ... shall inform the Authority- (a) on or before the July 31 and January 31, respectively of each year, the quantity and characteristics of scheduled waste generated ... in the previous six months." "Tolerance limits are also set for different types of wastes.
2009	Gazette Notification No. 1627/19 dated 10.11.2009	Environmental protection	General Rules on SWM discharge and collection of waste (Prohibition of waste dumping at national highway and at any place other than places designated for such purpose by the LA)	Under National Environmental (Municipal Solid Waste) Regulations, No. 1 of 2009.
2010	Gazette Extraordinary 1660/30 dated 29 th June 2010	Material cycles (indirect)	Under Food (Packaging Materials and Articles) Regulations - 2010	Under Food (Packaging Materials and Articles) Regulations - 2010
2011	Gazette Extraordinary 1709/15 dated 7 th June 2011	Environmental protection	These regulations cover the list of food grade packaging and materials Under THE MARINE POLLUTION PREVENTION ACT, No. 35 OF 2008, Part 1 (7) mentions that any person in charge of the exploration for or exploitation of natural resources on sea shall maintain a garbage record book. The garbage record book also records plastics. Garbage is to be incinerated.	Under THE MARINE POLLUTION PREVENTION ACT, No. 35 OF 2008, Part 1 (7) mentions that any person in charge of the exploration for or exploitation of natural resources on sea shall maintain a garbage record book. The garbage record book also records plastics. Garbage is to be incinerated.
2012	Gazette Extraordinary 1741/19 dated 19 th January 2012	Environmental protection	Under- MARINE POLLUTION PREVENTION ACT No. 35 OF 2008, Shipboard waste disposal requirements are specified.	Under- MARINE POLLUTION PREVENTION ACT No. 35 OF 2008, Shipboard waste disposal requirements are specified.
2013	Gazette Extraordinary 1816/37 dated June 28 th , 2013	Environmental protection	"24. All vessels engaged in the bunker facility are required to use the streamlines waste reception facility provided by the Authority, for their shipboard waste disposal"	"24. All vessels engaged in the bunker facility are required to use the streamlines waste reception facility provided by the Authority, for their shipboard waste disposal"
2016	Gazette Extraordinary 1996/27 dated December 6 th 2016	Environmental protection	This regulation concerns issuance of permits for dumping at sea and the discharge standards Under THE MARINE POLLUTION PREVENTION ACT, No. 35 OF 2008	This regulation concerns issuance of permits for dumping at sea and the discharge standards Under THE MARINE POLLUTION PREVENTION ACT, No. 35 OF 2008
2017	Gazette Extraordinary No. 2034/33 dated September 1 st 2017	Material cycles	This regulation regards waste reception facilities at sea and the rules of the same to enable safe disposal of waste Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980, Prohibition of manufacture of polythene or any polythene product of twenty (20) microns or below in thickness	This regulation regards waste reception facilities at sea and the rules of the same to enable safe disposal of waste Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980, Prohibition of manufacture of polythene or any polythene product of twenty (20) microns or below in thickness
2017	Gazette Extraordinary No. 2034/34 of 2017 dated September 1 st 2017	Material cycles	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of polythene or any polythene product which is twenty (20) microns or below in thickness Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980, Prohibition of the manufacture of food wrappers from polythene as a raw material.	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of polythene or any polythene product which is twenty (20) microns or below in thickness Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980, Prohibition of the manufacture of food wrappers from polythene as a raw material.
2017	Gazette Extraordinary No. 2034/35 of 2017 dated September 1 st 2017	Material cycles	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of food wrappers manufactured from polythene as a raw material. Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of manufacture of any bag of high-density polyethylene as a raw material.	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of food wrappers manufactured from polythene as a raw material. Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of manufacture of any bag of high-density polyethylene as a raw material.
2017	Gazette Extraordinary No. 2034/36 of 2017 dated September 1 st 2017	Material cycles	Prohibition of sale, offer for sale, offer free of charge, exhibition or use of any bag manufactured from high density polyethylene as a raw material. Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. National Environmental (Prohibition of open burning of waste and other combustible matters inclusive of plastics) Regulations No. 1 of 2017	Prohibition of sale, offer for sale, offer free of charge, exhibition or use of any bag manufactured from high density polyethylene as a raw material. Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. National Environmental (Prohibition of open burning of waste and other combustible matters inclusive of plastics) Regulations No. 1 of 2017
2017	Gazette Extraordinary No. 2034/37 of 2017 dated September 1 st 2017	Material cycles	Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of the use of all forms of polyethylene, polypropylene, polyethylene products or polypropylene products as decoration in political, social, religious, national, cultural or any other event or occasion.	Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of the use of all forms of polyethylene, polypropylene, polyethylene products or polypropylene products as decoration in political, social, religious, national, cultural or any other event or occasion.
2017	Gazette Extraordinary No. 2034/38 of 2017 dated September 1 st 2017	Material cycles	Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of the manufacture of food containers, plates, cups and spoons from expanded polystyrene	Under THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibition of the manufacture of food containers, plates, cups and spoons from expanded polystyrene
2021	Gazette Extraordinary 2255/50 of 2021 dated January 21, 2021	Material cycles	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of food containers, plates, cups and spoons manufactured from expanded polystyrene within the country. THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980.	Prohibition of the sale, offer for sale, offer free of charge, exhibition or use of food containers, plates, cups and spoons manufactured from expanded polystyrene within the country. THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980.
2021	Gazette Extraordinary 2255/51 of 2021 dated January 21, 2021	Material cycles	National Environmental (Plastic Material Identification Standards) Regulations No. 01 of 2021.	National Environmental (Plastic Material Identification Standards) Regulations No. 01 of 2021.
2021	Gazette Extraordinary 2255/54 dated July 8 th 2021	Environmental protection/Material cycles	THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibiting use of PET and PVC for packaging agrochemicals. Banning. 1.Sachets with volume less than 20ml/ weight less than 20 g (except food/medical use), 2.Inflatable toys (except balloons, water pools, floating gear),3.Cotton buds with plastic stems (except for medical use)	THE NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980. Prohibiting use of PET and PVC for packaging agrochemicals. Banning. 1.Sachets with volume less than 20ml/ weight less than 20 g (except food/medical use), 2.Inflatable toys (except balloons, water pools, floating gear),3.Cotton buds with plastic stems (except for medical use)
2021	Cabinet Paper presented by the president	Material cycles	Under URBAN DEVELOPMENT AUTHORITY LAW, No. 41 OF 1978 OF THE NATIONAL STATE ASSEMBLY	Under URBAN DEVELOPMENT AUTHORITY LAW, No. 41 OF 1978 OF THE NATIONAL STATE ASSEMBLY
2022	Gazette Extraordinary 2264/17 dated January 22, 2022	Environmental protection	This regulation regards land planning, distribution, and management. Points 77 and 78 particularly concern solid waste management and specify solid waste management requirements for residential and non-residential establishments. It particularly emphasizes creating facilities to enable smooth segregation and collection of waste.	This regulation regards land planning, distribution, and management. Points 77 and 78 particularly concern solid waste management and specify solid waste management requirements for residential and non-residential establishments. It particularly emphasizes creating facilities to enable smooth segregation and collection of waste.
2022	Gazette Extraordinary 2264/18 dated January 22, 2022	Environmental protection	Emphasizes reduction of plastic usage	Emphasizes reduction of plastic usage
2022	Gazette Extraordinary 2294/30 dated August 23 rd 2022	Material cycles	THE NATIONAL ENVIRONMENTAL ACT, No. 47 of 1980. This regulation specifies rules for establishments (as listed in 2264/18) that need a license permit to operate. In List (V), there is a mention of tolerance limits for the discharge of leachates in respect of either solid waste or hazardous waste landfill into either inland surface waters, coastal waters, or both. This regulation gives a list of establishments for which a license is required. This includes waste treatment/management facilities, composting plants and solid waste recycling plants of various scales.	THE NATIONAL ENVIRONMENTAL ACT, No. 47 of 1980. This regulation specifies rules for establishments (as listed in 2264/18) that need a license permit to operate. In List (V), there is a mention of tolerance limits for the discharge of leachates in respect of either solid waste or hazardous waste landfill into either inland surface waters, coastal waters, or both. This regulation gives a list of establishments for which a license is required. This includes waste treatment/management facilities, composting plants and solid waste recycling plants of various scales.
2022	Gazette Extraordinary 2294/30 dated August 23 rd 2022	Material cycles	Imports and Exports Control Act, No.1 of 1969. Importation of any goods, specified in Schedule 1 shall be suspended until further notice. Plastic related articles include: 1.Tubes, pipes, hoses of plastic, 2.Floor/wall/ceiling coverings of plastic, 3.Self-adhesive plates, sheets, film, foil, tape, strips, flat and other shapes of plastic, 4.Gloves or mittens,5.Trunks, suitcases, bags, cases etc. with plastic sheeting, 6.Waterproof footwear with outer soles of plastic, 7.Machine tools, 8.Combs/hair sliders, 9.Toys,	Imports and Exports Control Act, No.1 of 1969. Importation of any goods, specified in Schedule 1 shall be suspended until further notice. Plastic related articles include: 1.Tubes, pipes, hoses of plastic, 2.Floor/wall/ceiling coverings of plastic, 3.Self-adhesive plates, sheets, film, foil, tape, strips, flat and other shapes of plastic, 4.Gloves or mittens,5.Trunks, suitcases, bags, cases etc. with plastic sheeting, 6.Waterproof footwear with outer soles of plastic, 7.Machine tools, 8.Combs/hair sliders, 9.Toys,

Table 4 Development scenario on “Promotion of healthy environment through appropriate environmental regulations and pollution control.”

Task	Approach	Specific inputs (■: Technical support, □: Financial aid)
<u>Stage 1</u> Establish a waste management flow and maintain to improve public health	- Collect and comprehend waste data - Review short-term improvement measures and formulate medium- to long-term policies - Develop a waste management flow and management structure	<ul style="list-style-type: none"> ■ Organize the definition and classification of waste ■ Understand waste flows by introducing inspection methods and improving data management capabilities ■ Formulate the basic policy and master plan for waste management improvement ■ Improve the planning and implementation capacity at each stage of the waste management flow (Develop rules and guidelines for collection, transportation and final disposal; improve the competence of personnel in charge of waste management operations) □ Improve equipment and facilities (including collection and transport equipment, heavy machinery for disposal sites, transfer stations and disposal sites)
<u>Stage 2</u> Reduce environmental impact through proper waste management and reduction	- Develop plan and introduce technologies and equipment for waste reduction and intermediate treatment; - Strengthen legal and institutional bases	<ul style="list-style-type: none"> ■ Support the formulation and implementation of waste reduction plans ■ Optimize organizational and financial systems by streamlining operations and improving fee collection ■ Support the development of a legal system, planning and implementation for promoting the 3Rs and developing recycling businesses ■ Promote resident education and private-sector cooperation (social norms, environmental laws and public relations strategies) ■□ Introduce intermediate treatment facilities and environmentally friendly disposal methods (sorting, composting, sanitary landfills, etc.) ■ Support the formulation of policies and legal systems concerning waste that require special considerations such as infectious or hazardous waste, and development of the capacity to enforce such policies and systems
<u>Stage 3</u> Promote a Sound Material-Cycle Society through a wide range of actors	- Introduce measures that facilitate waste reduction and resource reuse - Strengthen financial base	<ul style="list-style-type: none"> ■ Support the introduction of regulations, incentive measures and an Extended Producer Responsibility system that will lead to increased producer responsibility ■ Pursue technological innovations and scale up such innovations by expanding partnerships (build and operate collaborative platforms) ■□ Support the mobilization of private funds and the introduction of Japanese technologies □ Improve intermediate treatment (Incineration power generation: yen loans; recycling and small-scale incineration: private-sector collaborative projects)

was launched by the Ministry of Environment in 2008 to develop small-scale decentralized composting plants across the island. The number of compost plants increased from 17 in 2006 to 71 in 2010 and further to 112 in 2015 (JICA, 2016). During this first decade, various issues were addressed for the improvement of public health with huge investments in waste management facilities. These inputs were mainly classified as addressing the Stage 1 Task of the JCCI Development Scenario. However, the GoSL’s capacities in understanding waste flow and improving data management were not adequately developed; hence, waste management data have not been systematically maintained while ad-hoc data collection surveys, led by development partners, complemented this to some extent.

Since 2011, more focus has been given to reducing environmental impacts. To begin with, the “Project for Development of Pollution Control and Environmental Restoration Technologies of Waste Landfill Sites Taking into Account Geographical Characteristics in Sri Lanka (2011–2016)” developed a guide for sustainable planning, management and pollution control at waste landfills. Japanese researchers also developed pollution control technology for landfills, utilizing locally available materials, with a view to ensuring the sustainability of

their operation and maintenance. Subsequently, the experts dispatched for “Pollution Control and Reduction of Environmental Burden in Solid Waste Management (2017–2019)” disseminated the guide and conducted pilot projects to protect the living environment from pollution. In parallel, a mechanised compost plant was introduced in collaboration with a Japanese company to adjust its technology to Sri Lankan local circumstances. During this second decade, localized Japanese technologies have been delivered to improve waste management and reduction, thereby contributing to environmental protection. These initiatives can be seen as a good practice for Stage 2 of the JCCI Development Scenario. However, in Western Province, where the highest population density and most business activity generate a tremendous amount of waste, necessary measures have been delayed until JICA commences assistance in formulating a master plan.

2017 marked a major juncture to provide huge assistance to Sri Lanka’s most congested and challenging province for waste management, namely Western Province, when the Meethotamulla waste disposal site collapsed claiming many lives of nearby residents, an unforgettable accident for Sri Lanka’s environmental administration. JICA immediately provided emergency relief goods and dispatched the Japan Disaster Relief



Fig. 2 Kurunegala Municipal Council's Kawashima compost plants.

Expert Team. One of their recommendations was to develop a waste management master plan (MP) for Western Province, and subsequently the biggest ever project the “Project for Formulation of Western Province Solid Waste Management Master Plan in Sri Lanka (2019–2023)” was initiated. The project supported formulating an evidence-based MP encompassing medium to long-term forecasts and a range of solutions to tackle waste management problems. The first Sri Lankan initiative to establish a waste management database system was implemented in Western Province through this project, which is expected to facilitate the PDCA cycle of MP implementation. The Sri Lankan authorities together with other donor agencies are working to disseminate this approach to other provinces. JICA will further expand the function of this database through a new project the “Project for Strengthening Plastic Management Capacity,” described below, to keep track of the segregated individual plastic materials rather than collectively monitor the amount of waste.

In addition, as many as 42 environmental education volunteers (Japan Overseas Cooperation Volunteers) have been dispatched since the first year of JICA's assistance to solid waste management (2002) and worked together with Sri Lankan counterparts to improve the waste management and living environment. The volunteers have supplemented the work done by Japanese experts dispatched under the above-mentioned projects to produce the desired outcome at the grassroots level.

4.3 Advancing Composting Policy Supported by Japanese Technology

In reviewing the solid waste management history of Sri Lanka, it is remarkable that the National Policy on Waste Management (2020) stipulates that “land filling shall be limited to non-recyclable, non-compostable and inert material generated through waste treatment processes.” This policy, which stipulates that all compostable waste shall be treated by composting, is unique to Sri Lanka with its thriving agriculture industry and strong compost demand. In 2022, agriculture's DGP contribution was 8.2% while its employment rate was 26.5% (Central Bank of Sri Lanka, 2023).

Sri Lanka's first mechanized compost plant was

introduced by Kawashima Co., Ltd. & ENVIR Solutions Lanka Japan (Pvt) Ltd. through the “Pilot Survey for Disseminating SME Technologies for Recycling Project of Organic Waste by Screw Type Composting Plant (2015–2017).” This survey scheme by JICA aims to verify the effectiveness of Japanese SME's technologies in developing countries and to enhance the development outcomes through dissemination of their products. After the successful completion of the pilot project to produce good quality compost by adjusting the Japanese technology and its operation based on waste composition and climate conditions, the GoSL decided to replicate this solution in other regions and has procured and commissioned nine additional Kawashima compost plants. This mechanized “screw-type” compost plant can treat 50 tons of biodegradable waste to produce 10–15 tons of compost per day through an aerobic biodegradation process utilizing Japanese technology. The Kawashima compost plants introduced at Kurunegala Municipal Council is shown in Fig.2.

4.4 Database System under Municipal Solid Waste Management Master Plan in Western Province

From 2019 to 2023, JICA implemented the Project for Formulation of Waste Management Master Plan in Western Province Master Planning Study in Western Province, which has the largest population and economy of Sri Lanka's nine provinces. The project developed a database system on municipal solid waste in Western Province. The database has been introduced to 49 LAs in Western Province. LA waste management officers input the amounts of waste collection; intermediate treatment amounts such as composting and WtE; volumes transferred at transfer stations; and amounts of final disposal and recycling on a daily, weekly and monthly basis, which are then shared with the relevant agencies in Western Province and the central government. It monitors the status of solid waste management and keeps the data used in these plans up to date. The database consists of the following five modules and the dashboard is shown in Fig.3.

Module 1: User control, database setting

Module 2: General waste management data input

Module 3: Waste collection database

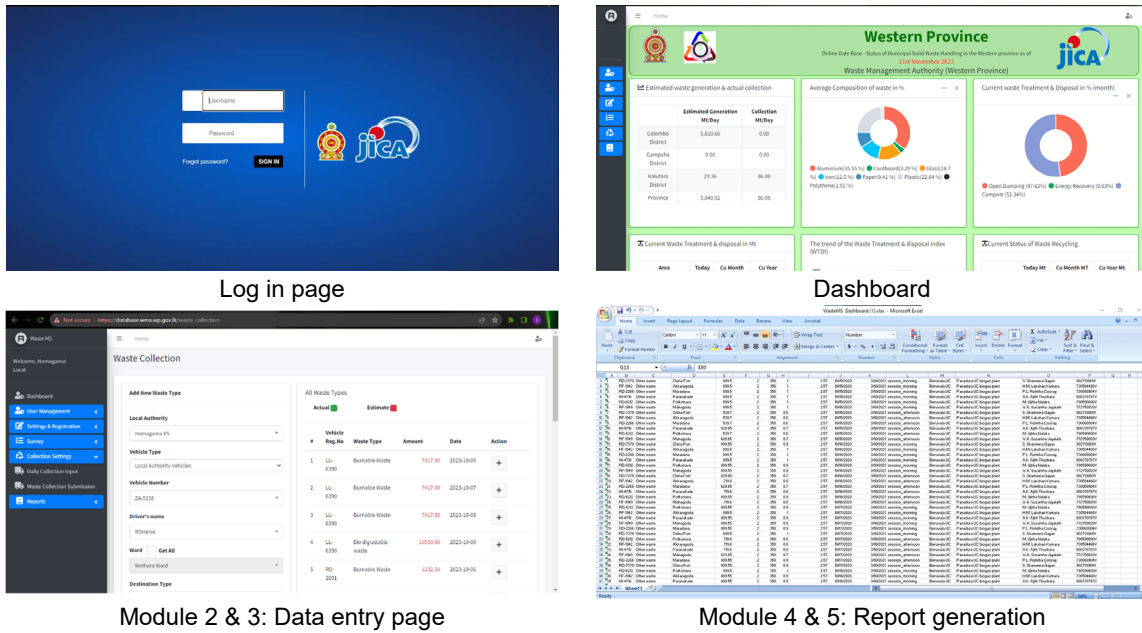


Fig. 3 Database system dashboard.



Fig. 4 Plastic recycling facility in Central Province.

Module 4: Data analysis

Module 5: Data publication

4.5 Project for Strengthening Plastic Management Capacity

The National Action Plan on Plastic Waste Management 2021–2030 was formulated with financial support from the Ministry of the Environment, Japan. It recommended the establishment of the Centre for Plastic Management (CPM), which was positioned as a priority for waste management in Sri Lanka. Although the CPM was established in 2022, its functions have not been clearly defined and the human resource system is still fragile. JICA has been supporting the CPM's capacity building under the Technical Cooperation Project since September 2023 for a term of three years. The several site surveys to understand the status of plastic recycling in Sri Lanka were conducted as shown in Fig.4.

5. Conclusions

Owing to solid waste management legislation, regulations and strategies, as well as technical assistance

and training through long-standing JICA projects, solid waste management in Sri Lanka has improved from previous years in terms of sanitation and the environment. Under current conditions of low recycling rates, however, solid waste management in Sri Lanka faces a number of issues, such as establishing a resource recycling system for plastics and other resources, and building a consensus for implementing regional solid waste management. Population and economic growth will continue to increase the amount of waste generated and the variety of waste types, and these are again causing serious environmental and social problems. To solve these existing and future problems, further appropriate policy decisions, applicable technologies to build a circular society, adequate financing and awareness-raising will be essential.

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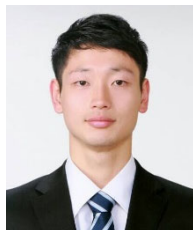
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