SOLID WASTE MANAGEMENT IN ESWATINI

CHALLENGES AND OPPORTUNITIES

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Maps used in this document are not to scale.

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List of Abbreviations

EEA	Eswatini Environment Authority
EMA	Environmental Management Act
GHG	Greenhouse gas
MCIT	Ministry of Commerce, Industry and Trade
MEE	Ministry of Enterprise and Employment
MEPD	Ministry of Economic Planning and Development
MH	Ministry of Health
MHA	Ministry of Home Affairs
MHCP	Multi Hazard Contingency Plan
MHSW	Ministry of Health and Social Welfare
MHUD	Ministry of Housing and Urban Development
MNRE	Ministry of Natural Resources and Energy
MOA	Ministry of Agriculture
MOAC	Ministry of Agriculture and Co-operatives
MOH	Ministry of Health
MOTEA	Ministry of Tourism and Environmental Affairs
MPWT	Ministry of Public Works and Transport
MTAD	Ministry of Tinkhundla Administration and Development
N_2O	Nitrous Oxide
NDMA	National Disaster Management Agency
NDMP	National Drought Management Policies
NSWMS	National Solid Waste Management Strategy
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
SEA	Swaziland Environment Authority

TEQ	Toxic Equivalents
UNEP	United Nations Environment Programme
uPOPs	Unintentionally produced persistent organic pollutants

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1. Introduction

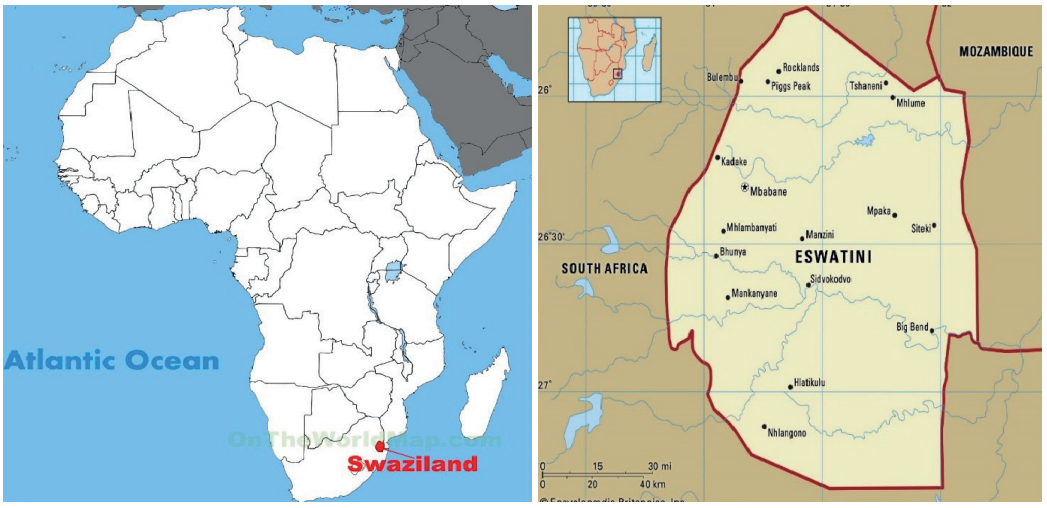
Demography

The Kingdom of Eswatini is situated in the south-eastern part of Africa between 25° and 28° latitude south and 30° and 33° longitude east. The country covers a land area of 17,364 sq km and has an elevation range of 60–1,860 metres above sea level. Eswatini is landlocked, bound by the Republic of South Africa on the north, west and south and by the Republic of Mozambique to the east (see *Map 1: Location of Eswatini in Africa*). Although small in size, Eswatini is characterized by a great variation in landscape, geology, soils, climate and biodiversity. It is a lower-middle-income country with a GDP of $4.71 billion. The country has a population of 1.15 million people.[1] The population density in Eswatini is 67 per sq km (175 people per sq mile). The population of Eswatini was found to be over 1 million in 2007, with an annual growth rate of 0.9 per cent; the population for the year 2017 was found to be nearly 1.1 million, with an increase of 10 per cent from 2007 (see *Graph 1: Year-wise population of Eswatini*).[2]

Increasing population in the country means that solid waste generation is also increasing. Most of the population resides in Manzini and Hhohho regions with small percentages in the Shiselweni and Lubombo regions. Hhohho has the highest population density of 78.1 people per sq km and Lubombo has the lowest population density of 33.6 people per sq km, far below the national average density of 58.7 people per sq km. Hhohho is the economic hub of Eswatini and hosts a significant fraction of the Manzini–Mbabane corridor. That is why it is home to a large chunk of the country's urbanized population and waste generation.

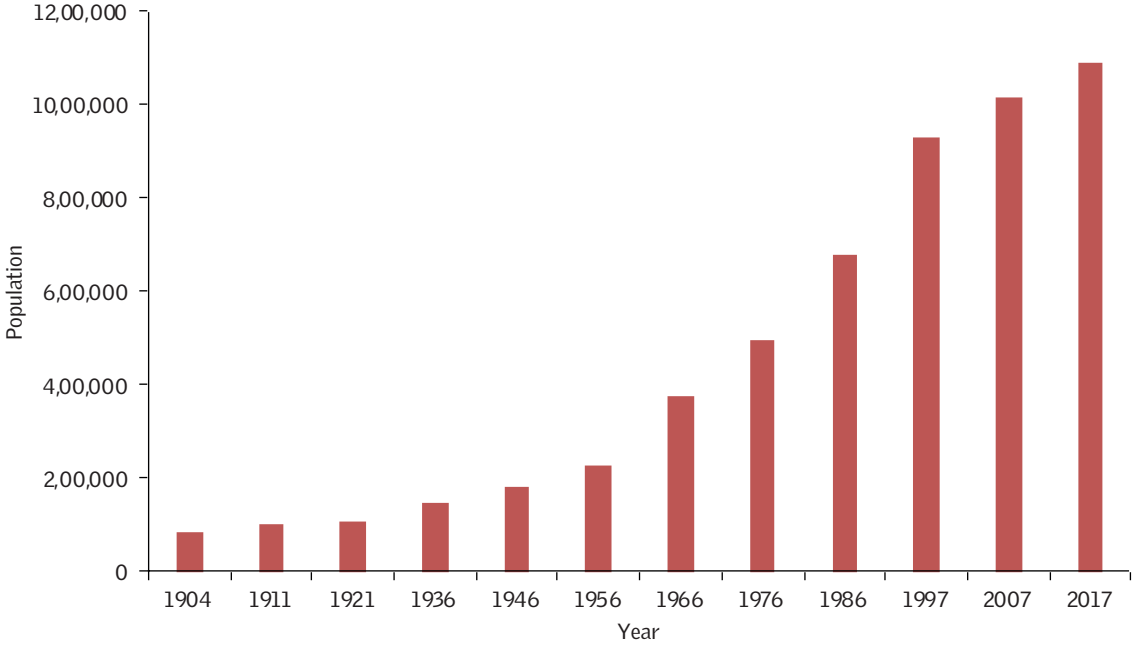
As Eswatini's population density and rate of urbanization are rising, waste generation is increasing at an escalating rate. In the future, waste management is expected to become even more challenging and expensive for the government, local authorities and urban residents.

Map 1: Location of Eswatini in Africa



Source: https://www.britannica.com/place/Eswatini

Graph 1: Year-wise population in Eswatini



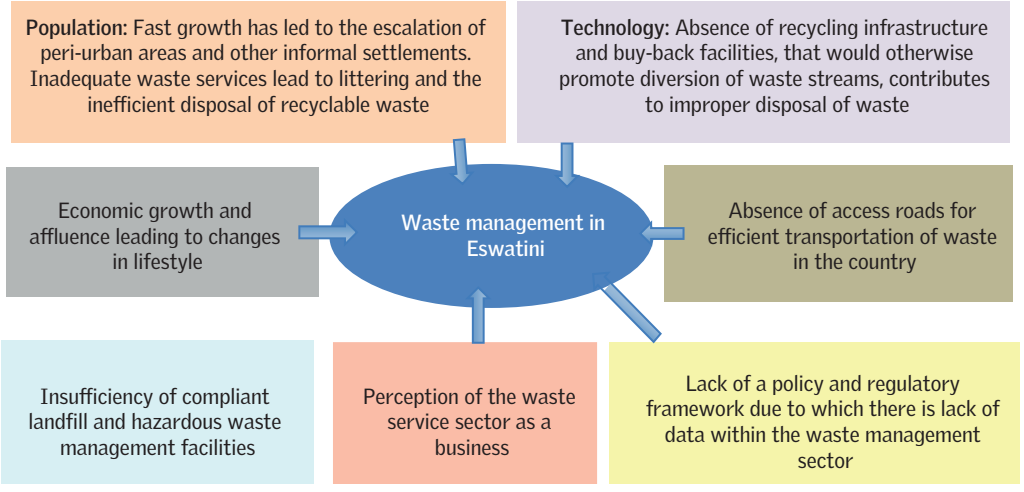
Source: 2017 Population and Housing Census Preliminary Results, Central Statistical Office, Kingdom of Eswatini

Need for improving waste management in Eswatini

Growing population and urbanization are the leading causes of waste generation in Eswatini. In addition, industrialization and consumption patterns clearly indicate that waste generation is going to increase at a high rate. Absence of concrete information about waste has restricted strategic management of waste thus far. It has prevented implementation of appropriate remedial actions such as changes in behavioural patterns, establishment of waste management infrastructure and the passing of required legislation to prevent, recycle and eventually collect, treat and dispose of waste scientifically.

As per World Bank's *What a Waste 2.0* report,[3] Eswatini's waste generation was estimated to be 218,199 tonne for the year 2016, with per capita waste generation at 0.45 kg/day. The predominant method of waste disposal in urban areas—landfilling or dumping of waste—is not a sustainable solution as it requires large amounts of land and leads to environmental and health hazards. Even in those urban areas where waste management services exist, waste collection efficiency is only 50–60 per cent. There are also growing problems of public littering and illegal dumping of both household and construction and demolition (C&D) waste. These are just some of the many reasons why Eswatini needs to overhaul its waste management systems (see *Figure 1: Drivers pushing improvements in waste management systems in Eswatini).*

Figure 1: Drivers pushing improvements in waste management systems in Eswatini



Source: CSE, 2021

In Eswatini, there are no intentionally produced dioxins and furans, but there may be release of unintentionally produced persistent organic pollutants (uPOPs) by different sectors of the economy such as waste sector, combustion processes and some industrial manufacturing processes. The Polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) inventory done in 2017 estimated total emissions to be 74.44 g TEQ/a, which was an increase from 51.16 g TEQ/a found in the inventory report of 2010.[6] Waste disposal was found to be a major source with a total contribution of 44.6 g TEQ/a (60 per cent). Waste disposal was followed by heat and power generation at 13.2 g TEQ/a (18 per cent), open burning processes at 12.1 g TEQ/a (16 per cent), and waste incineration at 4.5 g TEQ/a (6 per cent).

Currently, the most common way of dealing with waste in Eswatini is to collect it in the boundaries of respective local governments and disposing it of in dumpsites or burning it. Both these methods are deeply problematic.

Firstly, city authorities are running out of space to keep dumping waste and are finding it extremely difficult and costly to get new landfill sites. Secondly, even if they were able to get new landfill sites easily, this would still not be the best way to dispose of waste. Waste dumped in landfills is typically considered as aggregate waste, rather than being classified as hazardous, medical, household, etc., because the profile of this waste is unknown. As a result, hazardous leachates generated from mixed waste can contaminate groundwater and severely affect adjoining ecosystems. Further, organic waste disposed of in landfills decomposes and emits harmful gases like methane (a gas which is estimated to have a global warming potential of 28–36 over 100 years).[4]

Open burning of waste results in emission of harmful greenhouse gases (GHGs) and persistent organic pollutants (POPs) such as polychlorinated dioxins and furans. As a result, air, water and soil of adjoining areas may contain these POPs, thereby increasing the exposure risk to humans and animals. Potential health impacts could be increased risk of cancers, reproductive disorders, alteration of the immune system, neuro-behavioral impairment, endocrine disruption, genotoxicity and increased birth defects.[5]

Open burning is not only done informally by waste pickers to extract valuable recyclables but is also carried out in the dumpsites of formal institutions such as municipalities, company towns and upcoming development areas, particularly in peri-urban and rural areas, to reduce the volume of waste generated and to dispose of combustible waste materials.

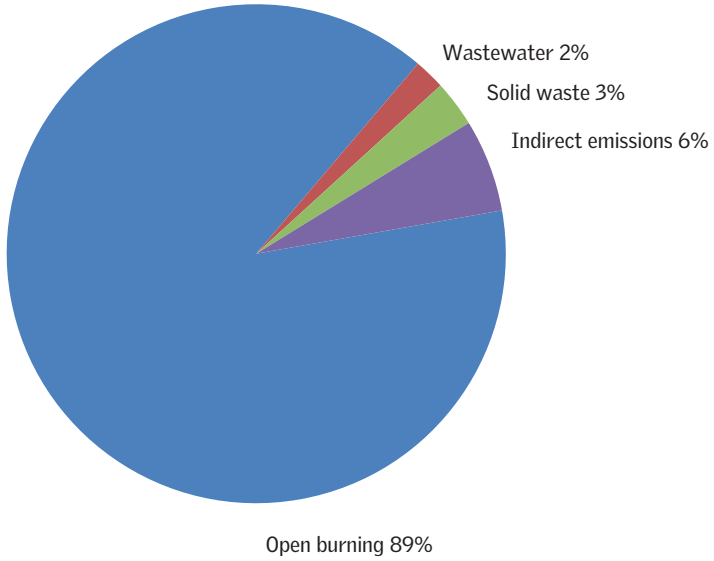
Need for scoping study

These waste (mis)management practices are likely to cause irreversible environmental and health hazards to the entire country and are highly unsustainable for future generations. According to a UNEP report (2016),[7] the waste sector is the second largest emitter in Eswatini with estimated emissions of 6,658 $GgCO_2e$ (about 33.7 per cent of the total GHG emissions in the country). Open burning of waste is responsible for 89 per cent of these emissions (see *Graph 2: Share of greenhouse gas emissions from the waste sector*).

GHG emissions from waste in Eswatini have steadily increased over the years, with a slight dip in 2007 (see *Graph 3: Summary of emissions from waste*). This could be attributed to the fear of fire damage after the massive destruction of property and forests in 2006. There has been an attempt to extend waste collection to peri-urban areas, but due to the excessive costs of waste collection, the practice of waste burning has continued unabated in these areas.

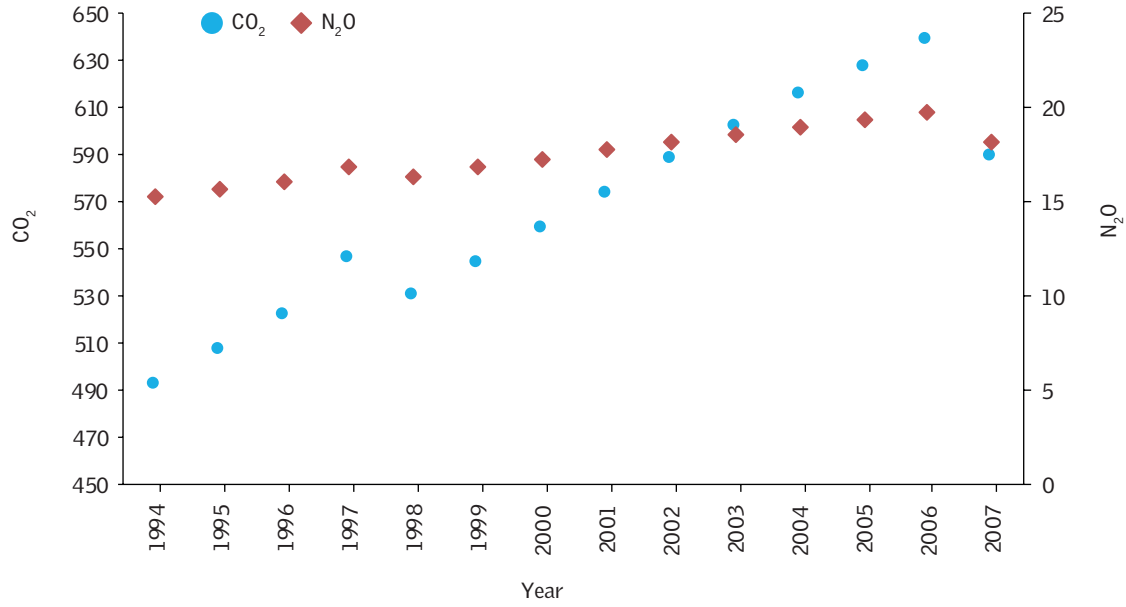
The last waste inventory in Eswatini was done in 1997. Waste generation was close to 86,000 tonne per year, with per capita daily generation at 240g. Clearly, there is an urgent need to review and strengthen the existing institutional and infrastructural capabilities of Eswatini in order to achieve sustainable solid waste management

Graph 2: Share of greenhouse gas emissions from the waste sector



Source: UNEP, 2016

Graph 3: Summary of emissions from waste (1994–2007)



Source: UNEP, 2016

based on resource conservation and circular economy principles. There are a number of critical areas that need improvement urgently, especially for poor rural communities. This can contribute to making growth more inclusive as nearly 40 per cent of the population currently lacks access to basic sanitation facilities.

2. Eswatini's governance structure

Current administrative framework

Eswatini is a 'constitutional monarchy', where both parliamentary and traditional systems of governance run concurrently. Eswatini is ruled by a King, with legislative powers vested with the Parliament. A Cabinet of Ministers and a National Council, whose members are drawn from among the country's traditional leaders, advise the King. Western and traditional Swazi systems of governance converge in the Parliament, which consists of the House of Assembly and the Senate. The country is divided into four administrative regions: Hhohho, Manzini, Shiselweni and Lubombo.

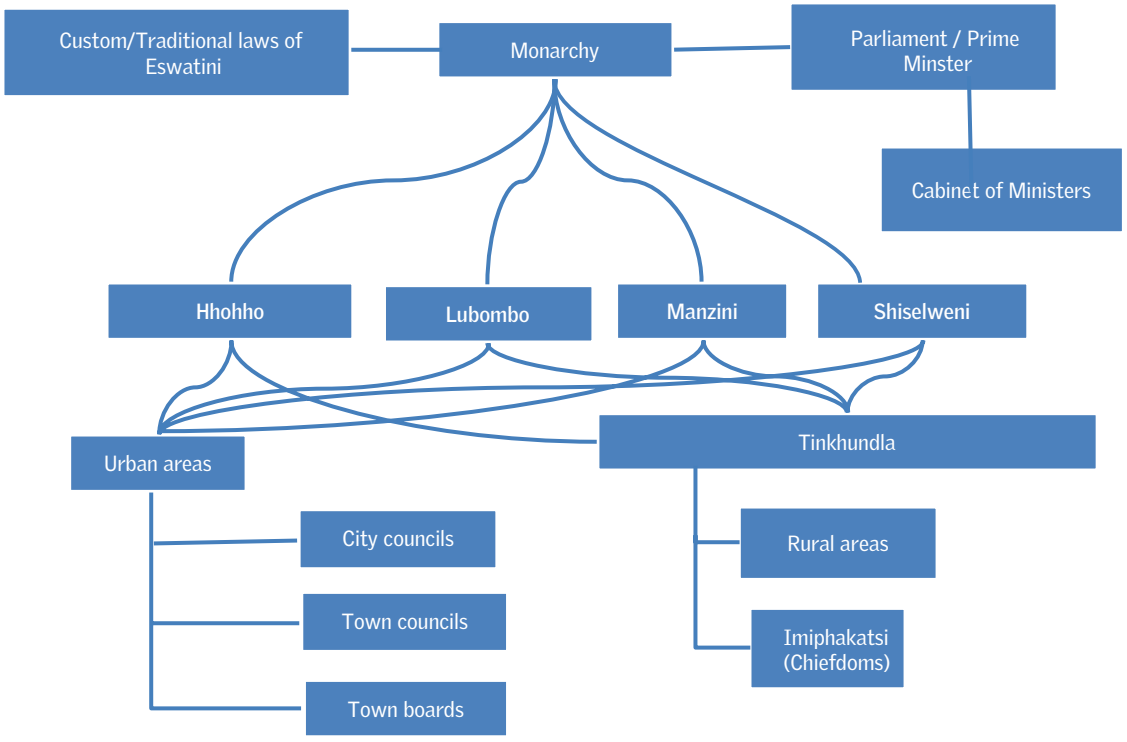
Council types: Local government is categorized into rural and urban councils which are structured differently. Although there are a range of political structures within the local authorities, effectively the urban councils are urban local governments and the rural councils are chiefdoms. Government in urban areas is three-tiered: city councils, town councils and town boards. Similarly, government in rural areas is also three-tiered: the regional administration, tinkhundla and chiefdoms. Decisions are made by the full council based on recommendations from various subcommittees. The town clerk is the chief advisor in each local authority council or town board.

The country is divided into four administrative regions—namely Hhohho, Lubombo, Manzini and Shiselweni. These regions have their 'capital' towns or cities which are governed by respective regional administrators. Within the regions, there are 59 tinkhundla or constituency areas. Each inkhundla houses a number of chiefdoms which are led by Chiefs. However, the Chiefs do not feature in the inkhundla leadership structure as they hold a traditional leadership role.

Table 1: Regional governance terminology

Regional governance terminology	Meaning
Tinkhundla	It is the third level of government responsible for governance at the local level.
Inkhundla	Tinkhundla is singularly known as inkhundla.
Umphakatsi/Chiefdom	It is an administrative subdivision smaller than an inkhundla.
Imiphakatsi	Umphakatsi are collectively known as imiphakatsi.
Bucopho	Bucopho is the representative of a chiefdom at inkhundla level.

Figure 2: Administrative framework of Eswatini



The inkhundla leadership structure only shows the Induvna Yenkhundla, the Member of Parliament (constituency representative in the House of Assembly), and Bucopho (chiefdom representative in the inkhundla leadership). All these are elected political figures at inkhundla level.[8]

Tinkhundla is the third level of government responsible for governance at the local level. There are 55 tinkhundla spread across the four regions in the country (under section 218 sub-section 2 of the Constitution).

Table 2: Tinkhundla across administrative regions[9]

Name of the region	Number of tinkhundla in the region	Number of chiefdoms in the region
Hhohho	15	97
Lubombo	11	101
Manzini	18	87
Shishelweni	15	100

The Ministry of Tinkhundla Administration and Development has a mandate to facilitate regional development and promote service delivery at Tinkhundla and chiefdoms levels. Tinkhundla are the foundation for the bottom-up development planning process and the delivery of local services in partnership with the central government. A major area of focus in the process is the development, implementation, monitoring and evaluation of evidence-based integrated development plans funded by development grants and central government budget where applicable. The ministry also has a mandate to bring about improvements in the performance and effectiveness of the administration and management of the regions, tinkhundla committees and chiefdoms. A chiefdom (Umphakatsi) is an administrative subdivision smaller than the tinkhundla. There are 385 chiefdoms or imiphakatsi in the country, each equivalent to a local community. Bucopho is the representative of a chiefdom at tinkhundla level. The Bucopho, together with their communities, initiate, compile and co-ordinate development projects and programmes within the chiefdom.

Currently, there are 12 gazetted urban local authorities, five company towns and four declared controlled areas spread across Hhohho, Lubombo, Manzini and Shiselweni. Urban Local Areas are formed by the Ministry of Housing and Urban Development (MHUD) and established by the Urban Government Act, 1969. The Urban Government Act recognizes three types of urban local governments—town boards, town councils and city councils. This variation depends on the size (in terms of population) of the town or city.

Mbabane is the administrative capital of the country. Mbabane and Manzini are major urban areas and, together with their hinterlands, form dual growth points in the core region centered around the Matsapha industrial estate. They are located in the west-central part of the country where approximately 70 per cent of the country's urban population resides.

Table 3: Urban areas of Eswatini

• Mbabane and Manzini are classified as city councils.
• Nhlangano, Pigg's Peak and Siteki are classified as town councils.
• Matsapha, Ezulwini, Hlatikhulu, Mankayane, Vuvulane, Ngweyna and Lavumisa are classified as town boards
• Simunye, Big Bend, Mhlume, Bhunya and Matata are company towns.
• Mhobodleni, Magindaneni, Buhleni and Sikhuphe are controlled areas.

Current regulatory framework for waste management

Key policies for governing waste management in Eswatini are Environmental Management Act (EMA) of 2002, the Waste Regulations Act of 2000 and the National Solid Waste Management Strategy (NSWMS) (see *Table 4: Existing legal framework for waste management in Eswatini*).

Part VI of EMA lays down provisions for effective waste management in the country in order to protect health and environment by providing for institutional arrangements for the same.

Waste Regulations Act 2000 provides the regulatory framework for managing waste in the country. The Regulations introduce regulatory instruments, such as waste management licensing and controls, waste management services, remediation of contaminated land, national waste information system, and compliance and enforcement mechanisms to enforce effective waste management. The Regulations also lay down the duties and responsibilities of relevant stakeholders such as Eswatini Environment Authority (EEA), local authorities, and waste generators and waste service providers (recyclers, sorters).

The key tool for implementing waste management in Eswatini is the NSWMS. The strategy attempts to give effect to the Environmental Management Act of 2002 and the Waste Regulations Act of 2000. It details out the goals and action points for all relevant government agencies for adopting and implementing a holistic approach in waste management.

Most importantly, EMA 2002, Waste Regulations 2000 and the NSWMS together mandate all municipalities and regions to develop an 'Integrated Waste Management Plan (IWMP)' for efficient on-ground waste management. Integrated waste management represents a move away from waste management via impact management to a proactive management system which focuses on waste prevention, minimization and recovery in order to move towards a circular economic model for waste management. For this purpose, the EEA must draft and promulgate regulations and guideline documents for integrated waste management planning for all waste types. Local authorities must develop and submit plans for integrated waste management to the EEA via line ministries for approval. The approved IWMP must be included in the municipalities Integrated Development Plan (IDP) and implemented.

Table 4: Existing legal framework for waste management in Eswatini

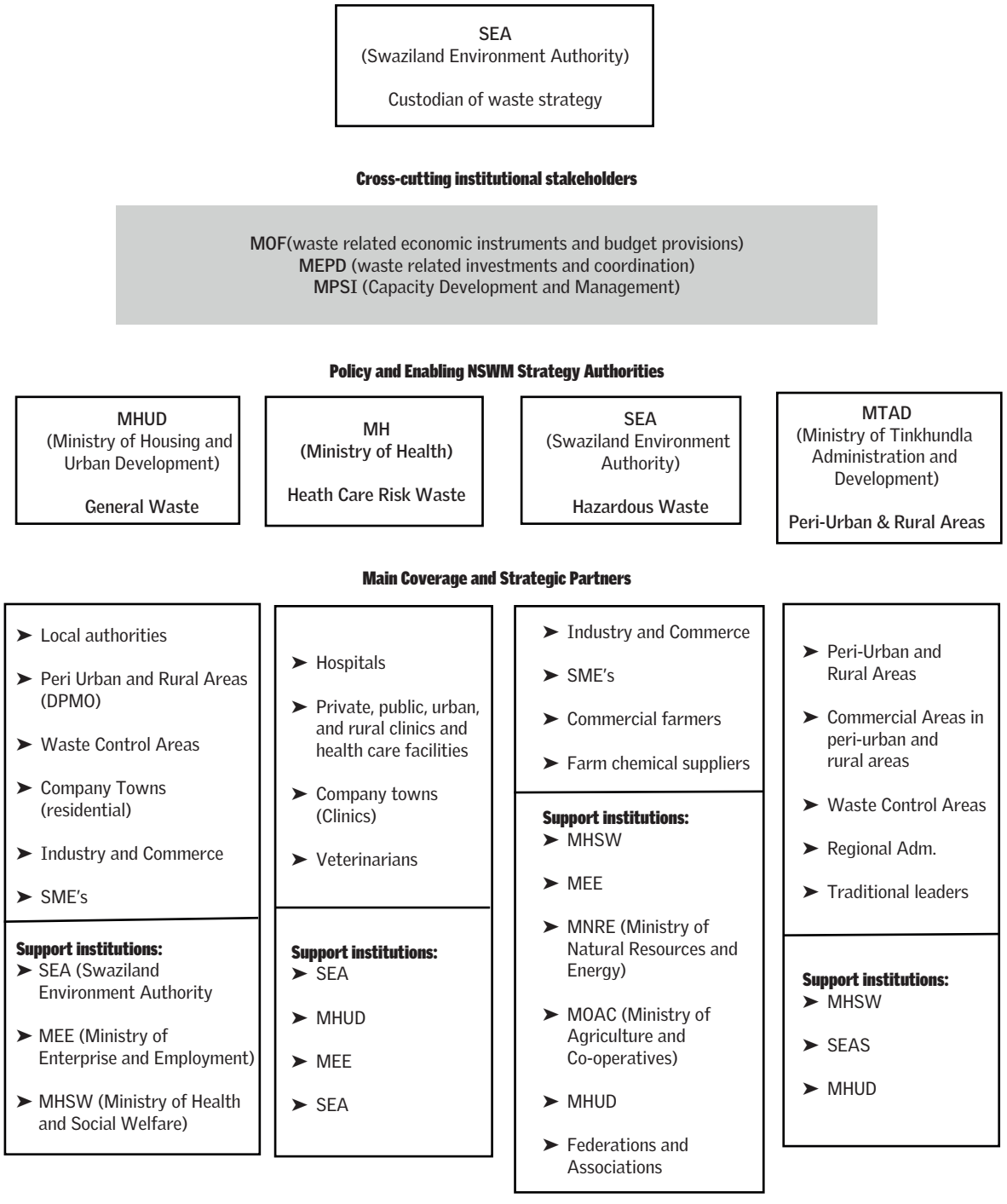
Environment Management Act, 2002
The Act's objective is: • To provide national guidelines and standards for waste management such as waste reduction, reuse, recycling and recovery; physical separation of waste; movement of waste and final disposal • To minimize waste generation wherever practicable; waste should, in order of priority, be reused, recycled, recovered and disposed of safely in a manner that avoids creating adverse effects or, if this is not practicable, is least likely to cause adverse effects • To outline the responsibilities of authorities for waste management measures • To provide a licensing regime for people who are assigned waste management activities • To assess penalties in case of contravention of laid down regulations • To provide for the national waste information system • To implement awareness programmes about importance of waste management • To provide for compliance and enforcement of the policies • To outline and regulate management of all forms of waste including solid waste, hazardous waste, effluent and other forms of waste not specified
Public Health Act, 1969
• The Act provides measures for the promotion of health safety and for the rendering of health services, and defines duties of organs of government which render health services in the country. • It mandates the Ministry of Health (MoH) to ensure hygiene and sanitation in all four regions of Eswatini by putting health inspectors on ground. • It mandates every local government to maintain its district in a clean and hygienic condition.
Waste Regulations, 2000
• The regulations guide authorities to manage different fractions of waste. • They mandate proper storage of waste in urban areas and the usage of waste receptacles such as bins and skips (in inaccessible areas) for different categories of waste (household, commercial, recyclable), making it compulsory to store it in aforementioned manner. • They mandate collection of solid waste at least once a week and transportation of different streams of waste to approved disposal facilities. • They outline the requirements of waste disposal only in designated landfills or dumpsites and list down penalties in case of non-compliance. • They outline waste management license regimes. • They mandate each local authority to prepare a long-term plan for the management of waste that conforms to the national waste management strategy. • They propose declaration of waste control areas in non-urban areas where informal disposal of waste is leading to adverse effects on the environment. • They mandate organs of government responsible for waste control areas to prepare a plan, designate disposal or collection sites, and report annually to the EEA on implementation status. • They propose that waste generators in waste control areas indulge in pit burying, in case disposal or collection sites are inaccessible. • They provide minimum standards for landfill sites (Schedule 1 of the Regulations).

Litter Regulations, 2011
• The Regulations make provisions to manage littering in urban and peri-urban areas. • Dumping, depositing, dropping, throwing, discarding or littering in any public place, private property, river stream or any other body of water in the country is prohibited unless otherwise stated under Regulation 4 of the Regulations. • Every local authority shall ensure that adequate litter receptacles are distributed within the vicinity of all public places, streets, roads and buildings for purposes of being used by members of the public. A person who contravenes this regulation commits an offence and shall be served with an infringement notice under Regulation 5. • Every local authority is to appoint and list down the duties of a litter warden to ensure implementation of the Regulations across the municipality.
National Solid Waste Management Strategy
The Strategy has set goals for stakeholders (with a cross-sectional approach) to achieve effective and efficient waste management services based on waste hierarchy approach: • Implement waste management hierarchy: 100 per cent source segregation programmes; divert recyclables from landfills by creating material recovery facilities, buy-back centres, sorting centres, etc. • Access to waste management services for all in urban and rural areas • Increase contribution of waste sector to green economy: Small enterprises and cooperatives to participate in waste service delivery, especially recycling. • Ensure sound budgeting and financial management for waste management services by conducting full cost analysis and implementing cost effective tariffs. • Establish effective compliance with and enforcement of waste related legislation. • Implement awareness programmes at regional and local levels on benefits of waste management and involve communities in implementing new approaches to waste management.

Institutional arrangement for waste governance

The responsibility for waste management is divided among different line ministries which are responsible for regulating waste management within their legal jurisdictions. It is important to note that responsibility for management of different waste streams in Eswatini relies on the institutional directives of the ministry. For example, MoH is accountable for monitoring and control of biomedical waste generated from hospitals, health centers, clinics and medical retailers while the MHUD is the principal national agent for supervising household and commercial waste under the auspices of urban local government bodies such as city councils, town councils and town boards. In general, EEA is the national directing body for development of environmental laws, policies and strategies, for setting up environmental regulations, and for ensuring implementation. In practice, implementation and enforcement of these laws often demands cooperation, collaboration and coordination between different ministries, departments and other stakeholders.

Figure 3: Overview of the institutional arrangement for waste management in Eswatini



Source: SEA, 2014

Table 5: Institutional authorities involved in solid waste management

Institutional authority	Description
Eswatini Environment Authority (EEA)	Swaziland Environment Authority Act 1992, along with the Ministry for Tourism and Environmental Affairs, established the Swaziland Environment Authority. However, the Environment Management Act 2002 repealed the Swaziland Environment Authority Act 1992 and transformed the SEA (now EEA) into a corporate body. EEA is the lead agency for environmental management, including waste management, at national, regional and local levels. It develops environmental policies, strategies, guidelines and regulations. Duties and responsibilities of EEA are fully defined in the Environment Management Act of 2002, the Environmental Impact Assessment Regulations, and the Waste Regulations of 2000.
The Ministry of Housing and Urban Development (MHUD)	MHUD is responsible for household and commercial waste management undertaken by urban local government bodies such as city councils, town councils and town boards. Their responsibilities are outlined in the Urban Management Act of 1969 and the Environment Management Act of 2002. The Department of Urban Governance within the MHUD is responsible for environmental management.
Ministry of Tinkhundla Administration and Development (MTAD)	MTAD is responsible for overall governance of tinkhundla and regional administrations. As a consequence, MTAD is responsible for the monitoring and control of Waste Regulations 2000 with respect to domestic waste generated in rural and peri-urban areas.
Ministry of Health (MOH)	MOH is responsible for all issues related to public health safety and for monitoring and control of Waste Regulations 2000 with respect to healthcare waste (generated from hospitals, health centers, clinics and medical retailers) and solid waste management at the regional level under the direction of Public Health Safety Act. Department of Preventative Health Services engages in an Environmental Health Programme via the support of Environmental Health Officers to ensure sanitation and hygiene at regional level.
The Ministry of Commerce, Industry and Trade (MCIT)	MCIT is responsible for monitoring and control of the implementation of the Waste Regulations 2000 in industrial estates and company towns (company towns are urbanized areas that are not under the jurisdiction of MHUD).
National Disaster Management Agency (NDMA)	NDMA was established under the Deputy Prime Minister's Office (DPMO) by section 13 of the Disaster Management Act, 2006. It is the principal agency for disaster management in the country and reports directly to DPMO. Funds for functioning of NDMA are appropriated by the parliament. The objective of the agency is to address the requirements for disaster management, including mitigation, preparedness, response and recovery measures, and public awareness and capacity building programmes. It mandates disaster management responsibilities of the government at national and regional levels. It promotes disaster risk reduction as a national priority.

Institutional authority	Description
Local authorities	'Local authorities' are the municipalities established under the Urban Government Act, 1969. The role of local authorities is the most vital in implementation of waste management services in the country. The obligations of local authorities with regard to waste management are defined in the Environment Management Act 2002 and the Waste Regulations 2000. The key responsibility of local authorities is to provide waste management services for the areas under their jurisdiction by securing funds from national institutions (MHUD) or grants from international donors, apart from the revenue they generate from services provided to residents. The local authority consists of councillors democratically elected by the residents of each ward of the urban area every five years. Each local authority is headed by a mayor elected from within the councillors. The councillors appoint a town clerk or chief executive officer who is responsible for implementing the policies. Services provided by local authorities are divided into four parts: Financial, community, technical and corporate. Waste Management is listed under 'community services' under the 'Department of Environment & Health' in the local authority. The department is responsible for providing waste management services within the jurisdiction of the local authority.

Rural areas

MTAD is legally responsible for regional administration and community development of tinkhundla. As a consequence, it is responsible for monitoring and controlling domestic waste generated in rural and peri-urban areas as per the Waste Regulations 2000. However, these responsibilities have no specific legal basis. EMA 2002 gives MTAD the power to declare any non-urban area as a 'waste control area' and implement a waste management system there. Currently, the on-ground responsibility of waste management is taken care of by the health inspectors or rural health motivators spread across rural councils. They are employed by MoH under the mandate of the Public Health Act.

Table 6: Existing institutional framework for waste management in Eswatini

Institutional body	Key roles
EEA	· To issue guidelines, strategies and regulations for integrated waste management planning at national, regional and local levels · To assist in development of municipal and regional integrated waste management plans (IWMPs are expected to be outcome focused and are expected to include priorities, objectives, targets, and implementation and financing arrangements. EEA is expected to publish guidelines for integrated waste management planning) · To monitor compliance and enforcement of such plans by means of environmental inspectors · To implement licensing/permitting system and monitor compliance of waste management licenses and permits · To collect and analyse statistical data on waste generation and composition · To issue annual reports on waste generation, composition, handling and disposal of different streams of waste · To launch awareness programmes on waste management · To ensure capacity building of officers at national, regional and local levels on effective waste management
MHUD	· To monitor and control household and commercial waste management in urban areas · To develop generic bye-laws to assist municipalities in the process of developing their own waste management bye-laws · To provide budgetary and financial support to urban local bodies for carrying out waste management services. · To declare an area a "Controlled Area" through the provisions made for the declaration of "Waste Control Areas", described in Waste Regulations 2000
MTAD	· To monitor and control household and commercial waste management in rural and peri-urban areas · To provide budgetary and financial support to regional offices for carrying out waste management services · To declare any non-urban areas "Waste Control Areas" and develop waste management plans and systems for those areas
MOH	· To monitor and control implementation of the Waste Regulations 2000 with respect to healthcare waste (generated from hospitals, health centres, clinics and medical retailers) · To monitor and control solid waste management at the regional level as per the direction of Public Health Safety Act
MCIT	· To monitor and control implementation of Waste Regulations 2000 in industrial estates and company towns

Institutional body	Key roles
NDMA	· To develop a national disaster management plan and ensure its integration with regional disaster management plans/policies · To facilitate and monitor the implementation of disaster management policies at national and regional levels · To develop budgets for disaster management via Disaster Management Fund at national and regional levels · To disseminate information in order to support and facilitate the implementation of disaster management policy · Promote public awareness and capacity building of officials at regional and local levels
Local authorities	· Integrated waste management planning: The compilation of integrated waste management plans for submission to and approval by EEA, routed via line ministries. It is to report annually to the EEA on the status of implementation of its approved waste management plans. · Waste Information System: Collect data and report annually to the EEA on quantity and composition of waste generated and disposed of. · Waste minimization: Implement and enforce appropriate waste minimization initiatives (create material recovery facilities, buy-back centres, sorting centres, composting centres, etc) and push for waste segregation. · Waste collection and transportation: Ensure efficiency and frequency of waste collection fleet. · Recycling: Establish recycling centres and facilitate community initiatives. · Waste disposal: Establish and manage landfills and dumpsites. · Fiscal instrument: Carry out full cost analysis of waste management services and implement cost effective tariffs for financial sustainability.

Source: CSE, 2021

3. Current status of solid waste management

Major generators of waste in Eswatini are households (residential), industry, commercial businesses, vendors and institutions (hospitals, schools, etc.) Households generate the most amount of waste.

Table 7: Different solid waste streams and their percentage contribution

Solid waste sources	Contribution in weight (%)	Waste characteristic
Household waste	52–80	Food; packaging: paper; cardboard; plastic; textile; glass & ceramics; ashes; electronic
Vendors and markets	4–20	Vegetable; chicken feather; packaging material; ashes
Commercial: shops, hotels, offices (excluding markets)	4–8	Packaging material; food; paper; electronic; glass; wood; scrap metals
Institutions (schools, colleges, government ministries)	5	Food; stationery; packaging material; paper; electronic
Manufacturing industry	3	Packaging and industry dependent waste
Health care centres	1	Domestic; hazardous
Other (sport centres, constructions sites, public park)	11	Domestic

Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Waste generation and quantification

In its National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases 2017, EEA estimated municipal solid waste (MSW) generation in the country to be 238,341 tonne per year in 2016 (see *Figure 7: Share of Waste Generation in Eswatini*). Per capita waste generation in Eswatini stands at almost 0.2 kg per day. However, this doesn't provide the correct picture as 76 per cent of the country's population which resides in rural areas generates 0.43 kg per capita daily as against 0.9 kg per capita in urban areas. Per capita waste generation of Eswatini's rural population is in agreement with the average per capita generation of sub-Saharan Africa i.e., 0.46 kg per day reported by World Bank (2016).

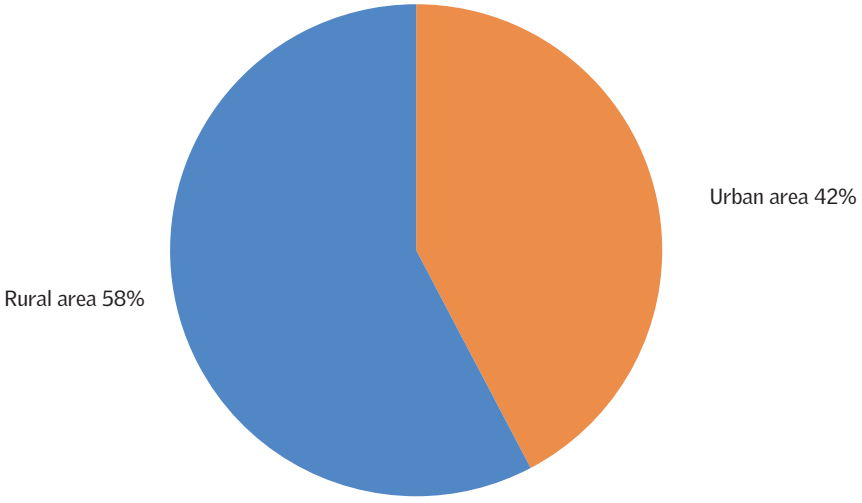
Table 8: Annual waste generation in Eswatini

Annual waste generation (in tonne)	1996	2017	Percentage increase in waste generation
Urban	44,567	100,103	125
Rural	41,756	138,237	231
Total	86,323	238,340	176

Source: Compiled from State of Environment Report, 2001; National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

A 2020 study revealed that affluent urban areas are not the only hotspot household waste generators, some peri-urban areas and rural areas relatively close to towns and cities also generate a high quanity of waste. This was attributed to a common trend locally whereby the urban workforce of the country is relocating to close-by rural areas, and thus these now record higher levels of affluence. This has resulted in some rural areas with much higher affluence than nearby townships in urban areas.

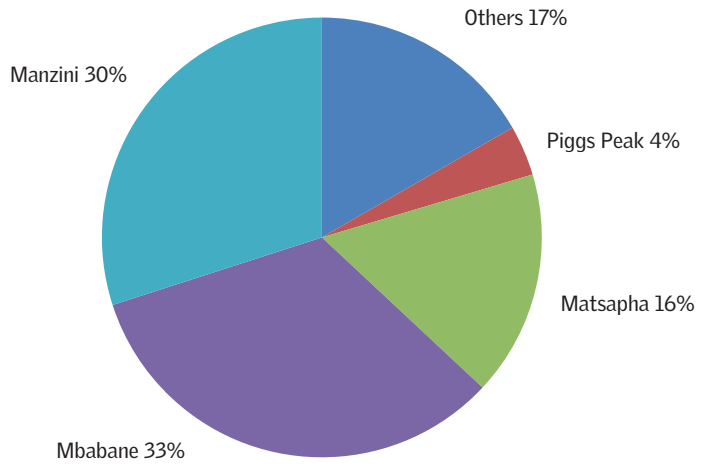
Graph 4: Share of waste generation by urban and rural Eswatini



Four cities—Mbabane, Manzini, Matsapha and Piggs Peak—where over 54 per cent of urban population resides, together contribute around 84 per cent of the total waste generated in urban areas. One of the major reasons for this is that Matsapha is the largest industrial area in the country and job opportunities in and around Matsapha makes the cities of Mbabane and Manzini target areas for migrants. Manzini, in particular, is the largest and fastest growing city in the country. These places face enormous challenges related to availability of land and infrastructure for waste management facilities. Mbabane, the capital and one of the biggest cities in the country, generates the most quantity of waste.

Cities with large populations and low ratings on the poverty index generate the highest quantities of waste. Accordingly, cities with the highest poverty incidences were found to generate the lowest amounts of waste. Per capita generation of waste varies according to the degree of urbanization. It is important to note that Mbabane generates 91 tonne of waste per day with per capita generation of nearly 1 kg daily. Similarly, Manzini generates nearly 82 tonne of waste per day with per capita generation of 0.8 kg daily.

Graph 5: Waste generation in urban areas

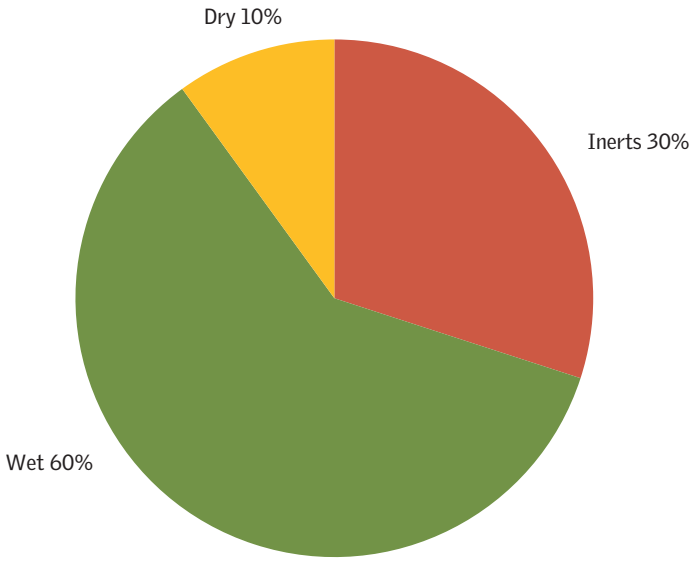


Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Waste composition and treatment

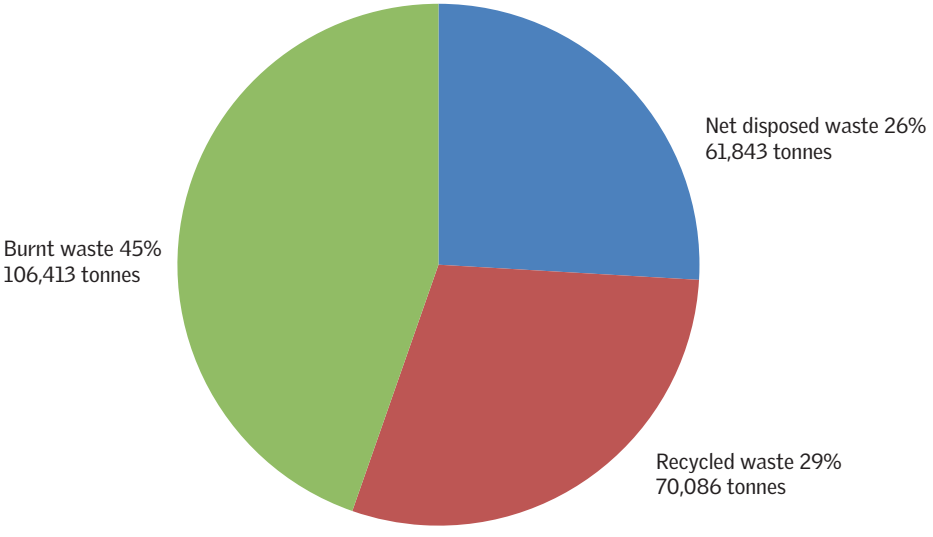
Waste generated in Eswatini comprises 50–55 per cent organic fraction and remaining 45–50 per cent recyclable waste (such as paper, plastic, metal, glass) and inerts (such as C&D debris, drain silts and road sweepings).[10] However, National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases in 2017 estimated that inerts are 30 per cent and dry fraction is merely 10 per cent of total generated waste.[11] These findings are debatable because these estimations are not based on systematic and scientific sampling procedures. Moreover, this assessment may have included waste reaching the dumpsite for ultimate disposal, excluding the valuable recoverable material or the dry fraction of waste which would have been extracted already by the informal sector. These are merely estimated figures and no official study to assess the composition of waste has been done so far in the country despite the legal mandate to conduct such studies in order to adopt appropriate technologies for treating and managing the three fractions of waste—wet, dry and inerts.

Graph 6: Waste Composition in Eswatini



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Graph 7: Recycled, burnt and net disposed waste in Eswatini

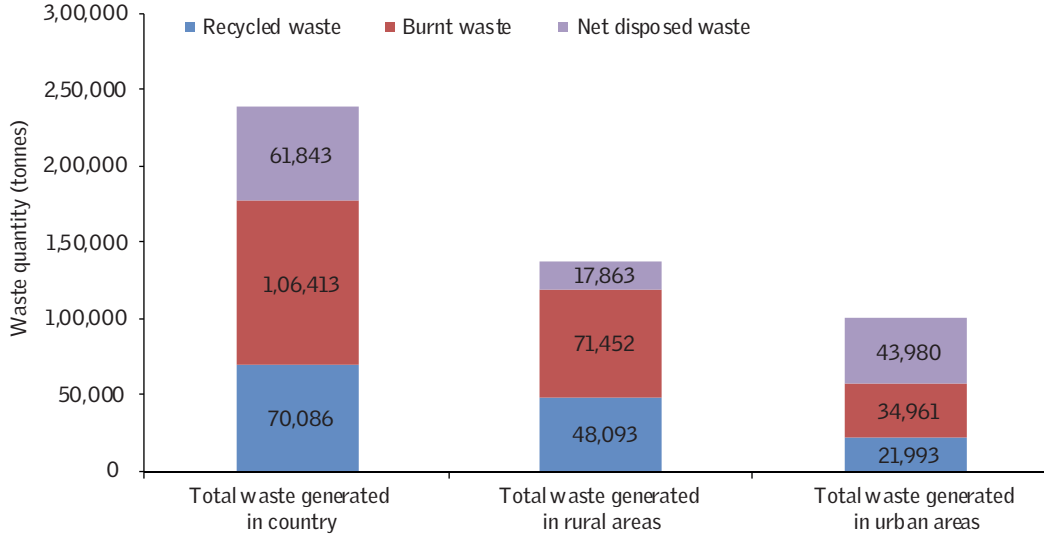


Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

It is estimated that approximately 30 per cent of the waste is recycled in the country. Recycled waste not only refers to processed waste but also to the waste which is recovered and reused at the source or community level. A whopping 45 per cent of the total waste generated in the country is burnt, thereby making waste burning a major problem in the country causing excessive GHG emissions and climate

risk. The remaining waste is disposed of. This could have been seen a positive sign had the rest of the waste been processed, leaving only 25 per cent for the landfill. However, as mentioned above, almost half of the total waste generated in the country is burnt and even the waste which is dumped in landfills or dumpsites is poorly managed leading to methane gas emissions.

Graph 8: Waste management scenario in Eswatini



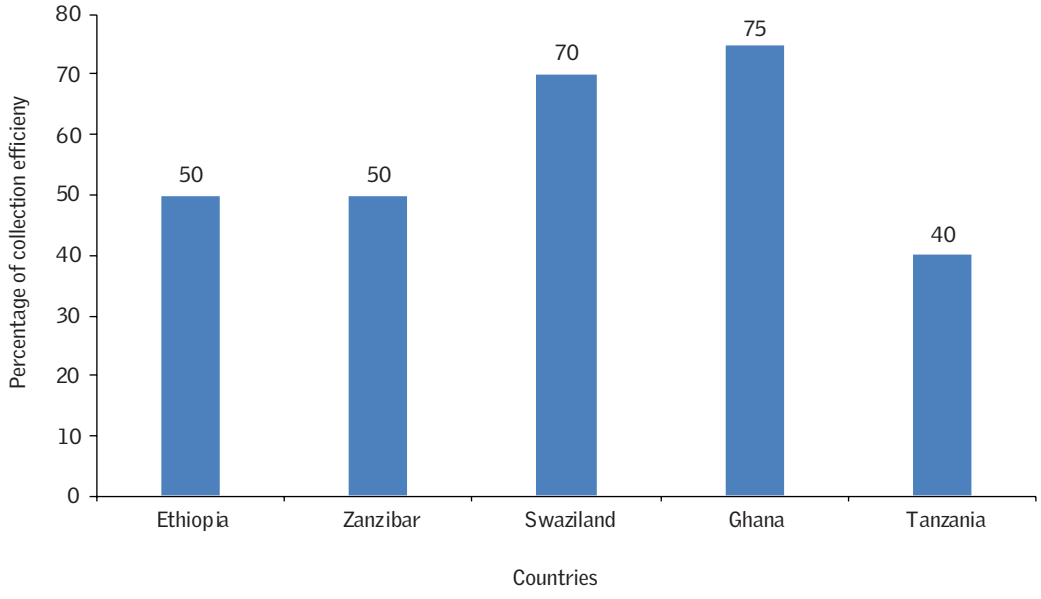
Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Waste collection and transportation

Waste collection system in sub-Saharan countries is insufficient due to lack of infrastructure. Eswatini has a good collection system in comparison to other sub-Saharan countries with a collection efficiency of 70 per cent. However, it is important to note that collection of waste is only efficient in certain areas and nearly non-existent in many rural and peri-urban areas.

A report taken out by CSE in 2017, *Integrated Waste Management Policy and Legislation for African Nations*, states that door-to-door collection is taken care of by the municipalities in major urban areas with a collection efficiency of above 75 per cent.[12] However, UPOPS Release states that collection efficiency is merely 42 per cent, with collection frequency varying from once to thrice a week depending on the affluence of the area (see *Table 8: Waste movement along the value chain*). Currently, major urban areas like Manzini, Matsapha and Mbabane consist of straggling peri-urban areas where household waste is not adequately collected by the municipalities.

Graph 9: Collection efficiency in sub-Saharan countries



Source: CSE, 2017

Waste is collected in non-compartmentalized vehicles collectively from residential and commercial areas. Segregation is not practised in any of the towns. For areas inaccessible by collection vehicles or for informal settlements, municipalities have set up collection centres. However, there are no transfer stations in any urban area. It is important to observe that only 1 per cent of the total waste collected is being recycled. Maximum fraction of the collected waste is directly transported to the dumpsites.

The difference between collected waste and estimated waste generated is significantly large. This can be attributed to growing suburban informal settlements with very few or no waste collection services. Overall, collection and transportation in urban areas are taken care of by compactors, trucks and tractors, majorly secondary collection vehicles. These vehicles do not engage in primary or door-to-door collection.

Image 1: Collection of garbage from peri-urban and rural areas around Matsapha town

Image 2: Waste Collection bags in peri-urban and rural areas around Matsapha town

Table 9: Waste movement along the value chain

Name of the town	Waste generated (tonne/year)	Waste collected (tonne/year)	Waste recycled from collected waste* (tonne/year)	Waste disposed (tonne/year)	Waste disposed (%)
Mbabane	33,367	9,902	105	9,797	29
Manzini	30,242	6,183	86	6,096	20
Matsapha	16,733	11,942	124	11,818	71
Piggs Peak	3,780	1,530	15	1,515	40
Mankayane	674	316	3	313	46

* Waste is also recycled from uncollected waste.

Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Table 10: Collection vehicles used in urban areas

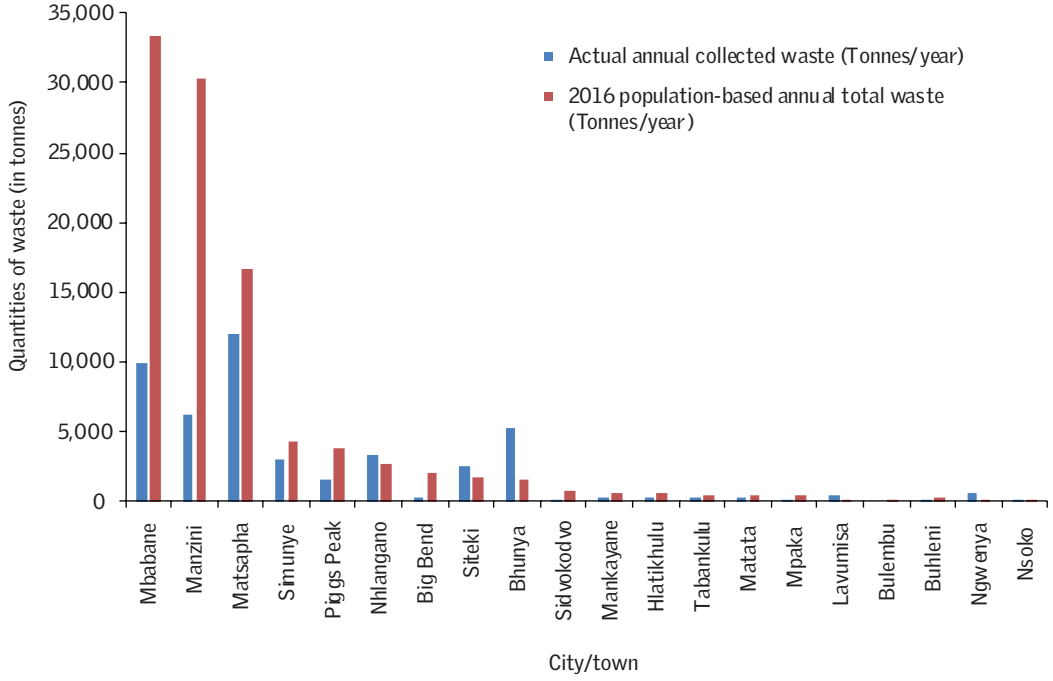
Name of the urban area	Waste generated (TPD)	Available vehicles
Mbabane	91	4 compactors 3 skip master trucks
Manzini	82	3 compactors 1 skip master truck
Matsapha	46	2 skip trucks 1 tractor
Piggs Peak	10	1 refuse truck 1 refuse tractor
Mankayane	2	2 trucks

Source: CSE, 2021

In Mbabane, vehicles are non-compartmentalized and collect mixed waste from both households and commercial institutions collectively. Waste collection frequency is once a week for residential areas and thrice a week for commercial establishments. According to Mbabane City Council, waste collection coverage is about 82 per cent. However, the UNIDO (2017) report suggests 30 per cent coverage. In Manzini, household waste is collected twice a week and commercial waste is collected daily in the same vehicle and directly transported to the Manzini Controlled Dumpsite. In Matsapha, waste is collected twice a week from residential and commercial areas, and dumped directly at the Matsapha dumpsite.

In Piggs Peak, mixed waste is collected and segregated thereafter at the disposal site. Piggs Peak Town Council (PPKTC) engages in door-to-door collection in four wards. The remaining two wards are looked after by the informal sector. There are no collection sites either. Mankayane Town Board engages in door-to-door collection of waste, barring in informal settlements, thrice a week.

Graph 10: Comparison between population and income-based waste generation estimates and actual waste collection data



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

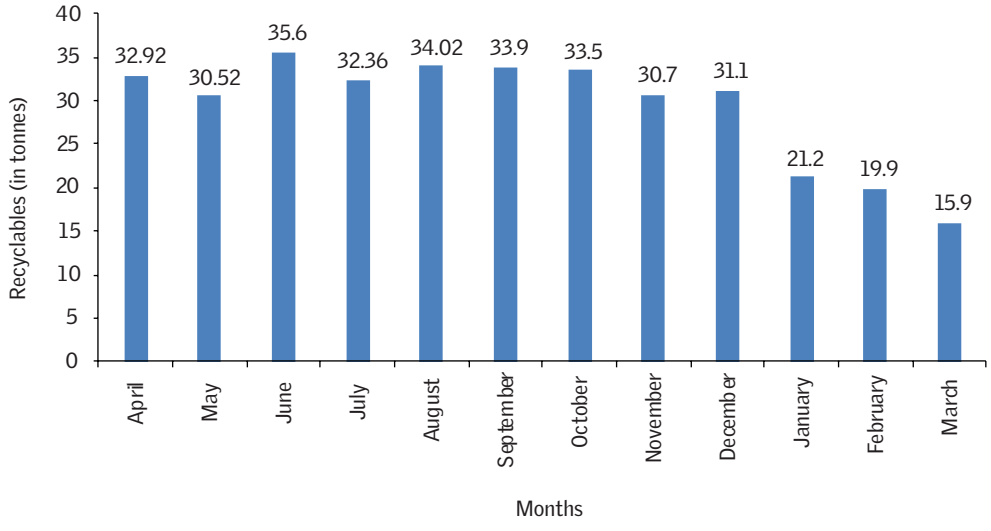
In most areas, it is clear that waste collected is significantly lower than estimated waste generated. This is due to inefficient waste collection. However, in Bhunya, collected waste is found to exceed estimated waste quantities generated. The under-estimated waste generation figure might be because Bhunya is an industrial town with many timber industries. Since waste generation estimates are based on waste generated from households and not the waste generated from industrial sector, waste generation quantities in Bhunya have been underestimated.

Recycling and waste processing

In Eswatini, cities and major towns dispose of their solid waste in dumpsites, while smaller towns burn their solid waste in the open.[13] Once waste reaches a landfill or dumpsite, recyclables are extracted by waste pickers who collect different types of plastic, paper, metal and cardboard from the dumpsites. These waste pickers work independently of the establishment, without any direct linkage to any authority responsible for the dumpsite or landfill. As a result, they are sometimes given access to the dumpsite and sometimes not. Although they contribute significantly to the recycling of waste in Eswatini, they do not have access to sanitary facilities or protective equipment.

Recycling of waste is most prevalent in areas with high population densities. The reason is that only generation of high quantities of recyclable materials (plastic, paper, glass, metal) can sustain the business of junk shop owners and recycling industries. Not all the generated waste is being upcycled, recycled or reused. Recyclable material in Eswatini mostly consists of ferrous and nonferrous metals, transparent glass bottles, aluminium, cardboards, and plastic. In Matsapha, almost every type of plastic is being recycled, such as plastic crates, grocery bags, refuse bags and liquid containers. Despite this, a lot of plastics end up at the dumpsites. Recyclables that are not segregated at source end up in the landfill together with general waste. There are about 30 registered informal reclaimers who salvage recyclable waste from the Matsapha landfill site for sale to local recycling companies.[14]

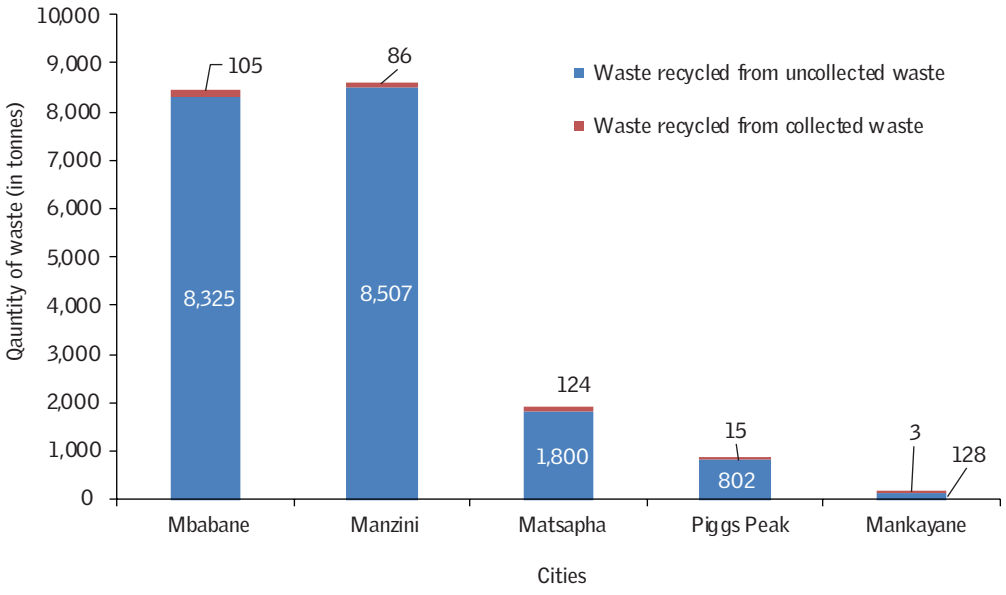
Graph 11: Volumes of recyclable waste retrieved from the Matsapha landfill from April 2019 to March 2020



Source: Matsapha Municipality, Annual Reports 2019–2020

It is estimated that 30–35 per cent of the total waste generated in Eswatini is recycled.[15] Nearly, 70,086 tonne of waste is recycled per annum, with 21,993 tonne recycled in urban areas, which is 22 per cent of the total waste generated in urban areas. More importantly, of this 22 per cent, only 1 per cent of the waste recycled is after collection by a municipal authority (see *Graph 12: Recycled waste in urban areas in 2016*).

Graph 12: Recycled waste in urban areas in 2016



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

The ratio of recycled waste from collected and uncollected waste is skewed due to several factors. To start with, the term "recycled" as per EEA is used for reuse, upcycling and downcycling of material done by households or commercial establishments at point of generation or community level. In addition, informal sector is playing a major role in recycling as compared to formal facilities. There is a huge quantum of waste that is being reused or repurposed at the community level.

Formally, there are only two buy-back centres in Mbabane and one in Matsapha, five plastic recycling facilities located in Matsapha and one glass recycling facility located at Ngwenya. Recovery of valuable materials such as glass, Polyethylene terephthalate (PET), cans, paper, cardboard, shrink wrap and metals is primarily done by informal scavengers at collection sites and disposal sites usually illegally by trespassing. They are devoid of any protective equipment or sanitary facilities due to this. Informal scavenging or sorting of valuable waste from collection sites or informal dumpsites is a common practice.

As far as waste collected is concerned, it never reaches recycling centres. Even after reaching the dumpsite, waste does not reach recycling facilities as mandated by various legislations. This can be attributed to the lack of sorting centres, dry

waste collection centres, and material recovery facilities or recycling facilities. Even those that do exist are inaccessible for a large chunk of the population.

There is potential to build material recovery facilities or secondary sorting centres near collection sites in order to divert recyclable waste away from dumpsites. At the same time, there is also an incentive for authorities to integrate informal sector players in the formal cycle of waste management as informal sector is familiar with the sorting of waste. This does not necessarily mean employing informal sector players on payroll but hiring them on contracts can be exercised as an option.

Plastic waste management infrastructure in Eswatini

There is no control and disposal mechanism for plastic waste management in either urban or rural areas. Plastic bag bans and levies, if properly deliberated and imposed, are some measures that can efficiently counter the over-exploitation of plastic materials and bags and ultimately restrict plastic pollution. However, this has not been very successful in Eswatini, where attempts to ban and curb the use of plastic bags has produced little or no results. Instead, it led to massive misunderstandings between the government and the citizens.

Many campaigns had been launched in Eswatini to diminish unnecessary usage of plastic bags in order to protect the environment and stimulate changes in consumer behaviour.[16] These campaigns failed due to opposition from industries, retailers, groceries and the plastic industry. One of the campaigns that failed was the plastic bag tax policy introduced in 2015 by EEA, namely the Environment Management Act, Control of Plastic Bags Regulation Notice. The act proposed a 35-cent charge (lilangeni is the currency of Eswatini and it is subdivided into 100 cents) for every plastic bag handed out to consumers.

Waste disposal by landfilling

From 1990 to 2018, there were six commissioned and managed sanitary landfill sites in Eswatini—in Matsapha, Mbabane, Piggs Peak, Bigbend, Simunye and Bhunya—three in urban areas and three in company towns. These are based on the strict definition of landfill being well-engineered and well-controlled for disposal of solid and non-hazardous waste. In these, delivered waste is spread and compacted in layers with soil at least once a day. Other solid waste disposal sites are classified as either formal or informal dumpsites.[17] These include those managed by rural or urban local authorities and should be classified as dumpsites because they do not have the above stated characteristics of landfill sites. It is reported that there are thirteen of these controlled, semi-controlled and open dumpsites.

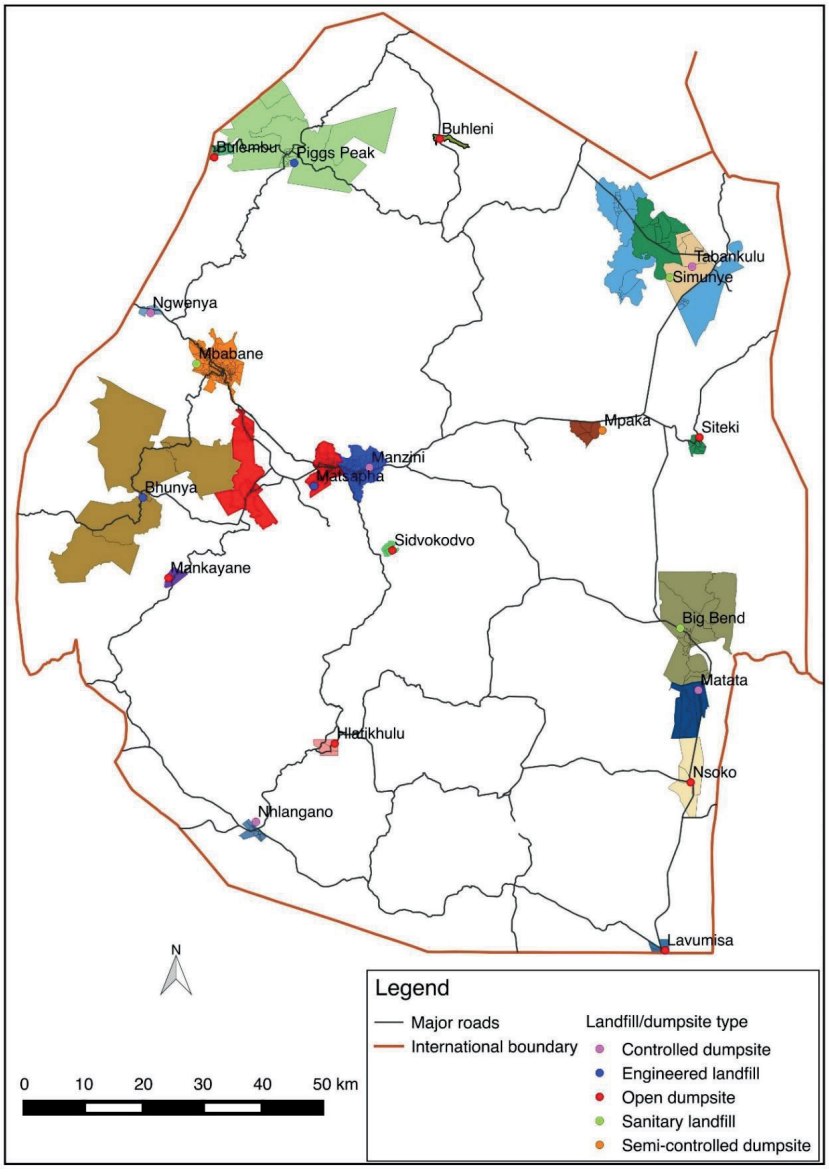
Eswatini has very few properly constructed (engineered) landfills and the distribution of landfills and dumping sites in the country is a matter of concern.[18] As such, waste is dumped in prohibited sites all over the country, contributing to environmental deterioration. Rural Eswatini has no formal dumping sites.

In many small- and medium-sized towns, municipalities dig a hole in the ground and dump waste in the pit. When the waste reaches a certain level, it is flattened by tractors and covered with soil. More waste is dumped and the process is repeated until the dumpsite is full. At that stage, another dumpsite is dug up. Smaller towns in the country still practise open burning of municipal waste and some dense settlements, especially peri-urban settlements, lack any waste disposal systems. This is the main reason why open burning and littering is still a challenge in the country as people burn and throw waste anywhere to get it out of their immediate space.[19]

- Schedule 1 of Waste Regulations 2000 (Minimum standards for landfill sites)
- The location of the landfill should not give rise to any adverse effects or pose a significant risk of any adverse effects.
- Solid waste landfills shall meet the following minimum technical location standards: a.) the bottom of the landfill shall be at least 3 metres above the seasonal high ground water level; b.) the edge of the landfill shall be no closer than 60 metres to a surface water body and 100 metres upstream from a public water supply well; and c.) the landfill shall not be located in aquifer recharge areas or public water supply catchment areas unless there are no other feasible alternatives, in which case the landfill shall be lined with an appropriate material and subjected to additional water quality monitoring.
- The technical design of the landfill shall meet the standards required by the regulations to ensure that the operation of the facility does not give rise to any adverse effects or pose a significant risk of any adverse effects.
- No landfill site shall be located in any area where it is likely to have a significant negative impact on existing land uses.
- The site shall not be closer than 3,000 metres from an airport, airfield or site reserved for the construction of an airport or airfield.
- The site shall be located and operated in such a manner that it does not create significant negative impacts on flora and fauna of adjoining lands.
- The site shall not be closer than 300 metres from an existing residential development.
- The edge of the landfill shall not be closer than 100 metres from an area to which the public have access, a national park, protected area or an area having national historical or archaeological significance.

- There must be a buffer area around the landfill of at least 20 metres to allow provision for visual screening from adjoining property and/or future access for installing additional ground water quality monitoring facilities and/or future remediation in the event of migration of gases or leachates.
- Landfill access roads shall be located and constructed.

Map 2: The geographical coverage of landfills and dumpsites in the urban areas of Eswatini



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Landfills or dumpsites of particular urban areas receive waste from other urban areas from across the country. Towns like Malkerns and Ezulwini dispose of their waste at Matsapha landfill; Vuvulane disposes of its waste at Siteki dumpsite, Mhlambanyatsi disposes of it waste at Bhunya landfill; and waste from Mhlume and Tjaneni urban areas is disposed of at Simunye landfill (see *Table 11: Types of landfills and dumpsites*).

Table 11: Types of landfills and dumpsites

Name of the ULB	Type	Type of landfill or dumpsite	Other cities dumping waste	Quantity of waste dumped (tonne/ year)
Mbabane	City	Sanitary landfill		9,797
Manzini	City	Controlled dumpsite		6,096
Matsapha	Town	Engineered landfill	Malkerns Ezulwini	11,818
Siteki	Town	Open dumpsite	Vuvulane	2,445
Nhlangano	Town	Controlled dumpsite		3,304
Hlathikhulu	Town	Open dumpsite		352
Pigg's Peak	Town	Engineered landfill		1,515
Lavumisa	Town	Open dumpsite		392
Mankayane	Town	Open dumpsite		313
Ngwenya	Town	Controlled dumpsite		521
Matata	Company town	Controlled dumpsite		348
Bhunya Montigy	Company town	Engineered landfill	Mhlambanyatsi	4,723
Simunye RSSC	Company town	Sanitary landfill	Tshaneni Mhulme	2,914
Big Bend Ubombo Sugar	Company town	Sanitary landfill		247

Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Table 12: Description of landfills (urban areas)

Name of landfill	Description
Mbabane sanitary landfill	Mbabane landfill was constructed and commissioned for operation in 1998, with a projected operational life of 25 years. Mbabane assesses the quantity and type of wastes from various towns before it agrees to accept these wastes. The landfill is located about 14 km from the city centre. It is licensed and audited four times per year (twice externally and twice internally). Surface and ground water monitoring is done monthly by a laboratory. Remaining air space in the landfill is +/- 2 years (decommissioning). New landfill cell is at design stage.
Matsapha engineered landfill	Matsapha landfill site is located along Usuthu Crescent. This is a sanitary landfill and it meets the required standards for safeguarding the environment. General waste, including commercial waste and industrial waste, collected around the town is disposed of at this facility on a daily basis. The average rate of waste disposal is 1,550 tonne per month as per the airspace survey conducted in August 2019. During the course of the year under review, 2019–20, 17,906 tonne of waste was disposed of at the landfill. This indicates an increase of 3,408 tonne compared to the previous year (2018–19).
Piggs Peak engineered landfill	PPKTC has a landfill called the Glen Township landfill which is to serve the municipality until the end of 2021. All collected domestic, commercial and industrial general refuse is disposed of at this site. Use of the site is permitted by the EEA for disposal of non-hazardous waste only. The landfill is operated by the town council. It does not have a weighbridge and, therefore, the quantity of waste dumped is not ascertained. The landfill is not operated as per the standards of Waste Regulations 2000. The area is not fenced, there is no control gate and access is generally unrestricted. Unrestricted access at the site results in the disposal of all types of waste.

Source: Compiled from annual reports of Mbabane, Piggs Peak and Matsapha city councils

Total waste dumped annually at these three urban landfills is 23,130 tonne per year, amounting to 50 per cent of the net waste disposed in urban areas. This implies that the remaining 50 per cent is dumped indiscriminately without any management.

Image 3: Matsapha landfill site

Image 4: Mbabane landfill site

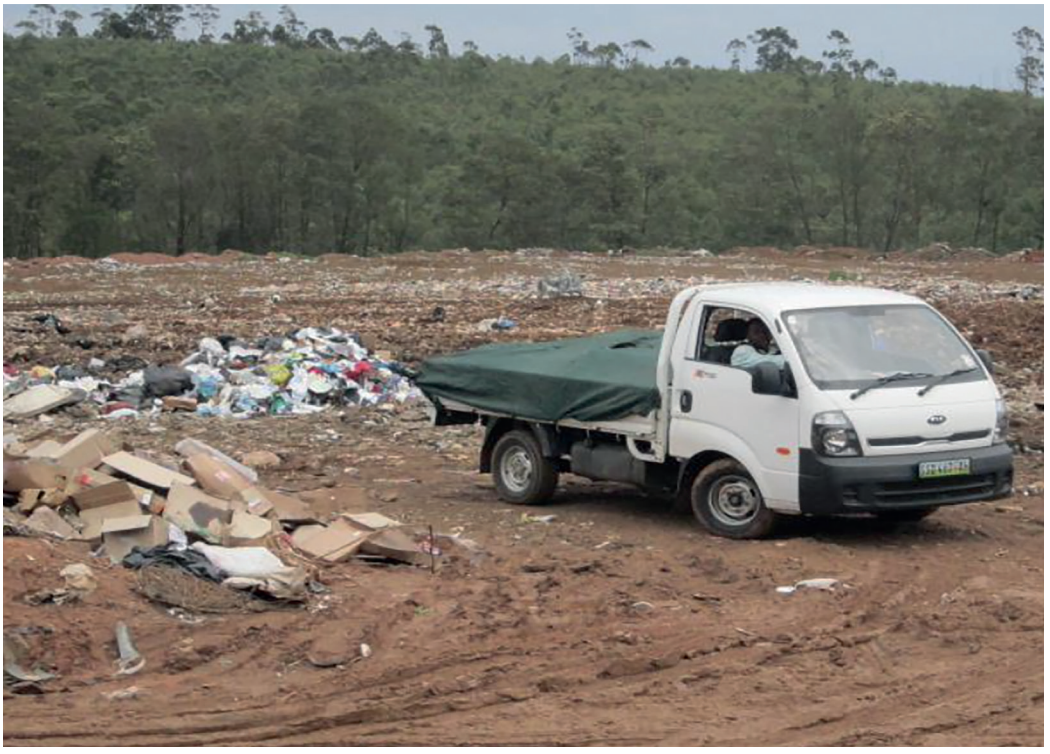


Image 5: Burial pits to dump garbage in Ngwenya area

Image 6: Piggs Peak dumpsite

Source: CSE, 2017

A total of 106,413 tonne (45 per cent of the total waste generated) of waste is burnt in Eswatini per annum. The total amount of waste burnt in urban areas of the country, from both collected and uncollected waste, is 34,960 tonnes per annum, amounting to 35 per cent of all waste in urban areas. Waste burnt from collected waste in urban areas is merely 3,892 tonne (10.7 per cent). This implies that the larger municipalities do not indulge in open burning as a waste disposal mechanism. Towns such as Siteki, Sidvokodvo, Mankayane, Hlatikhulu, Lavumisa, Buhleni, Ngwenya and Nsoko burn a lion's share of the waste at the dumpsites. This can be attributed to constraints in technological, human and financial resources.

Table 13: Waste burnt in urban areas.

Town/City	Total waste generated in 2017 (tonne)	Uncollected urban waste burnt in 2017 (tonne)	Collected urban waste burnt in 2017 (tonne)
Mbabane	33,367	12,202	0
Manzini	30,242	12,510.8	0
Matsapha	16,733	2,491.3	0
Simunye	4,254	615	0
Piggs Peak	3,780	1,169.8	0
Nhlangano	2,740	0	102
Big Bend	2,016	921.8	0
Siteki	1,750	0	1,956
Bhunya	1,511	0	0
Sidvokodvo	779	323.7	127
Mankayane	674	186	250
Hlatikhulu	644	152	282
Tabankulu	478	65.4	0
Matata	406	28	279
Mpaka	406	170.1	24
Lavumisa	351	0	314
Bulembu	239	124.1	N/A
Buhleni	231	46.6	112
Ngwenya	175	0	417
Nsoko	159	62.2	31
Total	100,933	31,068.6	3,892
Grand total (Uncollected and collected urban waste burnt in 2017)	34,960.63		

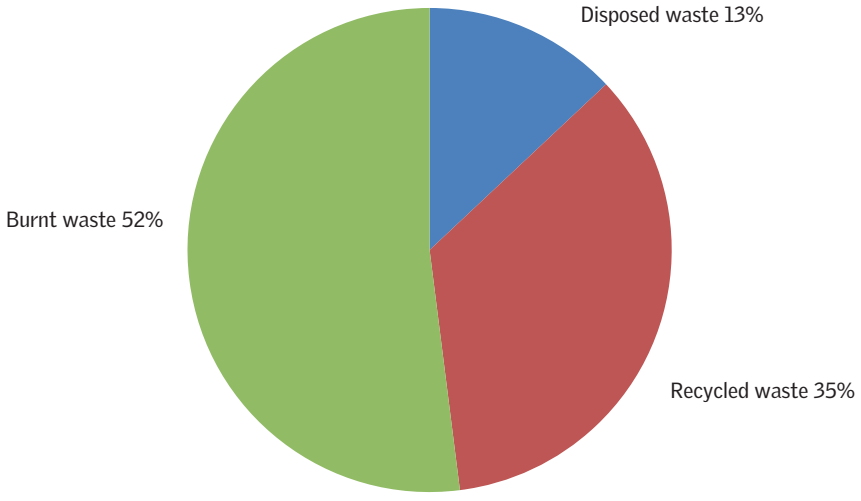
Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Waste management in rural areas

Like other low- and middle-income countries, the rural waste management sector is poorly developed in Eswatini as well, even though a significant share of the population lives in rural areas. Due to lack of proper data, rural waste management issues and challenges are less discussed in the literature and at policy levels than the issues in urban areas.

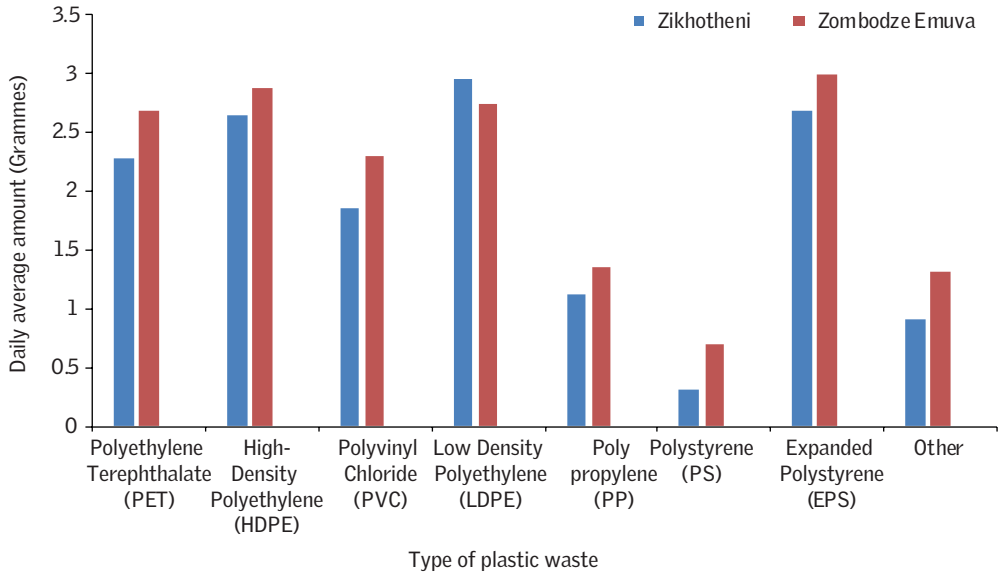
Total waste generation in rural and peri-urban areas in Eswatini is estimated to be 137,409 tonne per year. With a population of 859,030, the per capita generation in rural areas stands at 0.43 kg per day. It is estimated that 35 per cent of the waste is recycled at the point of generation or at community level. The rest is disposed of indiscriminately. Furthermore, it is assumed that 80 per cent of the disposed waste is burnt. Therefore, the total amount of waste burnt in rural areas is 71,452 tonne per year, which amounts to 52 per cent of the total waste generated in rural areas of the country (see *Graph 13: Waste scenario in rural areas*). Reportedly, there has been very little deliberation on plastic waste management issues on a local scale in rural areas. Very few studies utilize data to understand plastic management issues from a geographical point of view. Also, no data on collection and transportation is available for the rural areas of Eswatini.

Graph 13: Waste scenario in rural areas



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases, 2017

Graph 14: Type of plastic waste generated in two rural areas in Eswatini

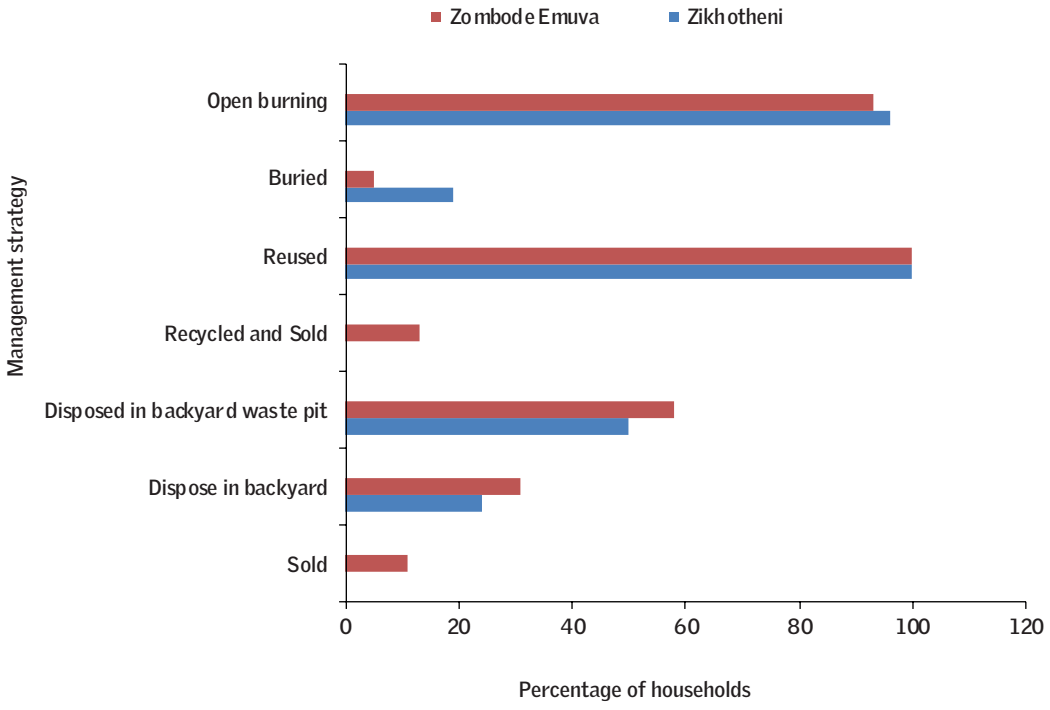


Source: Nxumalo et al (2020)[20]

Households in the rural areas of Eswatini generate an average of 15.9 g of plastic waste per day.[21] As per the estimates of the study, households in Zikhotheni region were found to generate relatively higher quantities of low-density polyethylene (LDPE) (2.96 g), followed by extended polystyrene (EPS) (2.68 g). Whereas, in Zombodze Emuva, extended polystyrene was found to dominate (nearly 3 per cent) followed by high-density polyethylene (2.8 per cent) (see *Graph 14: Type of plastic waste generated in two rural areas in Eswatini*). Reasons behind the generation of LDPE by a majority of households are that it is affordable (cheap) and lightweight, as well as the fact that local plastic grocery bags are made of LDPE and these are dispensed freely to customers in local shops.

Plastic waste management practices adopted by residents of Zikhotheni and Zombodze Emuva included open burning, reuse, burying, disposal in pits, and indiscriminate disposal in backyards. However, it was found that some households in Zombodze Emuva further practised some plastic waste management strategies which are not practised at all in Zikhotheni, namely: selling of plastic waste to recyclers (11 per cent) and upcycling of plastic waste (13 per cent).[23] In Zikhotheni, every household included in the sample reuses generated plastic waste and a large proportion (96 per cent) dispose of their plastics through open burning. The proportion of households who dispose of their plastic waste indiscriminately in their backyards (31 per cent in Zombodze Emuva and 24 per cent in Zikhotheni) is cause for concern as this proportion is not negligible.

Graph 15: Plastic waste management strategies adopted by two rural areas in Eswatini



Source: Nxumalo et al (2020)[22]

Peri-urban areas located on the periphery of urban areas produce most waste after cities or effluent towns. Waste management services in such peri-urban areas are often limited. In addition, residents of such settlements typically do not pay fees that could be used for the financing of services such as waste management. Therefore, waste management is in shambles and waste is generally dumped in backyards or buried in pits (acceptable as per the Waste Regulations), openly dumped or burnt indiscriminately.

Waste management in company towns

Company towns are urbanized areas that are not under the jurisdiction of MHUD. These are established by industries, such as the sugar industry, mining industry and forestry, which provide industrial, commercial, residential and medical facilities. Simunye, Big Bend, Mhlume, Bhunya and Matata are the five declared company towns. Currently, these are not under the jurisdiction (physical planning and/or waste management planning) of any ministry and waste management services are

independent of the government. As per government officials, bare minimum waste management services are carried out by private contractors hired by companies operating in these company towns.

Table 14: Types of landfills and dumpsites in company towns

Name of town	Type of landfill or dumpsite	Other cities which dump waste here	Quantity of waste disposed (tonne/year)
Matata	Controlled dumpsite		348
Bhunya	Engineered landfill	Mhlambanyatsi	4,723
Simunye	Sanitary landfill	Tshaneni Mhulme	2,914
Big Bend Ubombo Sugar	Sanitary landfill		247

As per the institutional framework, the Ministry of Commerce, Industry and Trade is responsible for monitoring and control of the implementation of the Waste Regulations 2000 in these areas. However, there is currently no dedicated unit or staff group within MCIT assigned to enforce waste legislation or to advise and monitor environmental management issues or policies within these areas.

4. Current challenges

Adequate financial and human resources are crucial for the proper enforcement and administration of environmental laws. With regard to waste management, Eswatini is currently facing the repercussions of inadequate resources. The present section focuses on aspects that need to be prioritized to ensure an environmentally sound waste management system and minimization of health hazards.

Legislative and institutional challenges: Waste management laws are enforced ineffectively, which may be attributed both to inherent weaknesses in the laws themselves, and to a lack of capacity and manpower to ensure compliance and enforcement.

An institutional and legal framework has been devised by the Government of Eswatini for the purpose of ensuring effective waste management in the country. However, there is lack of clarity on the implementation mechanism to be adopted for enforcing the framework for sustainable waste management. There are no specific guidelines, standard operating procedures and protocol for enforcing implementation. EEA, as per EMA 2002, is mandated to issue guidelines and standards for implementation of effective waste management practices. However, the same are yet to be notified. Legislations such as Waste Regulations 2000 and National Solid Waste Management Strategy talk about waste segregation, but guidelines are still required to specify the number of streams waste shall be segregated in. Moreover, there is need for assessment of infrastructure to strengthen collection, transportation and treatment of segregated waste. There is a legal mandate to collect data on waste management, monitoring compliance and enforcement. However, the Waste Information System for the same is yet to be implemented. Field inspectors deployed to monitor compliance are insufficient in number and need to be capacitated.

The obligations of local authorities with regard to waste management are defined in the Environment Management Act 2002 and the Waste Regulations 2000. However, these obligations need to be supported by a robust institutional and implementation mechanism at the local level. The financial constraints currently experienced by many local authorities make it difficult for them to prioritize the entire suite of waste management services over and above a minimum of waste collection services. Moreover, urban local bodies also have to adopt and notify bye-laws to address local challenges.

For rural and peri-urban areas where 76 per cent of the country's population resides, the legal and institutional framework for waste management is limited. The only provision for waste management in rural areas laid down in EMA 2002 and Waste Regulations 2000 is declaring any rural area as a 'waste control area' to enforce the regulations for waste management in that jurisdiction. However, such areas are yet to be designated. Moreover, there are limited institutional responsibilities laid out for the concerned authorities for service provision (including the identification and implementation of appropriate waste management systems), arranging finances, and monitoring and enforcement. The tinkhundla and chiefdoms lack a legal mandate and the capacity to operationalize waste management services. This calls for stronger linkage between traditional and formal government authorities.

Lack of waste quantification data: A comprehensive assessment of sustainable waste management options in a country can only be made with a reliable waste database. However, many developing countries, including Eswatini, lack the required basic statistics. A few studies have reported waste quantities that cannot be validated and are sometimes based on assumptions, not scientific measurements. Data on municipal solid waste generation and composition is not available for cities. In general, a nationwide waste statistic is lacking; field studies on household waste composition and generation have not been conducted holistically in the country.

The primary problem related to the estimation of household waste, commercial waste and litter is the absence of reliable data. All local authorities are supposed to report waste amounts generated within their areas of jurisdiction to the EEA. Reliable information can only be obtained by maintaining weighbridge records at the dumpsites and by conducting regular surveys of different waste types and waste fractions from specific waste sources. Mbabane landfill is the only place where waste is weighed.

Inefficient segregation: Eswatini's legal framework mandates the local government authorities to implement source segregation. However, there are no further guidelines as to how many streams waste should be segregated in. Moreover, there is a lack of infrastructure instrumental for ensuring segregation at source. Awareness campaigns have not been conducted, staff has not been trained, separate bins have not been provided, and transportation vehicles do not have sperate compartments for different streams of waste. Due to lack of segregation, there are limited processing and recycling options after collection. As per Waste Regulations 2000, people can indulge in sorting at the dumpsite but that is not a sustainable waste management practice.

Inefficient collection and transportation: Waste is only collected in urban areas but even there it is not done daily. Certain urban local bodies do not even engage in door-to-door collection. They still carry out curb-side collection through skip bins. Most urban local bodies have deployed secondary collection vehicles and there is a lack of primary collection vehicles such as auto-tippers, wheel barrows and tricycles, due to which door-to-door collection is hindered.

Collection frequency and efficiency are insufficient to ensure proper management of waste. The average collection rate is a meagre 46 per cent. As per Waste Regulations 2000, waste must be collected at least once a week. However, at least the organic fraction of waste must be collected daily. Commercial waste is collected along with household waste using the same vehicle, which leads to poor management of waste post collection. Effective collection mechanisms are lacking in informal areas. Hence, incomplete collection leads to illegal collection points.

After door-to-door collection, waste is directly transported to the dumpsites. There are no transfer stations in any city or town in the country and many urban local bodies do not even have official secondary collection points, implying that every waste collection truck has to take the waste directly to the dumpsite. This leads to insufficient collection of waste and formation of illegal collection points, thereby aggravating problems like open dumping, burning and burying of waste.

Processing: There is no processing facility available for treatment of organic waste. For dry fractions of waste, there are no material recovery facilities or sorting centres to divert recyclable material from reaching the dumpsite. There are very limited recycling facilities spread across vast distances. Moreover, the recycling space is dominated by informal workers who scavenge for recoverable materials from dumpsites and sell them to unauthorized recycling facilities, which also export the materials to South Africa.

Waste disposal: There are six landfills in the country. The operation and distribution of these landfills is a matter of concern. Moreover, large quantities of waste is dumped in prohibited sites or illegal dumpsites, thus contributing to environmental deterioration. Landfills are termed engineered but there are no clear guidelines available in terms of design criteria, site selection and operational criteria. Also, no distinction is made between the so-called engineered and sanitary landfills. Informal dumpsites in town councils and town boards are a major challenge as waste burning is common in these areas.

Informal sector: The informal sector has a very strong presence in the solid waste management ecosystem of the country. Informal rag-pickers are a common sight in both urban and rural areas. No precautions are taken to avert occupational health hazards. Waste pickers are exposed to high health risks because they work in close contact with waste, including hazardous and medical waste. There is an urgent need to identify all informal hotspots in the cities and plan their inclusion into formal waste management operations to improve recycling rates and minimize the waste ending up in landfills.

Financial sustainability: Currently, MHUD is responsible for appropriating funds for solid waste management in urban areas. The budget currently is insufficient as waste management is not a prioritized service. Further, as observed from the data received from the cities, revenue earned from collection of user fees is insufficient to meet the cost incurred by local bodies for waste management services. To increase the financial sustainability of the overall process, city authorities need to shift focus to channelizing waste from various sources to relevant processing facilities, and extracting optimum amounts of valuable resources from the waste while also creating meaningful livelihood opportunities for formal and informal workers in the process. Since rural areas are governed by traditional forms of government, there is no funding for waste management services in these areas.

Public awareness and behaviour change: In the context of its international and national obligations, the government of Eswatini must promote environmental awareness and education among the people of Eswatini, especially with regard to indigenous knowledge and the role of women and youth in safeguarding the environment, specifically targeting sustainable waste management practices such as source segregation and importance of no littering. It is important to note that public participation has been mentioned in the Environment Management Act, which addresses the significance of environmental awareness and edification adequately. Presently, rural and urban communities are not aware of waste management legislation, their rights and obligations in terms of waste management and the essential role they need to play in managing waste. The government will have to put much more effort into environmental education and awareness to empower not only local government authorities but also communities which will have to practice sustainable management and use of natural resources in rapidly changing rural and urban settings. This can be done by extensive IEC activities and capacity building programmes.

5. Recommendations for sustainable waste management in Eswatini

Waste inventorization: The most crucial part of waste management is the creation of a high-quality database on waste quantity and composition. Data collection on waste is inherently problematic due to its varied and heterogeneous nature. Without credible data, it is difficult to design sound waste management strategies or to make wise budget allocation. It is important to note that Waste Regulations 2000 mandate data collection on various aspects of waste management, monitoring compliance and enforcement. However, the so-called Waste Information System for the same is yet to be implemented in the country. EEA can utilize the collected information for different purposes like making waste management plans, monitoring implementation of waste management plans, forecasting future quantities of waste and publishing annual waste statistics. Therefore, considerable efforts must be made to improve the information base in order to facilitate the drafting of integrated waste management policy for Eswatini.

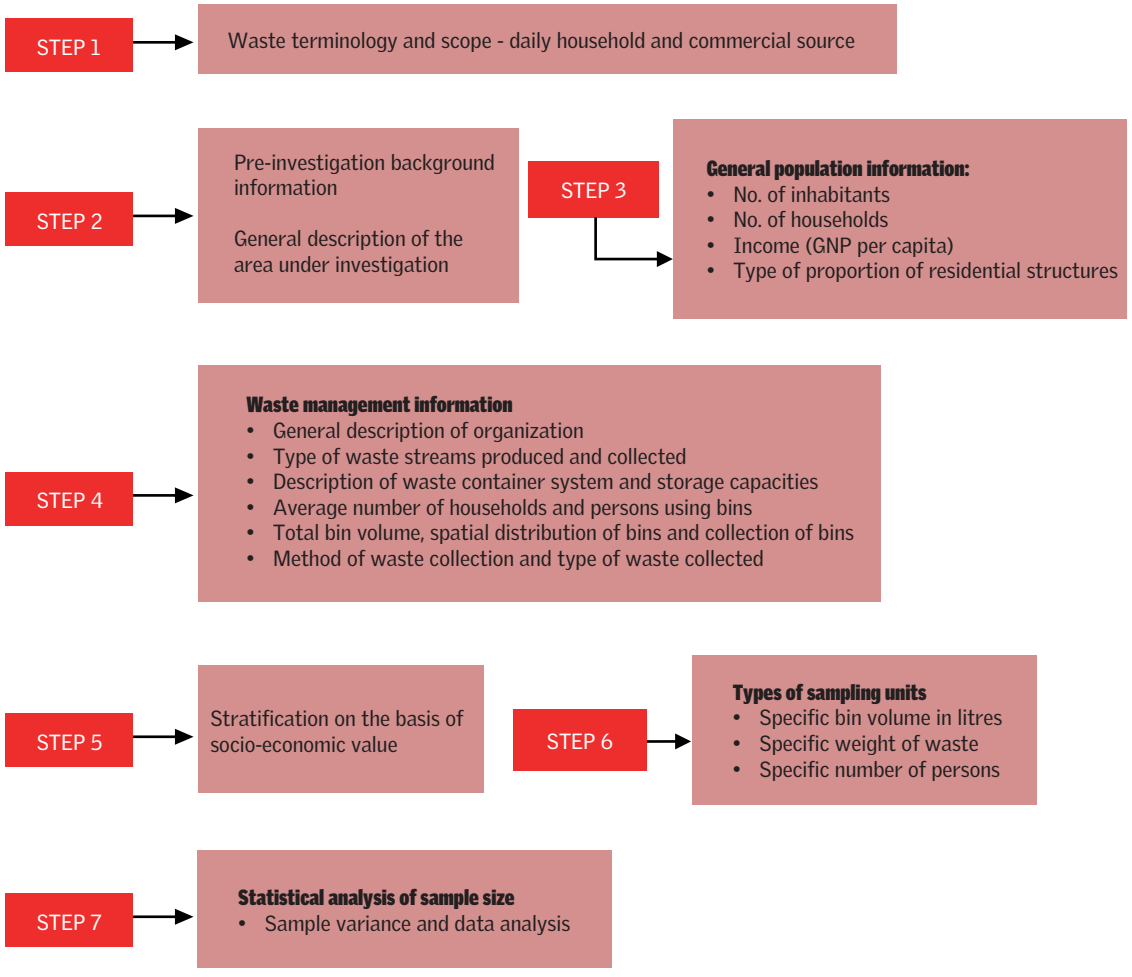
Adoption of 8R principle: The state should formally adopt the "8R concept" (Regulate, Rethink, Repair, Reduce, Reuse, Recover, Recycle and Re-manufacture) to conserve energy, minimize waste and promote recycling. This would be possible only when development planning agencies make targeted efforts to create markets and engage the local community to make this strategy financially viable and socially sustainable. Procurement done by all government departments and agencies should conform to the set of prescribed standards and codes so that regulators can ascertain "eco-friendly" characteristics and green properties in a given product.

Source segregation: Municipalities should ensure segregation of municipal solid waste at source. No other alternative can possibly provide as robust and economical a solution for sustainable waste management. Accordingly, municipalities should create processes and devise management systems to segregate different waste streams generated from households and bulk waste generators.

Community awareness: The community in general, and community–based organizations (CBOs) and non-governmental organizations (NGOs) in particular, should become active participants in recycling and reuse of recyclables (plastics, paper, glass, metal, etc.) in cities. CBOs and NGOs can help promote public awareness about waste management. They can also engage in educational

outreach programmes for small-scale generators, restaurants, wholesale and retail merchants, and commercial establishments.

Figure 4: Steps for municipal solid waste inventorization



Source: D.D. Basu, 2017, CSE

Efficient collection mechanism and establishment of material recovery facilities and transfer stations: If segregation of non-biodegradable and biodegradable waste is efficient, then it makes sorting and recycling of waste a lot easier. Cities should ensure collection systems are efficient and collect segregated wet waste every day from households. Dry waste can be collected once or twice a week while domestic hazardous waste and sanitary waste can be collected once a week with the help of requisite infrastructure and manpower. This collection frequency can be replicated for institutions as well. However, for hotels, restaurants, airports, hospitals and other commercial areas, wet waste can be collected twice

a day and dry waste once every alternate day. Furthermore, in order to enhance collection, transportation and recycling efficiency, ULBs may:

- Introduce a door-to-door collection system with designated days for collecting dry waste only from individual, commercial and institutional generators.
- Set up decentralized dry waste facilities or MRFs (material recovery facilities) in every inkhundla.
- Institute waste transportation mechanism to bring the entire volume of dry waste directly to the processing facilities or MRFs.
- Identify potential recyclers to whom dry waste can be sold at a reasonable price.
- Assess the requirement for new manpower and vehicles to strengthen collection and transportation services, and cut transportation costs.
- Make provisions for adequate and appropriate collection and transportation systems for segregated waste. Waste must be collected and transported in compartmentalized covered vehicles or covered containers in vehicles to processing facilities and, thereafter, to processing and disposal facilities.
- Ensure all the stakeholders are covered by collection and transportation vehicles.
- Allocate separate days for collection of wet and dry waste—wet waste should be collected daily and dry waste weekly or bi-weekly as per the quantity of generation.
- Assign a specific time to vehicles for collection and transportation.
- Geo-tag collection and transportation vehicles to ensure real-time monitoring of waste transportation.

Technological options and operational models: Municipal authorities should minimize the cost of collection and transportation of biodegradable waste, as well as prevent odour and public health issues by setting up decentralized waste processing facilities such as composting units and biomethanation within the community (colony, housing society, institution premises, local area, etc.) through resident welfare associations (RWAs), CBOs, NGOs, advanced locality management (ALM), self-help groups, etc.

Dry waste treatment: Recyclable dry waste should be collected with the help of the informal sector and sent to the respective recycling centres. For example, waste glass should be sent to the glass recycling plant, plastic to plastic recycling plant and metal to metal recycling plant. Non-recyclable dry waste should be sent to co-processing plants (energy-intensive industries such as cement kilns and steel plants). In order to minimize the environmental risk of plastic litter in both urban and rural areas of Eswatini, tried and tested tools such as extended producer

responsibility (EPR), deposit refund schemes (DRS), advanced recycling fee (ARF) or plastic ban should be adopted with relevant changes for local suitability.

Wet waste treatment: Projects related to wet waste treatment should be encouraged and supported for setting up environmentally and economically viable treatment options such as biomethanation and composting plants where the wet biodegradable portion of municipal solid waste can be processed to produce biogas (in case of biomethanation) or compost (in case of conventional composting or home composting). Such plants should preferably be community based (maximum 20 TPD) or decentralized in various parts of the city. In the absence of suitable land or local acceptance, centralized plants may be set up.

Separate treatment methodology for sanitary waste, household hazardous waste, healthcare waste and e-waste: Household waste typically comprises biodegradable kitchen waste, packaging plastics, non-packaging paper and cardboard, packaging glass, and packaging paper and cardboard. Nevertheless, e-waste, sanitary waste and healthcare waste are also generated from households and efforts should be made to segregate and treat these waste streams in a different manner as these are relatively more infectious and hazardous in nature. Especially serious efforts are needed for environmentally sound disposal of COVID-19 waste generated from households. COVID-19 pandemic has generated huge quantities of waste all across the world. This has to be addressed with extreme caution in order to prevent sanitation workers from contracting the infection while dealing with waste generated from households and institutions. Co-disposal of municipal solid waste (general waste) with other waste categories should be strictly prohibited by the authorities.

Sanitary landfill construction for disposal of inerts and rejects: Setting up of sanitary landfills for disposal of inerts and residual waste from processing plants should be facilitated through a public private partnership. Projects must be of large capacity and designed for a period of 25–30 years with initial cell capacity to handle not less than 100 TPD of inerts and residual waste for 5 years to ensure economic viability and professional management. Residual waste from all processing facilities should be sent to sanitary landfills. For minimizing the requirement of land for disposal of such waste, and to ensure economy of scale, regular monitoring and professional management of the facility, large common regional sanitary landfills covering at least 40,000 people may be setup for the disposal of only inerts in a cost-effective manner on a cost-sharing basis among the beneficiaries and municipal authorities. Independent landfills may be setup in cities with above one million populations.

Integration of informal sector: The informal sector plays a vital role in waste management. Integrating the informal sector in the waste management value chain so as to secure livelihoods while improving collection, segregation and material recovery will have major implications on waste collection expenditures and reduce the need for landfills. City authorities should first map the entire network of informal waste collectors including aggregators and dry waste recycling facilities to gain operational knowledge of the economy of informal waste collectors.

Capacity building for integrated waste management system: It is of paramount importance to build capacity of local officials for integrated management of solid waste and create a resource pool at key leadership positions that can drive the entire initiative to institutionalize a more sustainable, environment friendly and decentralized system of waste management. The process of capacity building needs to be planned in a phased manner to facilitate a 'learn and do' mode of implementation. The capacity building process also needs to create a pool of master trainers across themes concerning various facets of municipal solid waste management. These master trainers would be responsible for building capacity of ward-level officials, door-to-door collectors, volunteers for IEC campaigns and others to develop a common understanding around key parameters of circular economy that are vital for decentralized management.

Capacity building of other stakeholders is also equally important. There has to be a mission mode approach for training communities about the importance of source segregation and making them aware of sustainable waste management practices. Urban local bodies may:

- Design training on integrated solid waste management systems, planning a communication campaign and monitoring of planned activities.
- Prepare an annual training calendar for capacity building of officials.
- Plan exposure visits to cities with best practices for learning through field visits and interaction with city officials and other stakeholders.

Institutional and legal arrangements: The following institutional and legal arrangements are recommended for improving waste governance in Eswatini:

- EEA, along with the concerned ministry, must issue draft bye-laws to help local authorities notify their own municipal bye-laws.
- EEA must issue proper integrated waste management policies, guidelines and SOPs for management of waste in Eswatini for both urban and rural regions.
- EEA should also outline the clear responsibilities of institutions at each level of governance with regard to waste management.
- Monitoring and evaluation of compliance of other environmental legislation

with the provisions of the Waste Regulations 2000 should be done. Compliance monitoring is typically undertaken on both a reactive and proactive basis. Proactive compliance inspections, also known as strategic compliance and enforcement inspections, involve the prioritization of regions for waste management related inspection and physical inspections involving multi-disciplinary waste management task teams. On the contrary, reactive compliance inspections are undertaken when there is non-compliance reported in any city.

- Ensure enforcement of the provision of the rules for waste governance under The Environmental Management Act 2002 and The Waste Regulations 2000.
- Create a task force with selected senior officials from all units, and create an institutional mechanism to periodically review the progress made on various programme components and take necessary course correction measures.
- Improve coordination among various units and associated ministries.
- Ensure mandatory registration of all industrial and commercial units (bulk waste generators).
- Strengthen community-level surveillance to ensure source segregation and the anti-littering initiatives by engaging with citizens through IEC tools.
- There is a need for each Regional Office to establish a Waste Management Department with responsibilities and duties for ensuring safe waste collection and disposal in dense settlements and larger shopping/market places in rural areas. It is imperative to devise institutional mechanisms in tinkhundla and chiefdoms for waste management.

Remediation of old dumpsites and scientific landfill operations: Rehabilitation and remediation of landfills or dumpsites, including biomining of dumpsites, should be initiated on a priority basis in the cities where water table is typically high and the amount of waste being deposited is huge. Based on the outcome and cost implications, strategic policy and technological interventions regarding remediation and capping should be undertaken. Remediation of existing dumpsites should be planned to minimize further damage. A part of the land should be released by scraping and accumulating scattered waste and used for sanitary landfills or other profitable uses. Remediation to release precious land is highly recommended. Scientific construction of landfill and sustainable practices such as daily cover, compaction of waste, and disposal of non-recyclables and non-compostable waste should be adopted.

Adoption of PPP model for waste management services and financial sustainability: PPP has been effective in accelerating the supply of public services and alleviating the government's financial burden, especially in the

HOUSEHOLD HAZARDOUS WASTE

Unsegregated waste that ends up in landfills contains many toxic substances, including waste from households such as paints, varnishes, expired medicines, needles, empty bottles of mosquito repellents, rodenticides and pesticides. These substances are recalcitrant in nature and pose various hazards to human health and the environment when improperly disposed of along with regular municipal solid waste into the landfill. In addition, unsegregated dumping of domestic hazardous waste with municipal solid waste in the dumpsites or sanitary landfills leads to the generation of toxic wastewaters called leachate. The highly contaminated and hazardous leachate is formed due to infiltration of rainwater through landfill space and inherent water present in waste by physicochemical and biological transformations.

Although household hazardous waste is generated in lesser volumes, it poses extreme threat to human health and the environment. Household hazardous waste may include items such as *discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes, and contaminated gauge generated at household levels*. Leftover paints and varnishes are an example of common polluting waste in homes. They often contain toxic heavy metals and flammable solvents. Lead, a highly toxic metal, is found in lead-based paints which are often used on walls, toys and art supplies. Young children are particularly vulnerable as even low levels of lead exposure can cause cognitive disabilities in children.

City authorities should establish waste collection centres for domestic hazardous waste and ensure safe storage and transportation of domestic hazardous waste to the hazardous waste disposal facility or as may be directed by the city's municipal bye-laws.

Domestic hazardous waste should be disposed of in a hazardous waste management facility with state-of-art technologies for safe disposal of hazardous waste typically generated from industrial sources.

context of waste management. There have been several examples across the world where waste management services are being provided with the collaboration of government and private companies. PPP enables the government and private sector to build a long-term cooperative relationship in public service supply. A suitable institutional arrangement can help to facilitate the involvement of private sector and PPP adoption in Eswatini. Private players that have the means and are willing to pursue waste management businesses in Eswatini should be facilitated and promoted by certain bye-laws.

For financial sustainability and infrastructural development, Eswatini can seek funding from global funding agencies like African Development Bank, World Bank and European Commission. For example, the World Bank finances and advises on solid waste management projects using a diverse range of services, including traditional loans, results-based financing, development policy financing

and technical advisory. World Bank-financed waste management projects address the entire lifecycle of waste—from generation to collection and transportation, and finally treatment and disposal.

It is strongly recommended that the Government of Eswatini reviews the previous National Solid Waste Management Strategy and formulates a new Integrated National Waste Management Strategy taking into consideration emerging and contemporary issues on waste management, best practices and lessons learnt. This strategy should focus on waste reduction, reuse and recycling whilst using BATs/BEPs for waste to energy conversion, incineration and landfilling.

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As Eswatini's population density and rate of urbanization are rising, waste generation is increasing at an escalating rate. In the future, waste management is expected to become even more challenging and expensive for the government, local authorities and urban residents. There is an urgent need to review and strengthen the existing institutional and infrastructural capabilities of Eswatini in order to achieve sustainable solid waste management based on resource conservation and circular economy principles. This study is a step in that direction.

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