COMPARATIVE ANALYSIS

Comparative Analysis of Waste Management Systems in Slovakia and Sicily: Challenges, Approaches, and EU Policy Implementation

Co-funded by the European Union

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Introduction

Waste management plays a critical role in modern society, influencing environmental health, public well-being, and economic efficiency. The proper handling of waste—from generation and collection to treatment and final disposal—shapes sustainability, protects natural resources, and secures the long-term viability of local communities. Furthermore, waste management does not exist in isolation; it reflects a broader interplay between socio-political priorities, technological capabilities, and community attitudes.

This Comparative Analysis is one of the key outputs of the Erasmus+ KA210-VET *Waste Wise: Enhancing Governance for Sustainable Waste Management* project (No. 2024-2-SK01-KA210-VET-000260945). The initiative aims to strengthen professional development among employees of public offices and companies operating in the field of waste management and administration. Through such capacity-building, the project supports sustainable growth, promotes quality job creation, and reinforces European identity, legislation, and active citizenship.

By examining waste management practices in Slovakia and Italy (with a particular focus on Sicily), the project evaluates the strengths and weaknesses of each approach and explores how best practices might be adapted and transferred elsewhere. As part of this effort, over 120 public- and private-sector employees will receive targeted training in waste management and legislation.

The Comparative Analysis has five core objectives:

1. *Identify Legal Regulations:* Map out waste management legislation at the EU level, and within Slovakia and Italy (Sicily), to understand how policies guide on-the-ground practices.
2. *Analyse Waste Management Organization*: Investigate how waste management is structured in both countries/ regions, including the roles of public offices, private entities, NGOs, and other stakeholders.
3. *Identify Good Practices and Emerging Trends*: Compare successful strategies, such as recycling programs and energy recovery initiatives (e.g., biogas production), while highlighting the role of community engagement in promoting responsible behaviour.
4. *Compare Practices in Slovakia and Sicily*: Examine organizational structures, operational methods, and policy implementation to evaluate how each setting addresses shared challenges.
5. *Propose Policy Recommendations and Educational Initiatives*: Draw on international benchmarks and evidence-based insights to formulate policy recommendations and training materials tailored to the contexts of Slovakia and Sicily.

A mixed-method approach underpins the analysis, combining quantitative data—such as legislation, waste generation rates, and recycling performance—with qualitative insights from surveys administered among employees and the wider public. This dual focus on numerical indicators and community feedback enables a more holistic understanding of waste management systems.

This comparative analysis is divided into 5 chapters, each examining a different dimension of waste management in the EU, Slovakia and Italy (particularly Sicily). By covering legislative frameworks, practical implementations, community engagement, and policy recommendations, the analysis provides a comprehensive overview of current practices and future opportunities for designing future educational activities.

This comparative analysis contains the following chapters:

1. *Chapter 1 „Overview of EU Waste Legislation":* The Chapter presents the primary EU directives and regulations that regulate and influence the waste management in both Slovakia and Sicily.

2. *Chapter 2 „Waste Management in Slovakia":* The Chapter reviews Slovakia's waste management laws and policy objectives, aligning them with EU requirements. It highlights administrative structures, oversight mechanisms, infrastructural challenges, and replicable initiatives.

3. *Chapter 3 „Waste Management in Sicily":* The Chapter outlines Italian and Sicilian legislation and examines existing recycling and separation programs, including approaches to special and hazardous waste. It emphasizes the roles of governmental bodies and private actors, showcasing successful local or regional interventions.

4. *Chapter 4 „Community Engagement in Slovakia and Sicily":* The Chapter assesses public and office-staff attitudes regarding waste reduction, recycling, and legislative compliance. Surveys conducted from March to May 2025 reveal levels of awareness, willingness to adopt more sustainable practices, and remaining knowledge gaps.

5. *Chapter 5 „Summary and Policy Recommendations":* The final Chapter synthesizes the key findings from the previous chapters, provides a comparative analysis of waste management systems in Slovakia and Sicily, and illustrates how a comprehensive understanding of waste management and legislation contributes to advancing sustainability.

This Comparative Analysis offers a comprehensive view of waste management from legislative and policy perspectives to practical, technological, and community-driven approaches. By systematically comparing Slovakia's and Sicily's models, the report highlights both areas for improvement and outstanding successes, laying the groundwork for robust collaboration, knowledge exchange, and the adaptation of best practices. Ultimately, the insights presented here seek to inform policymakers, practitioners, and citizens alike, fostering more efficient, sustainable, and inclusive waste management systems across Europe.

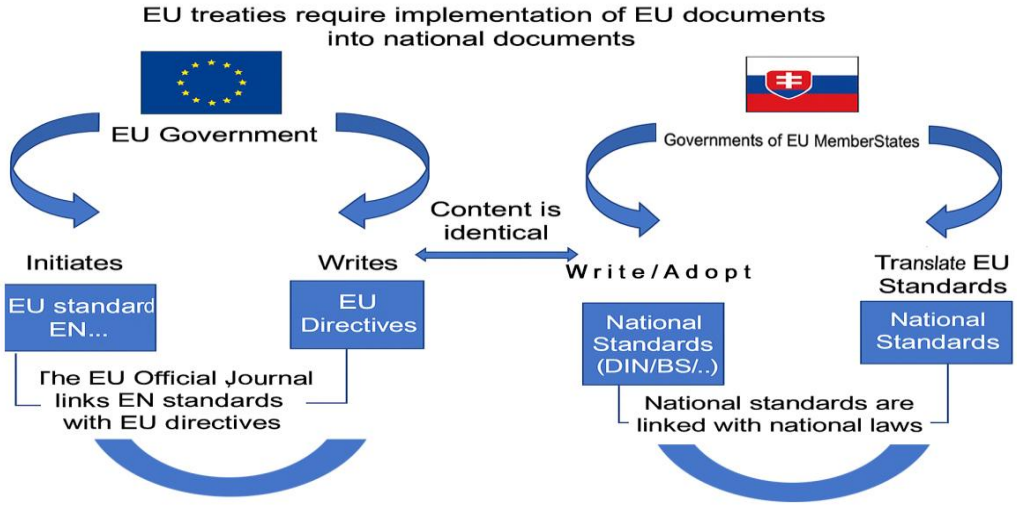
Chapter 1: Overview of EU Waste Legislation

Effective waste management within the European Union (EU) is guided by a series of directives, regulations, and policy measures designed to protect the environment, conserve resources, and promote sustainable economic growth.
This chapter provides an overview of the most relevant EU legislation shaping waste management, laying the foundation for the comparative analysis presented in subsequent chapters.

1.1 The Role of the European Commission and Member States

The European Commission acts as the central body responsible for proposing and enforcing EU legislation. Member States, including Slovakia and Italy, are required to transpose EU directives into their national legal frameworks and ensure compliance. Monitoring and enforcement may involve the European Court of Justice if a Member State fails to meet its obligations. This hierarchical structure aims to maintain consistent standards while also allowing for regional nuances in implementation.

Harmonization of EU standards into the laws of individual Member States



Source: Feher, 2024

1.2. Fundamental EU Legislative Framework for Waste Management

The evolution of EU environmental legislation on waste began in earnest in the 1970s, spurred by growing awareness of pollution and resource depletion. Over time, the scope of EU policy expanded to encompass diverse areas such as chemicals regulation (e.g., REACH), industrial emissions, and waste management. The progression of EU waste-related legislation has been guided by a desire to minimize landfilling, promote recycling, and extend the life cycle of products through reuse and recovery.
Over the past three decades, the European Union (EU) has established an extensive body of environmental legislation aimed at protecting human health, safeguarding natural resources,

and promoting sustainable economic growth. This framework comprises more than 300 legal instruments—directives, regulations, decisions, and recommendations—supplemented by policy documents, bulletins, and position papers, many of which address waste management specifically. Collectively, these measures seek to reduce environmental harm, encourage efficient resource utilization, and foster an eventual shift toward a circular economy.

1.3. Important EU Waste Legislation

I. The Waste Framework Directive (Directive 2008/98/EC)

A cornerstone of EU waste legislation is Directive 2008/98/EC, amended by Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 , commonly referred to as the Waste Framework Directive (WFD). Enacted on 19 November 2008, it came into force on 12 December 2008, replacing several earlier directives. The WFD establishes:

1. Core Definitions: It clarifies the term *waste* as "any substance or object which the holder discards or intends or is required to discard." This definition highlights the perspective that waste, if mismanaged, constitutes a substantial loss of resources—both material and energy.
2. The Waste Hierarchy: Article 4 sets out the waste hierarchy, ranking options from most preferable to least preferable:
    1. Prevention (avoiding or reducing waste at source)
    2. Reuse (using a product again without significant reprocessing)
    3. Recycling (reprocessing waste materials for original or alternative purposes)
    4. Other Recovery (including energy recovery)
    5. Safe Disposal (landfilling or incineration without energy recovery)

Source: https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

This hierarchy informs all subsequent EU waste policies, encouraging stakeholders to prioritize prevention and reuse over disposal.

3. End-of-Waste Criteria: The WFD introduces the notion of *end-of-waste*, defining conditions under which certain wastes cease to be classified as waste. If an item meets specific quality and safety criteria, it can be recognized as a viable secondary raw material, fostering more efficient resource utilization.
4. Roles and Responsibilities: The directive clarifies duties for waste generators and holders, emphasizing that Member States should adopt necessary measures to ensure environmentally sound waste handling. It also promotes the principle of *extended producer responsibility* (EPR), encouraging product manufacturers to consider waste management implications throughout a product's life cycle.

Through its core definitions and guiding principles, the WFD aims to reduce the environmental and human health impacts of waste. By incorporating prevention, reuse, and recycling as the top priorities, the directive lays the groundwork for further legislative initiatives that address specific waste streams and promote circularity.

II. Directive (EU) 2018/851: Updates to the Waste Framework Directive

Directive (EU) 2018/851, adopted on 30 May 2018, amended and updated the 2008 WFD. Key modifications include:

1. Revised and Expanded Definitions: New terminology was introduced to keep pace with evolving waste management practices and policy developments. For example, "preparing for reuse" was clarified to distinguish between direct reuse and forms of recycling or recovery.
2. Economic Instruments for Waste Prevention: Member States are encouraged to use economic tools—such as taxation, fees, and deposit-return schemes—to incentivize adherence to the waste hierarchy. These measures can help reduce waste generation and raise public awareness of waste issues.
3. Municipal Waste Recycling Targets: The directive sets ambitious yet phased targets for preparing municipal waste for reuse and recycling. These are:
    - 55% by 2025
    - 60% by 2030
    - 65% by 2035

These targets seek to standardize performance across Member States, pushing them to invest in infrastructure and public education campaigns while discouraging practices that lead to excessive landfilling.

4. Construction and Demolition Waste Management: Recognizing that building and demolition operations often generate large volumes of waste, the directive calls for selective demolition practices to facilitate the safe removal and management of hazardous substances. It also encourages the adoption of best available techniques to ensure high-quality recycling and recovery of valuable construction materials.
5. Prevention Measures: Member States are asked to develop strategies that minimize the creation of waste in the first place—particularly in sectors such as construction, demolition, and manufacturing. Prevention efforts may also address product design, packaging materials, and consumer behavior.

By raising targets for reuse and recycling, Directive 2018/851 reinforces the EU's long-standing commitment to resource efficiency and positions waste management as a key enabler for achieving a more circular economy.

III. The List of Waste: Decision 2014/955/EEC and Regulation (EU) No 1357/2014

A critical step in standardizing waste management is the List of Waste (LoW), governed by Commission Decision 2014/955/EEC and Regulation (EU) No 1357/2014.

These legal acts:

- Harmonize the classification of waste across the EU, mandating a six-digit code that identifies each waste type.
- Enable waste producers and regulatory authorities to determine whether waste is hazardous or non-hazardous.
- Relate specific waste codes to a set of hazardous properties, ensuring consistent labeling and management strategies.

This uniform classification simplifies data collection, streamlines cross-border waste shipment protocols, and fosters clarity among waste generators, treatment operators, and governmental bodies.

IV. National Legislation within Member States

In addition to harmonized EU directives, each Member State enacts its own set of laws, regulations, and decrees. While these must align with minimum EU standards, they often contain specific provisions suited to national circumstances, such as administrative structures, geographic considerations, and waste-generation profiles.

For example, a national waste management act might:

- Prohibit any person from holding, transporting, or disposing of waste in a manner that risks environmental pollution.
- Oblige commercial and industrial entities to reduce waste or handle it responsibly.
- Restrict the transfer of waste to unauthorized persons.
- Mandate that local authorities develop comprehensive waste management plans for both hazardous and non-hazardous waste.
- Empower environmental protection agencies to oversee compliance, issue permits, and enforce penalties for violations.

Taken together, national legislation ensures that EU directives are effectively transposed into actionable regulations at local and regional levels, backed by enforceable standards and penalties where necessary.

V. Broader European Policy: From the 7th Environmental Action Programme to the European Green Deal

EU waste legislation is also underpinned by broader environmental policies. Notable among them are:

1. 7th Environmental Action Programme (EAP): In force from 2014 to 2020, this program guided the EU's environmental policy, advocating a transition to a recycling-oriented society. It called for eliminating the landfilling of recoverable waste, reducing total waste generation per capita, and enhancing the efficient use of materials through prevention, reuse, and recycling.
2. European Green Deal (2019): Presented by the European Commission in December 2019, the Green Deal outlines an action plan to make the EU's economy more sustainable by turning climate and environmental challenges into opportunities. Its objectives include achieving net-zero greenhouse gas emissions by 2050, decoupling economic growth from resource consumption, and spurring investments in greener technologies—waste management improvements play a key role in this agenda.

3. Circular Economy Action Plans (2015, 2018, 2020): In 2015, a package of measures was introduced, including recommendations and legislative proposals for implementing the circular economy. The culmination of this effort was the unanimous agreement of 193 countries in New York, in which they committed to jointly fight for a better future for our planet and all the people of the world by signing the 2030 Agenda, comprising 17 Sustainable Development Goals.

Source: Khouri et al., 2018.

These action plans seek to transform Europe's traditional linear economy into one in which materials are kept in use for as long as possible. They encourage innovation in sustainable product design, promote the creation of new markets for high-quality secondary raw materials, and address waste-intensive sectors like plastics, packaging, and electronics.

Key legislative measures have included:

- Directive (EU) 2018/850, amending landfill legislation to tighten restrictions on waste disposal.
- Directive (EU) 2018/852, amending packaging and packaging waste legislation to raise recycling targets.
- Directive (EU) 2018/849, addressing vehicles, batteries, and electronic equipment.
- Directive (EU) 2018/851
  (Member States shall set up separate collection at least for paper, metal, plastic and glass, and, by 1 January 2025, for textiles.)

Source: Parliamentary News (2021) "Circular economy: defining importance and benefits"

1.4. Key Goals, Targets, and Future Directions

A central aim of EU waste legislation is to drive higher recycling rates and a reduction in landfilling. By 2030, the aspiration is to ensure that no recyclable or recoverable waste ends up in landfills, except where disposal is environmentally optimal. The EU also sets specific sectoral targets, such as a ban on landfilling certain categories of recyclable waste, higher recovery rates for packaging, and the progressive improvement of resource productivity.

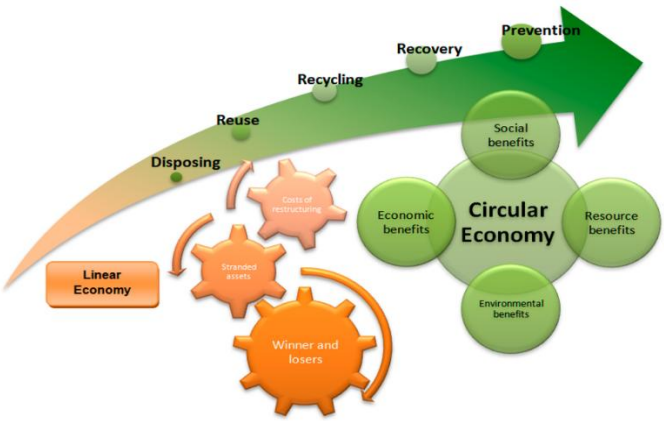
1. Packaging Waste: Targets for packaging recycling have been increasing steadily. For instance, the directives outline achieving a minimum 60% overall recycling rate for packaging waste by certain deadlines, with sub-targets for materials like paper, glass, plastics, and metals. These requirements incentivize the development of more sustainable packaging, advanced sorting infrastructure, and producer responsibility schemes.

2. Food Waste: Although not formalized into directive-based targets in the same manner as packaging, food waste prevention has gained prominence. Through policy statements and action plans, the EU encourages Member States to adopt measures that reduce food waste along the entire supply chain—from production to consumption.
3. Construction and Demolition Waste: These sectors can produce large waste volumes, some of which is highly recyclable (e.g., scrap metals, concrete, bricks). EU legislation mandates selective demolition and high-quality recycling or recovery, aiming to increase resource efficiency and reduce reliance on virgin materials.
4. Electronics and Batteries: Through directives on Waste Electrical and Electronic Equipment (WEEE) and batteries, the EU imposes extended producer responsibility on manufacturers, encouraging them to design products that can be easily dismantled, repaired, or recycled. Substances that hinder recycling or pose health risks—like certain heavy metals—are restricted or banned under the Restriction of Hazardous Substances (RoHS) Directive.

1.5. Toward a Circular Economy Model

The overarching goal of EU waste policy is a circular economy: an economic system in which resource use, waste generation, emissions, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. Key components of this transition include:

- Innovative Technologies and Process Improvements: Investments in research and development are crucial for improving waste sorting, recycling, and resource recovery technologies.
- Design for Circularity: Product design strategies, such as modular construction or simplified materials composition, can significantly facilitate reuse and recycling.
- Extended Producer Responsibility: Shifting responsibility upstream to manufacturers incentivizes them to consider the entire lifecycle of their products, reduce hazardous content, and make items more durable.
- Behavioral and Cultural Shifts: Public awareness and social acceptance are vital for achieving high participation in waste separation schemes, returning used electronics for recycling, or choosing repair over disposal.
- Global Leadership and Cooperation: The EU continues to collaborate with other regions, contributing to international treaties and promoting the global adoption of circular practices.



Source: Sustainability Indicators Concerning Waste Management for Implementation of the Circular Economy Model on the University of Lome (Togo) Campus

1.6. Challenges in Implementation

Despite robust legislation, Member States face varied obstacles as they work to align national policies and local practices with EU directives:

1. Infrastructural gaps: Some regions, particularly those with limited access to financial or technical resources, may struggle to develop the necessary waste sorting, collection, and treatment facilities.
2. Administrative capacity and enforcement: Successful implementation requires strong governance, monitoring, and enforcement mechanisms. When capacity is lacking, illicit dumping or subpar landfill operations can undermine policy objectives.
3. Public engagement: Achieving high recycling rates and effective source separation often hinges on citizen awareness and willingness to participate. Educational initiatives and incentive schemes are crucial in promoting positive behavioral change.
4. Economic constraints: Establishing modern waste management facilities can require substantial investment, and not all municipalities or regions have the same budgetary flexibility. EU funding and private-public partnerships can help bridge this gap, but disparities often remain.
5. Data collection and reporting: Accurate data is critical for tracking progress and informing policy adjustments. Member States use different data-collection methods, leading to inconsistencies in measuring recycling rates or assessing whether certain waste streams meet established targets.

1.7. Opportunities for Growth and Innovation

Although challenges persist, they also open opportunities:

- Market creation for recycled materials: As recycling infrastructure becomes more sophisticated, new markets for secondary raw materials can thrive, encouraging competition and technological advancement.
- Job creation: The waste sector, particularly in recycling and resource recovery, offers potential for new employment in engineering, facility operations, environmental services, and green innovation.
- Global competitiveness: By reducing reliance on raw material imports and pioneering sustainable systems, the EU can showcase leadership, turning waste management expertise into an exportable skill set.
- Research and development: Continuous innovation in areas such as bioplastics, high-tech sorting, and advanced chemical recycling can make EU industry more competitive and resilient.

1.8. Key EU waste management regulations that must be implemented into national legislation by all EU Member States:

1. Waste Framework Directive (Directive 2008/98/EC)

- Establishes the waste hierarchy:
  prevention → reuse → recycling → other recovery → disposal
- Requires Member States to adopt waste prevention programs and waste management plans.
- Introduced the concepts of "end-of-waste" and "by-product."

Landfill Directive (1999/31/EC)

- Sets technical requirements for landfills and aims to reduce the landfilling of biodegradable municipal waste.
- Focuses on minimizing environmental impact and encouraging more sustainable waste treatment.

Packaging and Packaging Waste Directive (94/62/EC)

- Sets targets for the collection, recycling, and recovery of packaging waste.
- Applies to all packaging placed on the EU market, regardless of material.

Regulation (EU) No 2023/1542 concerning batteries and waste batteries

- Regulates the collection, treatment, and recycling of batteries.
- Bans certain hazardous substances (e.g., cadmium) in batteries.

Waste Electrical and Electronic Equipment Directive (WEEE – 2012/19/EU)

- Ensures proper collection, treatment, and recycling of electronic and electrical waste.
- Introduces the extended producer responsibility principle.

Waste Shipment Regulation (Regulation (EC) No 1013/2006)

- Governs the transboundary movement of waste within, into, and out of the EU.
- Includes a system of notifications and consents for controlled waste shipments.

Single-Use Plastics Directive (2019/904)

- Bans or restricts certain single-use plastic products (e.g., straws, cutlery, plates).
- Aims to reduce marine litter and promote sustainable alternatives.

1.9. Conclusion

The EU's legislative framework for waste management exemplifies a commitment to balancing economic development with environmental protection. It stresses preventive measures, robust classification systems, strict disposal standards, and ambitious recycling targets, all buttressed by broader policy programs like the European Green Deal and Circular Economy Action Plans. While local, national, and transnational challenges in infrastructure, funding, and administrative capacity remain, these same challenges can spur creativity, collaboration, and the emergence of a greener, more innovative economy.

Through continuous updates to directives—such as Directive (EU) 2018/851, which raises municipal waste recycling targets—the EU signals that legislative evolution will persist in parallel with scientific discoveries and market demands. At the heart of this progression is the vision of a circular economy in which waste is not merely a disposal problem but a resource opportunity. If managed effectively, the EU's waste framework can significantly reduce environmental impact, foster sustainable growth, and secure Europe's global standing as a champion of resource efficiency and environmental stewardship.

Chapter 2. Waste Management in Slovakia

2.1. Legislative and Policy Framework in Slovakia

Historical Evolution of Waste Legislation in Slovakia

Waste management in Slovakia has evolved significantly since the early 1990s. The first national law to regulate waste in the territory was Act No. 238/1991 Coll. on Waste. Subsequently, legislative requirements continued to develop in line with EU regulations and directives.

The current principal legal instrument for Slovak waste management is Act No. 79/2015 Coll.. on Waste (the "Waste Act"), which has already undergone 37 amendments. According to the official explanatory memorandum to Act No. 79/2015, its overarching goal is to modernize and align national waste policy with the standards of economically advanced EU Member States.

The law aims to:

- Establish stable conditions that facilitate improvement and investment in waste management.
- Enhance legal certainty in line with EU best practices.
- Set clear rules for public and private stakeholders involved in managing various waste streams.

Overview of Key Waste Management Laws and Regulations

Act No. 79/2015 Coll. on Waste transposes essential EU directives—most notably the Waste Framework Directive (2008/98/EC)—into Slovak law. It enshrines core principles such as the waste hierarchy (prevention, reuse, recycling, recovery, and disposal), the polluter-pays principle, and extended producer responsibility (EPR). Section 3(1) defines "waste management" as a series of activities focused on preventing or reducing waste generation and handling waste in an environmentally sound manner.

The Waste Act also regulates:

- Program documents in waste management (e.g., the national Waste Management Programme).
- Measures for waste prevention (minimizing or eliminating waste at its source).
- Rights and responsibilities of legal entities and individuals in waste handling.
- Extended producer responsibility for specific product categories ("reserved products"), such as packaging, electronic equipment, and batteries.
- Management of municipal waste (including obligations of municipalities).
- Transboundary movement of waste (aligning with Basel Convention requirements).
- Information system for collecting and reporting waste data (ISOH).
- Enforcement provisions and penalties for non-compliance.

Beyond Act No. 79/2015 Coll., several related laws reinforce the Slovak waste management framework. Notable examples include:

- Act No. 329/2018 Coll. on Landfill Fees, which discourages landfilling by setting higher charges.

- Act No. 302/2019 Z. z. on Deposit Schemes for Single-Use Beverage Packaging, introducing mandatory deposit-return systems for plastic and other containers.
- Act No. 346/2013 Z. z. on Restricting Hazardous Substances in electrical and electronic devices.
- Act No. 582/2004 Z. z. on Local Taxes and Fees, covering municipal fees for waste collection.
- Act No. 514/2008 Z. z. on Mining Waste, addressing disposal of wastes from extractive industries.
- Act No. 188/2003 Z. z. on Applying Sewage Sludge and Sediments in Soil, regulating specific waste-based materials used in agriculture.

These laws are complemented by numerous government regulations and ministerial decrees, for instance:

- Government Regulation No. , Z. z. on Landfill Fees, setting fee rates and redistribution rules.
- Decree No. 371/2015, implementing selected provisions of the Waste Act.
- Decree No. 373/2015, detailing extended producer responsibility for specified products and waste streams.
- Decree No. 365/2015, establishing the national Waste Catalogue.
- Decree No. 366/2015, specifying record-keeping and reporting obligations.
- Decree No. 382/2018, on landfill standards and temporary storage of mercury.

Key Amendments to the Waste Act (No. 79/2015)

Since its enactment, Act No. 79/2015 has undergone multiple amendments, aiming to refine processes and address emerging issues. Among the most significant:

1. 3rd Amendment (Act No. 90/2017 Z. z.)
    - Required reducing lightweight plastic bags and introduced local drop-off points for waste tires.
    - Added mandatory separate collection of paper, plastics, metals, glass, and composite packaging (based on cardboard) for municipal waste.
2. 4th Amendment (Act No. 292/2017 Z. z.)
    - Introduced over 200 changes, including regulations on biologically degradable municipal waste.
    - Obliged municipalities to supplement existing collection with mobile, large-capacity containers or collection yards (zberné dvory).
3. 8th Amendment (Act No. 312/2018 Z. z.)
    - Focused on landfill operations and contamination controls.
    - Reinforced that, from 1 July 2019, municipalities must ensure separate collection for paper, plastics, metals, glass, and composite materials to meet national recycling targets.
4. 11th Amendment (Act No. 460/2019 Z. z.)
    - Revised definitions such as “municipal waste,” “end-of-waste status,” and “by-product.”
    - Phased out exemptions regarding the mandatory separate collection of biodegradable kitchen waste.
    - Removed the requirement for municipalities to create local waste management plans, streamlining administrative tasks.
5. 18th Amendment (Act No. 216/2021 Z. z.)
    - Introduced mandatory weighing systems for waste collection vehicles at the request of municipalities, enhancing data accuracy.

6. 20th Amendment (Act No. 430/2021 Z. z.)
    - Transposed Directive (EU) 2019/904 on reducing the environmental impact of certain plastic products.
    - Established measures such as mandatory charges for specific single-use plastics, minimum recycled content for beverage bottles, and public awareness obligations.

Extended Producer Responsibility (EPR)
A major feature of the current Waste Act is the principle of extended producer responsibility, making manufacturers and importers financially and organizationally responsible for collecting and recycling specific product streams (packaging, electronics, batteries, and tires). They do so via producer responsibility organizations (OZV), which:

- Hold contracts with every municipality in Slovakia, relieving local authorities of the need to sign individual agreements with each producer.
- Pay for the costs of separate collection directly to authorized waste companies, reducing administrative burdens on municipalities.
- Require authorization and registration through the Ministry of Environment, ensuring regulatory oversight and transparency.

EPR schemes have helped Slovakia invest in separate collection systems and improve recycling rates for packaging waste, WEEE, and other streams.

Program Documents and Strategic Goals
National strategic documents complement the Waste Act:

- Waste Management Programme of the Slovak Republic (POH SR) for 2021–2025, focusing on higher rungs of the waste hierarchy. Key measures include mandatory textile collection, selective demolition, revised landfill fees, and the deposit-return system.
- Waste Prevention Programme (2019–2025), aiming to reduce overall waste generation, promote eco-design, and enhance consumer awareness.
- Strategy of the Environmental Policy of the Slovak Republic until 2030, targeting a greener and more circular economy, aligning domestic efforts with the European Green Deal and EU Circular Economy Action Plans.

Additionally, since 2020, a joint effort by the Ministry of Environment, the European Commission, and the OECD has led to a "Circular Economy Roadmap", finalized in 2022. This roadmap delineates clear priorities and timeframes for implementing circular solutions, especially in food and bio-waste, construction, sustainable production, and economic tools for circularity.

2.2. Waste Generation and Classification in Slovakia

Under Act No. 79/2015, Slovakia recognizes several main categories of waste:

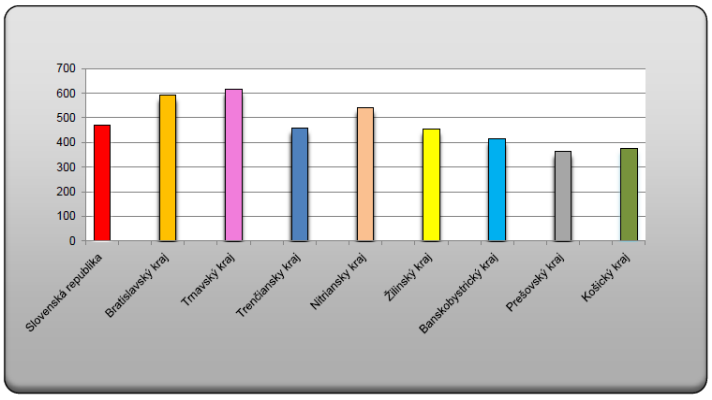
1. Municipal Solid Waste (MSW): Household and small business waste, including recyclables and residual fractions.
2. Industrial Waste: From manufacturing, mining, and energy production, potentially hazardous depending on content.
3. Construction and Demolition Waste: Generally inert materials (concrete, bricks), though may require special handling if contaminated (e.g., asbestos).

4. Hazardous Waste: Chemicals, solvents, healthcare wastes, WEEE with toxic components, etc.

Current Statistics
Recent data from the Statistical Office of the Slovak Republic and the Ministry of Environment highlight:

- 420–460 kg/person/year of municipal waste generated, showing slight increases paralleling higher consumption.
- Rising Recycling Rates, but still below the EU average of some Western Member States. Dependence on landfilling has decreased over time, although certain rural areas remain challenged by limited infrastructure.
- Gaps in Enforcement, where illegal dumping occurs in remote regions or where public engagement is weaker.

G5 Množstvo komunálneho odpadu na jedného obyvateľa za rok 2023
G5 The amount of municipal waste per capita for year 2023



Územie Area	Množstvo (kg/obyv) Amount (kg/capita)
	2023
Slovenská republika	472
Bratislavský kraj	591
Trnavský kraj	616
Trenčiansky kraj	458
Nitriansky kraj	543
Žilinský kraj	455
Banskobystrický kraj	415
Prešovský kraj	364
Košický kraj	377

Source: Statistical Office, Waste in the Slovak Republic for the year 2023

2.3. Recycling and Waste Separation Practices

Recycling Infrastructure
Since EU accession in 2004, Slovakia has modernized its recycling infrastructure. Most municipalities provide color-coded bins for separate fractions (paper, plastics/metals, glass), and urban areas often include bio-waste bins. Several materials recovery facilities (MRFs) near major cities sort collected recyclables before they're sold as secondary raw materials. Composting and biogas facilities for bio-waste have increased, supported by EU funding.

Waste Separation Systems
Door-to-door collection is standard for major recyclable streams. Pay-as-you-throw schemes incentivize households to minimize residual waste. Drop-off centers handle bulky waste and special items like WEEE or tires. Public participation is higher in cities, while rural municipalities cope with financing and logistical challenges.

Public Awareness
Environmental campaigns—co-financed by EU cohesion funds—emphasize the benefits of recycling. Educational programs in schools encourage children to adopt eco-friendly habits,

from sorting to composting. However, comprehensive monitoring and enforcement remain uneven, and some areas still lack consistent adherence to best practices.

2.4. Handling of Special and Hazardous Waste

Regulatory Requirements
Slovakia's regulations on special and hazardous waste comply with EU directives, covering:

- WEEE: Mandated collection centers, with EPR schemes to finance safe recycling.
- Medical and Healthcare Waste: Typically incinerated under strict protocols.
- Chemical and Industrial By-Products: Facilities operate under permits detailing storage, transport, disposal.
- Asbestos and Hazardous Materials: Removal must be performed by certified entities.

Collection and Treatment Methods
A manifest system tracks hazardous waste from origin to disposal. Incineration is used for wastes unsuited to recovery, while valuable fractions (e.g., precious metals in e-waste) are recycled whenever possible. Hazardous waste that cannot be recovered or incinerated is placed in specialized landfill cells with strict leachate and emissions controls.

2.5. Organizational Structures in Waste Management

Governmental Bodies and Agencies

- Ministry of Environment (MŽP SR): Primary policymaking and oversight.
- Slovak Environment Agency (SAŽP): Technical assistance, data management, and public outreach.
- Municipal Authorities: Responsible for local waste collection, implementing separate collection, and fee structures.
- Regional Offices: Sometimes issue permits and coordinate inter-regional initiatives.

The Slovak Environmental Inspectorate (SIŽP) enforces compliance via audits and can impose penalties or revoke licenses for violations.

Private Sector Involvement
Waste collection, transport, sorting, and disposal services are frequently provided by private companies—some domestic, others part of multinational corporations. Public-Private Partnerships (PPPs) offer financing solutions for constructing and operating advanced facilities, particularly in smaller municipalities.

Coordination Mechanisms

- National Waste Management Plan aligns local objectives with EU targets.
- Inter-Municipal Collaboration enhances economies of scale, for example, through shared recycling facilities.
- Producer Responsibility Organizations (OZVs) coordinate EPR obligations, ensuring that producers collectively cover costs for separate collection.

2.6. Entities Responsible for Waste Administration and Management

Administrative Hierarchy
Under Act No. 79/2015, the Ministry of Environment supervises national waste policies, while municipalities hold direct operational responsibility for municipal solid waste (MSW). Some oversight functions (e.g., issuing permits, checking compliance) are delegated to regional environmental authorities.

Inspection and Control
The Slovak Environmental Inspectorate (SIŽP) performs site visits, investigates public complaints, and addresses environmental incidents tied to waste. It enforces legislation through fines, suspensions, or remediation orders.

Data Collection and Reporting
Municipalities submit annual data on waste volumes, recycling rates, and other indicators to the Ministry of Environment and the Statistical Office of the Slovak Republic. The Information System of Waste Management (ISOH) is used increasingly for digital reporting, improving transparency and consistency.

2.7. Main problems/challenges related to waste in Slovakia

Here are seven of the most common waste-related challenges faced by Slovakia:

1.High reliance on landfilling
A large portion of Slovakia's municipal waste continues to end up in landfills. This practice not only wastes resources that could be recycled or recovered but also contributes to environmental concerns, such as soil and water contamination and greenhouse gas emissions.

2.Low recycling rates
While Slovakia has made progress in recent years, the overall recycling rate remains below the European Union average. Increasing recycling requires improvements in collection systems, processing facilities, and public participation

According to the European Environment Agency's 2022 report, Slovakia's municipal waste recycling rate reached 42.2% in 2020, which is 12.8 percentage points below the EU target of 55% by 2025. Despite this increase, Slovakia remains below the EU average, which was 48.6% in the same year. (eea.europa.eu, statista.com). However,recycling rate in Slovakia is growing-49.5 % in 2022.
Additionally, in 2020, Slovakia landfilled 49.7% of its municipal waste, more than double the EU average. (parlament.gv.at), however, the landfill rate fell **to 39.4 % in 2022 (eea.europa.eu)**
These figures highlight the need for improvements in collection systems, processing facilities, and increased public participation in recycling.

Table: Recycling and Landfilling of Municipal Waste in Slovakia vs EU (2020)

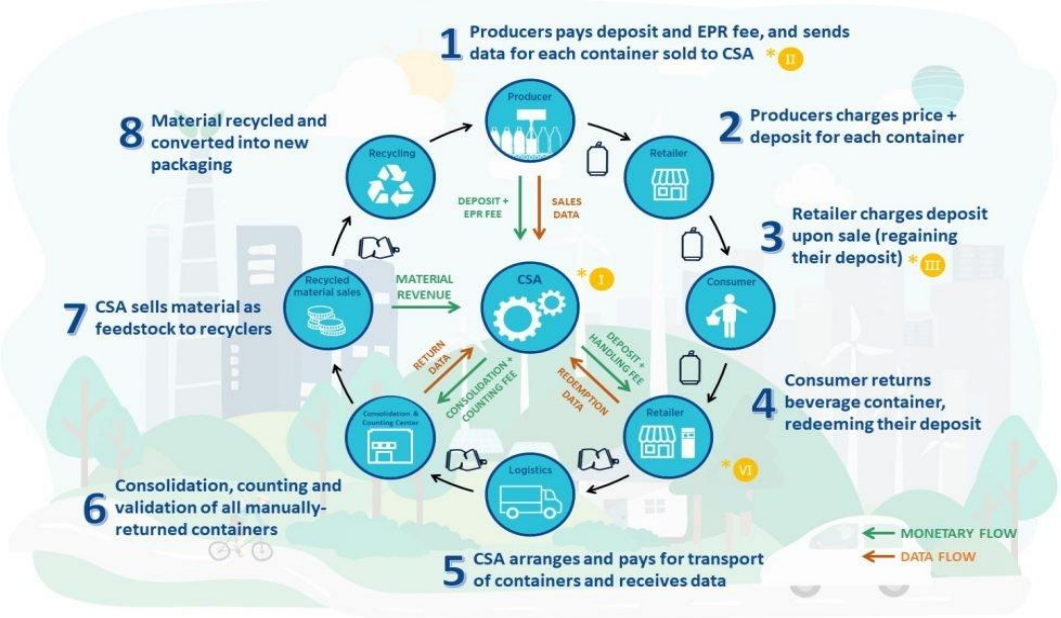
Indicator	Slovakia (2020)	EU Average (2020)	EU Target (2025)
Recycling Rate	42.2%	48.6%	55%
Landfill Rate	49.7%	~24.5% (half of Slovakia)	–

1. **Limited infrastructure for waste separation and treatment**
   In some regions, citizens lack convenient and well-managed infrastructure to separate and properly dispose of recyclable waste (e.g., plastics, paper, glass). Furthermore, inadequate waste treatment facilities can lead to more reliance on landfilling and less on material recovery or energy recovery.
2. **Insufficient public awareness and education**
   Although waste separation is becoming more common, many residents still do not fully participate or separate their waste effectively. Targeted campaigns and educational programs are needed to improve sorting habits and reduce overall waste production.
3. **Illegal dumping**
   The illegal disposal of waste—especially construction and demolition materials—remains a serious concern. Stricter enforcement and monitoring, combined with more accessible legal disposal/recycling options, can help reduce illegal dumping activities.
4. **Management of hazardous and special waste**
   Hazardous waste (e.g., chemicals, batteries, electronic waste) requires specialized handling to prevent environmental contamination and health risks. Existing infrastructure is sometimes insufficient or unevenly distributed, making it difficult for households and businesses to dispose of these materials properly.
5. **Food and organic waste**
   Much organic waste still ends up in landfills rather than being composted or used for energy recovery (e.g., biogas). Expanding composting infrastructure and raising awareness about food waste reduction can help Slovakia better capture the value of organic materials and reduce methane emissions from landfills.
6. **Weighed waste**
   Most municipalities charge residents an annual flat fee that is the same for everyone, regardless of the amount of waste they produce. This type of fee does not motivate citizens to reduce their waste production or to increase sorting or composting of waste Municipal interest in pay-as-you-throw waste collection is very law, however it is growing. growing. While in 2018 it was implemented in 167 municipalities, by 2022 the number had increased to 284 (16%).
7. **Old landfills**
   Slovakia has violated the EU Waste Directive, which requires landfilling to be safe and controlled. Old landfills that do not meet the directive's requirements are therefore to be closed and rehabilitated. European Commission has referred Slovakia to the Court of Justice of the EU for failing to close and rehabilitate a number of old landfills (21) in breach of the EU Landfill Directive.

2.8. Best Practices in Slovakia

Deposit-Refund System for Single-Use Beverage Containers

Slovakia's deposit-refund system for single-use beverage containers represents a key milestone in its transition toward a circular economy and reduction of plastic pollution. Introduced under Act No. 302/2019 Z. z. on Deposit Schemes for Single-Use Beverage Packaging, the system became operational in January 2022 and covers a wide range of plastic and metal beverage containers.



Source: https://socse.com/en/drs-deposit-return-systems/

The program covers most plastic (PET) bottles and metal cans used for drinks such as soft drinks, water, and beer; however, certain containers (e.g., dairy products and edible oils) are exempt for hygiene or technical reasons. When consumers buy a beverage, they pay an additional fee - €0.15 per container—which is fully refunded upon returning the empty container.

Implementation relies on a network of Reverse Vending Machines (RVMs), mainly located in supermarkets and high-traffic retail environments. Consumers insert empty containers into the machine to receive a voucher or refund ticket. Smaller shops without automated systems often process returns manually. A central system administrator coordinates logistics and finances, setting common standards for collecting containers and compensating retailers. The program is financed by contributions from Producer Responsibility Organizations (OZVs), which pool funds from manufacturers and importers so that the costs of managing returned containers do not fall entirely on municipalities.

Consumer engagement is crucial to the scheme's success. The monetary incentive of getting a deposit back encourages people to participate, and this effect is reinforced through awareness campaigns spearheaded by government agencies, retailers, and NGOs. These campaigns include media promotions, educational resources, and clear signage to guide consumers in using RVMs and underscore the environmental value of proper recycling. Location also matters: by placing RVMs in easy-to-reach places, participants are more likely to return their bottles and cans.

Early results show significant environmental and economic benefits. Return rates for covered containers have quickly surpassed 70–80%, with an ultimate goal above 90%. This high collection rate reduces litter, helps maintain cleaner public areas, and improves the quality of secondary materials for recycling. In turn, Slovakia curbs the need for virgin resources, lowers energy consumption, and decreases greenhouse gas emissions. Municipalities also save on cleanup and waste management costs—savings which can be redirected to other local needs—while shifting the financial and operational responsibilities to producers and importers aligns neatly with the extended producer responsibility principle.
Even so, there are ongoing challenges and areas for improvement. Reverse vending machines require consistent maintenance and technical upgrades to accommodate new container shapes and higher volumes, and some experts advocate for expanding the scope to include additional package types (e.g., certain composite cartons, smaller dairy containers). Education is an ongoing priority, especially in rural areas with fewer RVMs. Authorities continuously monitor redemption rates and may refine deposit amounts or adjust communication strategies to ensure optimal performance. Overall, Slovakia's deposit-return system illustrates how effective regulation, consumer-friendly infrastructure, and well-coordinated stakeholder efforts can boost recycling rates and reduce waste across the country.

Source: Ministry of the Environment on Facebook

Overall, Slovakia's deposit-refund system stands out as an effective example of how targeted legislation—supported by robust infrastructure, collaborative financing, and consumer incentives—can dramatically increase recycling rates and reduce environmental harm. Over time, the program is expected to become even more efficient, helping the country meet ambitious EU directives on single-use plastics and recycling, while also fostering greater public awareness of sustainable waste management.

Zero-Waste Events

Zero-Waste Events in Slovakia are specifically designed to minimize or completely eliminate the production of disposable waste at public gatherings such as festivals, craft fairs, farmers' markets, and cultural celebrations by focusing on reusable and compostable materials, as well as educating attendees on proper sorting and disposal. Organizers—often NGOs, city councils, or private entities—prioritize zero-waste principles during the planning phase by selecting durable tableware, compostable packaging, and clearly labelled sorting stations. Food vendors and exhibitors typically commit to serving meals in washable or biodegradable containers, sometimes receiving reduced stall fees for avoiding single-use plastics. Visible waste stations, staffed by volunteer "waste monitors," ensure correct disposal and reinforce the importance of sorting recyclables, compostables, and residual waste. At many events, workshops and demonstrations on topics like composting, low-waste cooking, and eco-conscious shopping encourage visitors to apply new habits beyond the event itself. Examples abound towns like

Pezinok, Trnava, and Banská Štiavnica have introduced zero-waste practices for their wine or craft festivals, while major cities like Bratislava and Košice host farmers' markets that promote reusable bags and containers, often banning plastic wrapping entirely. Large cultural gatherings and music festivals are also adopting deposit systems for reusable cups, compostable food trays, and crowd-sourced "clean-up challenges," reducing litter in real time. This approach yields significant benefits, including an immediate drop in landfill-bound waste, heightened environmental awareness across diverse audiences, and potential economic savings from repeated use of durable materials. Communities also take pride in collectively achieving "close-to-zero" waste, showing that well-coordinated efforts can reshape the public's understanding of sustainable event management.

Energy Recovery Facility for Waste

Kosit a.s. As one of only two operators in Slovakia, Kosit operates an energy recovery facility for waste. This processor exemplifies the waste management hierarchy by handling municipal waste in a highly responsible manner. Sorted waste components from the city of Košice, half of the city of Prešov, and over 100 surrounding municipalities are collected, packaged, and then sent to processors of plastics, glass, aluminum, and Tetra Pak. The heat released during the combustion of municipal waste ranges from 7 to 14 MJ/kg (with an average of 9.5 MJ/kg). Without this process, the municipal waste would otherwise end up in a landfill.

Kovohuty a.s. Krompachy – Production of technically pure copper from copper waste. This non-ferrous metals plant (focused on copper) processes secondary raw materials (waste) and is unique for the high purity of its final product. The plant processes over 60,000 tons of copper waste annually, thereby conserving primary raw material sources that would otherwise have to be extracted from the earth (kovohuty.sk, 2019)

Chapter 3. Waste Management in Sicily

3. 1. Legislative and Policy Framework in Sicily

The need to align with the Community Environmental Action Program led the country to adopt a new Directive in 2006 (Directive 2016/12/EC) which confirmed the previous frameworks adding the so-called "Environmental Code" which consolidated environmental laws. There was a shift in the approach which moved from waste disposal to waste management. This code has gone under several revisions and it has been updated according to the directive of EC. The revision of 2010 led to the introduction of the "waste Hierarchy" and the EPR. The first element promoted waste prevention, reuse, recycling and recovery over the disposal. The second point required producers to be in charge of the lifecycle product which ends with the recycling or the disposal.
In 2014 the Code was updated in order to include further management practices and the reduction of environmental damage due to landfills. This way, the decree highlighted the need of reducing the number of landfills in work and asked regions and local authorities to take part in the waste management.
Further revisions were introduced in order to minimize waste through the adaption of principles of the circular economy and the increase of power of regions allowing them to set up regional waste management plans based on their needs and resources. Regions were included in the realization of management strategies and the competencies they acquired are: the preparation of regional waste management plans; the regulation of waste management activities (including the separate collection of urban waste, with a general focus on separating food waste from other types of waste); the authorization for carrying out waste disposal and recovery operations; the definition of optimal territorial areas for the management of urban and similar waste, and the promotion of integrated waste management.
In Sicily, a new Urban Waste Plan has been approved after the strategic Environmental Assessment and the Environmental Impact Assessment procedures. The plan has been adopted by the President of the Region through the ordinance n.3 of November 2024 which replaces the previous version. The New plan puts an emphasis on the reduction of landfill use and set as goal the achievement of 10% of waste produced in landfills by 2035. This plan regards also the issue of energetical waste, indeed the Region wants to build two new waste-to-energy plants that guarantee high energy recovery. It also outlined the goal of enhancing separate waste collection extending the lifecycle of products following the circular economy approach. As established by Decree 152/2008 it is needed to respect the territorial proximity principle which urges waste disposal to occur in locations as near as possible to the points of production in order to seduce transportation needs, environmental impacts and logistical costs.

3.2. Waste Generation and Classification in Sicily

Waste management in Sicily represents one of the most complex environmental challenges in Italy, due to a combination of structural, administrative, and cultural factors that influence how waste is produced, collected, and treated. In this context, it is essential to analyze the types of waste generated, current production rates, sorting practices, and systemic challenges that hinder the transition to a more sustainable model.

Main Waste categories in Sicily: according to the official classification (EER), the main types of waste generated in Sicily include:

- Municipal Solid Waste (MSW): Waste from households, small businesses, public offices, and street cleaning services. This represents the largest share of waste generated.
- Special Waste: Produced by commercial, agricultural, healthcare, industrial, and other economic activities. These are often managed by private waste operators outside of the public collection system.
- Construction and Demolition Waste (C&D): Although technically special waste, C&D waste contributes significantly to illegal dumping and fly-tipping on the island.
- Hazardous Waste: Includes batteries, pharmaceuticals, solvents, paints, asbestos, healthcare waste, and waste electrical and electronic equipment (WEEE). It requires specialized collection and treatment procedures.
- Biowaste (FORSU - Organic Fraction of MSW): A large component of the total municipal waste stream, yet its management is constrained by the limited availability of composting and anaerobic digestion facilities in Sicily.

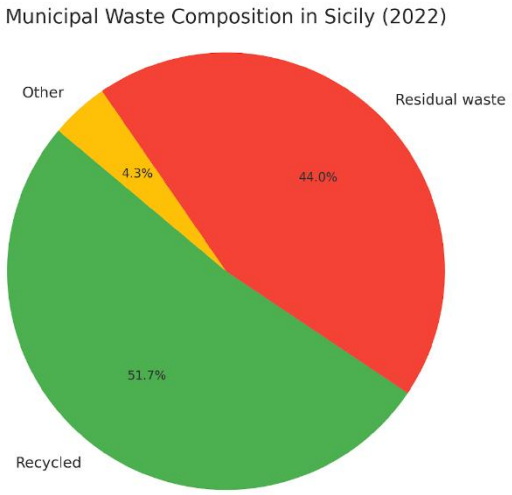


Figure 1: Composition of urban waste in Sicily (2022) –
Sources: ISPRA (Urban Waste Report 2023), ARPA Sicilia, Regione Siciliana (Regional Waste Management Plan 2022

→ The estimate of the production of residual undifferentiated waste is obtained by subtracting the production of separated waste from the total production of urban waste.

3.3. Recycling and Waste Separation Practices

Waste management in Sicily has been characterised by a prolonged state of emergency since the early 2000s. Legal, administrative, and managerial shortcomings have hindered the development of a well-structured and efficient system aligned with national legal frameworks. A key factor contributing to this situation is the delegation of waste management responsibilities to companies that operate both as regulatory authorities and service providers. Additionally, the fragmentation caused by the diverse approaches adopted by individual municipalities has further complicated coordination efforts.

The absence of a unified regional management system has led to a continued reliance on landfills, often located in different cities across the island. This has resulted in significant environmental impacts related to long-distance waste transportation and increased logistical costs. The fragmented approach is also a consequence of the failure to construct new facilities and the inability of existing public infrastructure to process the over 2.4 million tonnes of municipal waste generated annually in Sicily.
Moreover, the distribution of treatment facilities appears random and inefficient, with a significant disconnect between waste production sites and treatment locations.
Infrastructure-wise, the current system for managing the organic fraction in Sicily is dominated by composting plants, while integrated treatment facilities remain marginal. Notably, there are no anaerobic digestion plants in operation. It is therefore essential for the region to invest in new integrated systems and anaerobic digestion infrastructure to ensure more sustainable and circular waste management.

3.4. Handling of Special and Hazardous Waste

Concerning the collection and treatment methods we should first have a general overview on the national situation and then analyze the Sicilian one.
Italy → Out of an urban waste production of 30.2 million tons in 2018, 45 % is sent for recycling, 20% for incineration, 22% is sent to landfills and 2% is sent abroad.
Sicily → Out of an urban waste production of 2.3 million tons, only 17% is sent to recycling, 69% is sent to landfills, less than 1% is sent abroad, and a positive date is there are no wastes incinerated.
The management of special and hazardous waste in Sicily is governed by national regulations aligned with European Union directives, with implementation and control overseen by a variety of public and private actors. These waste streams include industrial by-products, electronic waste (WEEE), medical waste, construction materials containing hazardous substances (such as asbestos), and chemical residues.
Italian legislation—particularly Legislative Decree 152/2006 (Environmental Code)—defines the obligations for hazardous waste generators and treatment operators, including proper labeling, packaging, transport, storage, and disposal procedures. These regulations incorporate key EU principles such as the "polluter pays" and the "protection of human health and the environment."
Hazardous and special waste must be handled by authorized and certified operators, and always tracked via national registers such as MUD (Single Environmental Declaration) and the upcoming RENTRI (National Waste Tracking Register), which will digitize and standardize all reporting requirements.
Collection of hazardous waste in Sicily is managed through:

- Dedicated municipal drop-off points for WEEE, batteries, solvents, and used oils;
- Specialized collection services for healthcare waste and construction materials;
- Incineration plants and landfills with specific cells for hazardous substances—although Sicily has limited capacity and often relies on treatment facilities in other regions.

Industrial and commercial entities are responsible for organizing their own disposal in accordance with regulatory requirements. In contrast, households are served via local collection centers, where citizens can deposit small quantities of hazardous materials. However, a significant infrastructure gap remains. The region lacks modern treatment plants for many types of hazardous waste, creating logistical and economic challenges and increasing the risk of illegal dumping, particularly for construction and demolition debris.

The integration of RFID (Radio-Frequency Identification) technology in waste management enables precise tracking of objects or individuals through smart tags containing a microchip and antenna, readable at a distance via radio waves.
Applications in waste management in Sicily:
Traceability of Special and Hazardous waste
In Sicily, hazardous waste such as healthcare waste, electronic waste (WEEE), used oils, solvents, or construction materials with asbestos are subject to strict traceability, as defined by national legislation (Legislative Decree 152/2006).
Systems like RENTRI (National Electronic Waste Tracking Register), currently being implemented, envision the use of RFID tags to automate reporting, location tracking, and movement monitoring.
Real-Time Monitoring: RFID tags enable real-time tracking of containers with hazardous waste, ensuring they are transported and treated only by certified operators.
This is particularly crucial in Sicily, where a lack of treatment facilities forces waste to be shipped out of the region, increasing the risk of illegal dumping.

Figure 2: Hazardous Waste by Sector in Italy (2020)
Source: ISPRA, Special Waste Report 2022

Note: The manufacturing sector is the largest producer of hazardous waste (over 60%), followed by waste treatment activities and the health sector.

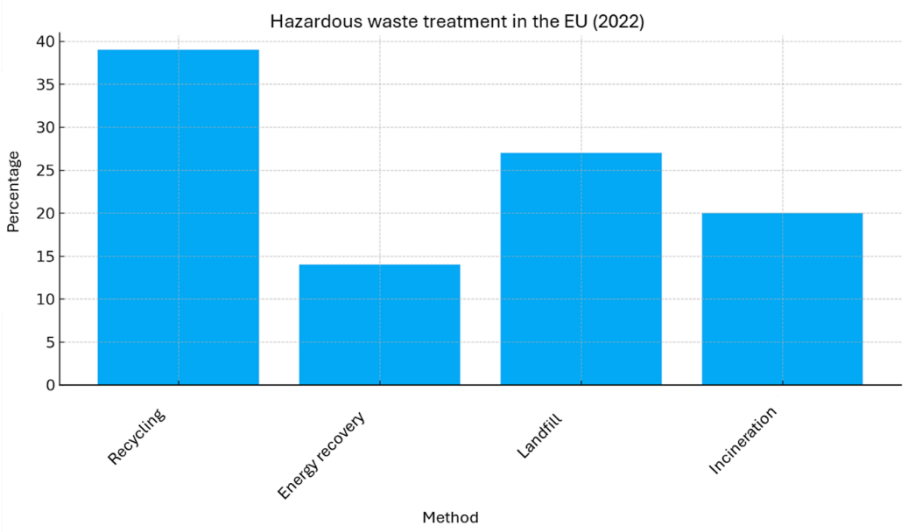


Figure 3: Hazardous waste treatment in the EU (2022)
Source: Eurostat, 2022

Using RFID can improve traceability and facilitate appropriate waste separation for proper treatment.

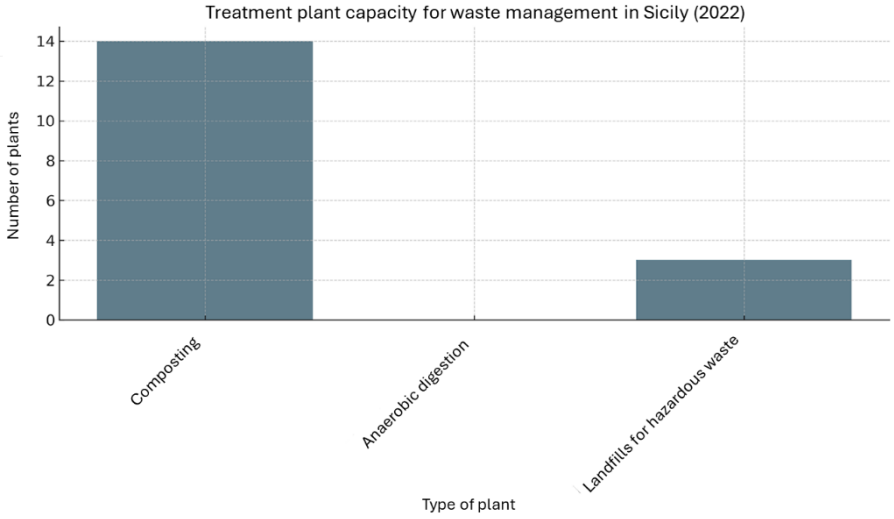


Figure 4: Treatment plant capacity for waste management in Sicily (2022)
Source: Regional Waste Management Plan, Sicily

- 14 active composting plants
- 0 anaerobic digestion plants
- 3 operational landfills with cells for hazardous waste

This infrastructure gap makes the use of RFID even more crucial to prevent illegal waste trafficking.

3.5. Organizational Structures in Waste Management

Sicily's waste management system operates within a multi-level governance structure, involving regional authorities, local municipalities, regulatory agencies, and private sector

actors. Each plays a distinct role in the planning, regulation, operation, and oversight of waste services.

Public Institutions: At the heart of the regional system is the Regione Siciliana, which is responsible for developing and updating the Regional Waste Management Plan (PRGR). This strategic document defines the infrastructure needs, treatment capacities, and targets for waste prevention, recycling, and landfill reduction in line with national and EU directives.

The Department of Energy and Public Utility Services coordinates with municipalities, evaluates infrastructure projects, and authorizes the construction and operation of new facilities.

Environmental control is provided by ARPA Sicilia (the Regional Environmental Protection Agency), which monitors emissions, performs inspections, and evaluates environmental risks associated with waste management activities.

Municipalities are directly responsible for organizing collection services, implementing communication campaigns, and enforcing local regulations. However, they operate under the umbrella of SRRs (Società di Regolamentazione del Servizio Rifiuti)—inter-municipal entities created to consolidate planning, improve service quality, and promote economies of scale across neighboring areas.

Private Sector Involvement: The private sector plays a central role in the operational delivery of waste services. Most waste collection and street cleaning activities are outsourced through public tenders to private companies, which must be registered in the National Environmental Register (Albo Gestori Ambientali) and meet specific technical and financial criteria.

Treatment and recycling plants—including material recovery facilities, composting centers, and storage sites—are also largely operated by private entities. These often work in partnership with EPR consortia (e.g., CONAI, COREPLA, RICREA) that coordinates the collection and recycling of packaging, plastics, metals, and other materials under extended producer responsibility schemes.

Public-private partnerships are increasingly used to finance and manage infrastructure projects, particularly in municipalities with limited technical and economic resources.

3.6. Entities Responsible for Waste Administration and Management

Sicily's waste administration and governance system is layered and complex, combining national legislation with regional implementation and local execution. Each level of government has defined responsibilities, and together they form an integrated (albeit sometimes fragmented) administrative framework.

5.1. Administrative Hierarchy

At the national level, the Ministry for the Environment and Energy Security (MASE) defines overall waste policy, transposes EU directives into national law, and manages financial tools like the National Recovery and Resilience Plan (PNRR) and cohesion funds that support infrastructure investments.

At the regional level, the Regione Siciliana assumes planning authority, granting permits and defining strategic objectives. The Regional Department for Energy and Utilities is the key actor in overseeing the implementation of the Regional Waste Plan.

At the local level, municipalities are legally tasked with organizing and funding the municipal waste collection service, promoting recycling, and ensuring citizen compliance. Through the SRRs, they coordinate infrastructure usage, define inter-municipal strategies, and report data to the region.

This multilevel system seeks to balance top-down directives with bottom-up responsiveness to local needs.

5.2. Inspection and control

Environmental enforcement is primarily carried out by ARPA Sicilia, which conducts inspections of landfills, treatment plants, and other facilities to ensure regulatory compliance. This agency also monitors environmental indicators such as water and soil quality, air emissions, and illegal waste activities.
The Carabinieri Forestali (Environmental Police), particularly their NOE units (Nucleo Operativo Ecologico), play a key role in prosecuting environmental crimes, such as illegal dumping and hazardous waste trafficking.
Municipalities and local police forces enforce local ordinances and issue fines for infractions such as improper waste sorting or illegal burning.

5.3. Data collection and reporting:

waste data in Sicily is collected and managed through various national and regional tools:

- MUD (Single Environmental Declaration Form) is submitted annually by companies handling waste, providing detailed information on quantities, types, and treatment methods.
- The National Waste Cadastre, managed by ISPRA, aggregates this data and supports national and EU reporting requirements.
- RENTRI, the upcoming digital registry, will standardize the tracking of hazardous and special waste across Italy, enhancing transparency and reducing fraud.
- Municipalities must also report key performance indicators—such as separate collection rates, landfill use, and costs of service—to the Regional Waste Observatory, which monitors progress toward national and EU targets.

3.7. Main problems/challenges related to waste in Sicily

Sicilian Municipalities are facing difficulties in increasing further waste separation. According to a report conducted by Conai and other institutions it has been found that one of the main issues that characterize Sicily and other regions of the South is the lack of cooperation and the incorrect waste disposal by citizens. Other issues have been identified such as the difficulty in implementing door-to-door waste collection in all the territory, the uncontrolled waste dumping and the shortage of staff and managing the costs in an appropriate way.
Despite some recent progress in separate collection and public awareness campaigns, Sicily continues to face a number of long-standing and systemic challenges that undermine the effectiveness and sustainability of its waste management system. These challenges span infrastructural, organizational, economic, and cultural dimensions, and reflect both regional specificities and broader issues common to southern Europe.

a. Over-reliance on landfilling

Sicily continues to rely heavily on landfilling, with approximately 44% of municipal waste disposed of in landfills—well above EU targets. This causes environmental risks, resource waste, and leads to emergency situations when landfill capacity is exceeded, resulting in high-cost waste exports to other regions.

b. Insufficient infrastructure for treatment and recycling

The region lacks sufficient infrastructure for recycling and treating waste, especially organic waste. Most facilities are basic composting sites, with little to no capacity for anaerobic digestion. This limits the ability to process bio-waste efficiently and recover valuable materials.

c. Fragmentation of governance and service delivery

The governance of waste management is fragmented among municipalities, SRRs, the Region, and private providers. Coordination is often poor, leading to inconsistent service levels and administrative inefficiencies.

d. Economic constraints and high operational costs

Waste management services in Sicily are often costly and inefficient. Limited access to investment, delays in public tenders, and the need to send waste outside the region increase financial burdens on municipalities and citizens.

e. Low public engagement and limited awareness

Citizen participation in recycling is inconsistent. In many areas, people are not fully aware of proper sorting practices and illegal dumping is common. Educational efforts are limited and lack continuity.

f. Illegal Dumping and Environmental Crimes

Unauthorized disposal of construction waste and household waste continues to plague the region. Limited enforcement capacity and slow administrative processes hinder effective prosecution of environmental crimes.

g. Critical Management of Special and Hazardous Waste

There are insufficient facilities to handle hazardous and special waste streams. As a result, such waste is often transported at high cost or poorly managed, increasing environmental and public health risks.

h. Underutilization of Circular Economy Opportunities

While EU and national policies promote circular economy models, Sicily has yet to fully leverage reuse, repair, and recycling innovations. Green jobs and sustainable enterprises in this field remain underdeveloped.

3.8. Best Practices in Sicily

Extended Producer Responsibility (EPR) system

Italy has developed one of the most advanced and well-structured EPR systems in Europe. Under this framework, producers are financially and operationally responsible for the entire lifecycle of their products, including post-consumer waste. These consortia ensure that municipalities are reimbursed for collection costs, and they coordinate treatment and recycling efforts across the country. Italy's EPR model is often cited by the EU as an example of best practice.

Key national EPR consortia include:

- CONAI: For packaging materials (paper, glass, plastics, metals, wood).
- COREPLA: For plastic packaging.
- COMIECO: For paper and cardboard.
- COBAT / CIAL / RICREA: For batteries, aluminum, steel packaging, etc.

b. Pay-As-You-Throw (PAYT) Schemes

Many Italian municipalities have adopted PAYT systems that link waste fees to the actual amount of residual waste produced by each household or business. This system:

- Encourages waste reduction.
- Rewards proper separation.

Penalizes excessive production of mixed waste. Cities like Parma and Treviso have reported municipal recycling rates above 80%, largely thanks to PAYT systems.

c. High-Performance recycling in Northern Italy

Regions such as Veneto, Trentino-Alto Adige, and Emilia-Romagna have pioneered integrated waste management models based on:

- Robust door-to-door collection.
- Composting and anaerobic digestion plants for biowaste.
- Advanced materials recovery facilities (MRFs).
- Extensive public education campaigns.

These models have enabled them to exceed the EU 2025 target of 55% recycling for municipal waste well ahead of schedule.

Though it faces unique geographical and infrastructural constraints, Sicily has also developed a number of promising initiatives and local innovations that align with national and EU goals.

a. Zero-Waste Municipalities

Several Sicilian towns (e.g., Ragusa, Ferla, and Giardinello) have adopted Zero Waste strategies, focusing on:

- Door-to-door collection.
- Composting programs for organic waste.
- Citizen training and eco-volunteer networks.

These towns have reported recycling rates above 70%, demonstrating that well-managed small communities can achieve excellent performance.

b. Composting and Home biowaste management

In areas with limited infrastructure, some Sicilian municipalities promote home composting as an alternative to centralized organic waste collection. Programs often include:

- Free or subsidized compost bins.
- Training on composting techniques.
- Incentives through reduced waste fees.

This reduces collection costs and landfill pressure while building a culture of sustainability.

c. Plastic-Free coastal campaigns

Sicily has launched multiple “Plastic Free” campaigns in coastal municipalities and tourist areas such as Lipari, Cefalù, and Lampedusa. These efforts include:

- Banning single-use plastics in public events.
- Promoting reusable containers in schools and public buildings.
- Installing water fountains to reduce bottled water consumption.

These initiatives are aligned with the EU Single-Use Plastics Directive (2019/904) and serve as models for awareness-based behavioral change.

d. Waste education and eco-schools

Several Sicilian schools are part of the international Eco-Schools network, promoting environmental literacy through:

- Classroom projects on waste sorting and reuse.
- School gardens using compost.
- Art installations made from recycled materials.

Educational efforts are crucial in shifting long-term public attitudes and habits regarding waste.

e. Digital Waste Tracking and smart tools

Municipalities such as Alcamo and Partinico have begun experimenting with RFID-tagged (objects that have an RFID tag, which is a small label containing a microchip and an antenna that can be read by an RFID reader via radio frequency.) bins and smart cards for users. These tools:

- Monitor individual waste production.

- Enable PAYT policies.
- Improve efficiency in collection routes.
- Digitalization is still in early stages in Sicily but shows promising potential for scaling up.
- Biogas in Sicily

The first anaerobic digestion facility in Sicily, located in the heart of Caltanissetta, has been established to produce biomethane and high-quality compost by recovering the organic fraction of municipal solid waste (MSW). Developed by Enersi, a company within the SNAM group, the plant will, once fully operational, process 36,000 tons of organic waste per year from the separate waste collection in local municipalities. This will result in the production of 20,000 tons of compost and 3.6 million cubic meters of biomethane, which will be supplied to the national gas grid. This plant, built with semi-dry technology, is a crucial step in addressing the infrastructure gap in Sicily and advancing toward a genuine circular economy. It represents a significant investment that will benefit the entire region by creating new jobs, promoting partnerships with local businesses, and providing cost savings for both citizens and municipal authorities. These savings will come from lower costs for waste disposal and transportation, avoiding the need to send waste outside the region, and offering environmental benefits, including reduced emissions. The facility, which was inaugurated on May 17, 2023, will produce over 3 million cubic meters of renewable methane annually. This is equivalent to a savings of 2,798 tons of oil and a reduction of 7,000 tons of CO_2 emissions. Every year, the company's production keeps 3,000 vehicles running, saving three and a half million liters of diesel. One of the common concerns about organic waste treatment plants is the potential for unpleasant odors. However, in the case of the Enersi facility, this issue has been minimized with the use of sealing doors at every entrance and air capture and purification systems featuring washing towers.

Sarco S.r.l. is one of the 19 glass recycling centers affiliated with CoReVe (Consorzio Recupero Vetro), specializing in the recovery and production of secondary raw materials through the treatment of glass and metal waste. It serves as an example of the circular economy in Sicily, focusing on sustainable waste management and the recovery of valuable materials. The company plays a key role in advancing the region’s commitment to environmental sustainability by turning waste into reusable resources.Sarco S.r.l. has an authorized waste treatment capacity of approximately 200,000 tons per year, making it a major player in Italy's glass recycling sector. In 2023, the company achieved significant performance, processing 104,350 tons of glass waste and producing 82,152 tons of secondary raw materials. These figures highlight Sarco's efficiency in recovering and valorizing glass, a material that, thanks to modern industrial processes, can be safely reintroduced into the production cycle in an environmentally beneficial way. Specifically, the glass treated by Sarco is certified under the "Re-Glass Sicilia" brand, which signifies high-quality glass sourced exclusively from waste collected in Sicily. Additionally, Sarco’s production process is powered entirely by 100% certified renewable electricity, ensuring the sustainability of its operations and minimizing the ecological footprint of its raw material production. This approach contributes not only to the conservation of natural resources but also to reducing greenhouse gas emissions.

Chapter 4 Community Engagement in Slovakia and Sicily

As part of the comparative analysis, a questionnaire survey was conducted between May 2025 and July 2025 in both studied and compared regions: in Slovakia and in Sicily.
The survey was carried out using a questionnaire method and was divided into two parts:
The first questionnaire survey was conducted among the general public, with the aim of identifying and comparing the overall perception of waste and related issues among the general population in Slovakia and in Sicily.
The second questionnaire survey was conducted among employees of public and private waste management companies in Slovakia and Sicily. The aim of this survey was to assess the employees' knowledge of current waste legislation and, based on these findings, to prepare appropriate educational workshops on waste and waste legislation.
A total of 44 people participated in the public questionnaire survey, including 24 participants from Slovakia and 20 from Sicily.

The age distribution of the respondents was as follows:
2% under 18 years
18% aged 19–29 years
38% aged 30–44 years
32% aged 45–59 years
8% over 60 years

Gender distribution:
59% of the questionnaires were filled out by women and 51% by men, meaning that 26 questionnaires were completed by women and 18 by men.

The educational background of the respondents was as follows:
0% primary education
5% secondary education without final exam
25% secondary education with final exam
70% higher/university education

Additional general questions focused on the type and location of housing, the number of people in the household, and whether the respondents live with underage children, as these factors may influence waste management behaviours.
85% of respondents reported that their household consists of 2–3 persons. 83% of respondents in Slovakia live in towns with more than 5,000 inhabitants, while in Sicily the figure was 70%

The responses regarding waste sorting revealed that in Slovakia, 16.7% of respondents do not sort waste at all.
The remaining respondents try to sort waste, although they sometimes neglect it (25%), sort selected types of waste such as plastics and paper (45.8%), and 12.5% sort waste consistently and thoroughly. In Sicily, all respondents indicated that they separate.

The biggest motivation for sorting waste in Slovakia was pressure or requirements from the city or municipality (58.3%).
Other motivating factors included: environmental protection (29.2%), economic reasons (16.7%), and responsibility toward future generations (4.2%).
In Sicily**,** the biggest motivation was the environmental protection (70%) and responsibility towards future generations (10%).

The main barriers to sorting waste in Slovakia included a lack of space for separate containers in the home (47.8%) and the time-consuming nature of the task (34.8%). Approximately 17% of respondents identified a lack of information about proper sorting as the main obstacle.
Almost all respondents in Slovakia stated that containers for separate waste collection are relatively accessible, but in Sicily 40% of respondents find the containers as inaccessible. In Sicily, as the main barrier of separating was indicated lack of information on how to separate properly(60%) and poor infrastructure (30%).

Other sections of the survey focused on respondents' overall knowledge of environmental issues related to waste, their understanding of the "zero waste" concept, and proper waste management practices.
Responses to these questions revealed certain knowledge gaps, especially among respondents living in smaller towns and those with lower levels of education.

The final part of the questionnaire assessed respondents' willingness and motivation to participate in initiatives aimed at waste reduction.
According to the survey results, approximately half of the respondents would support active participation in such initiatives, and the most significant incentive for a more active approach to recycling and waste reduction would be financial or material rewards.
More than 8% of respondents in Slovakia stated they would not participate in any campaigns or initiatives related to waste reduction and sorting, but people in Sicily are willing to participate.

The questionnaire survey provided valuable insights into public perceptions of waste management. The results showed noticeable differences and similarities between the two regions in terms of awareness, motivation, and obstacles related to waste sorting.
In Slovakia, while a significant portion of the population attempts to sort waste, 16.7% still do not engage in sorting at all. The main motivators for sorting waste were external pressures from municipalities and environmental concerns, while the biggest barriers were lack of space for bins and time constraints. Most respondents confirmed that separate waste containers are readily accessible.
Knowledge gaps were most prominent among respondents from smaller towns and those with lower education levels, particularly in their understanding of concepts such as "zero waste" and proper waste management. These findings highlight the need for targeted educational campaigns and workshops to improve public understanding and engagement.
Encouragingly, about half of the respondents expressed willingness to participate in initiatives aimed at reducing waste, especially if incentivized by financial or material benefits. However, over 8% of respondents in Slovakia were not willing to participate in any such activities, indicating a need for more effective awareness-raising strategies to reach disengaged groups.
Overall, the survey underscores the importance of education, infrastructure, and local policies in shaping waste management behaviors. These insights will be instrumental in designing

effective outreach programs and legislative improvements to promote sustainable waste practices in both regions.

The second part of the questionnaire survey was conducted among employees of public administration and private companies involved in waste management. A total of 45 respondents participated in this survey, including 25 employees from Slovakia and 20 from Sicily.
In Slovakia, more than three-quarters of the respondents were from public administration, whereas in Sicily, employees from the private sector dominated the responses (35%).
More than 60% of Slovak respondents had been working in the field of waste management for over 4 years, compared to 50% in Sicily.
In Slovakia, all respondents stated that they had at least a basic understanding of the core EU waste regulations (e.g., Directives 2018/851 and 2008/98/EC on waste). Likewise, nearly all respondents (98%) indicated they were aware of the EU recycling targets (e.g., for the years 2025 and 2030) concerning municipal waste or specific materials (such as plastic, glass, paper, etc.).
When asked to assess the practical implementation of EU legislation in Slovakia, 4.8% of respondents rated it as very good, 76.2% as good, and 14.3% as average. In contrast, in Sicily, 15% of respondents considered the implementation to be very good, 50% indicated they had some knowledge of it, and 30% reported only limited awareness or understanding.
Over 90% of Slovak respondents considered their knowledge of national waste legislation to be good or very good. The question referred specifically to Act No. 90/2017 Coll., which amends Act No. 79/2015 Coll. on Waste and amends certain other laws (as amended), as well as relevant regional regulations (e.g., the Waste Management Program of the Slovak Republic).
Very similar results were in survey realized in Siciliy, the only differnece were when assesing the waste legislation where 60% of respondents from Sicilian companies find the legislation and its use as unclear and complicated.
According to the results, employees of waste management organizations generally possess good to very good knowledge of waste legislation, potential penalties, inspections, and issues related to hazardous waste. Regarding current training opportunities on these topics, Slovak respondents noted that their organizations do provide training. However, respendents from both examined regions expressed interest in more sessions focused on practical procedures (e.g., digital record-keeping and reporting – 52%), legal interpretation (19%), and examples of good practice (almost 10%).
As many as 67% of respondents stated that simplifying and clarifying waste management legislation would improve the effectiveness and compliance of legal enforcement in this field.
From these findings, it can be concluded that while respondents consider their knowledge sufficient for performing their jobs in waste management, there are still gaps—especially in practical training and the interpretation and application of legislation—which they would welcome as part of future training and educational activities.

Chapter 5: Summary and Policy Recommendations

This chapter provides a comparative overview of waste management systems in Slovakia and Italy, with particular focus on the region of Sicily. Both regions operate within the broader framework of European Union legislation, yet they demonstrate distinct national and regional characteristics that influence the implementation and effectiveness of waste management policies.
The aim of this chapter is to summarize and analyze the key similarities and differences between the two systems, while also identifying their respective strengths, weaknesses, and ongoing challenges. Areas of comparison include the legislative and policy frameworks, infrastructure and operational practices, waste classification and treatment methods, organizational structures, and citizen engagement.
Special attention is given to shared obstacles such as over-reliance on landfilling and low public participation, as well as region-specific barriers like fragmented governance in Sicily and rural infrastructure gaps in Slovakia. Conversely, the chapter highlights strategic advancements, including Slovakia's adoption of a Circular Economy Roadmap and Sicily's efforts to reform its waste system through its updated Urban Waste Plan (2024).
By comparing these two regions, the chapter contributes to a deeper understanding of how diverse political, geographic, and institutional contexts affect waste governance, and what lessons can be drawn to improve environmental performance across different parts of the EU.

5. 1. Legislative and Policy Frameworks

Common Ground: EU-Driven Convergence
Both Slovakia and Sicily align their legislative systems with core EU directives, particularly Directive 2008/98/EC on waste and the principles of the circular economy. The waste hierarchy (prevention, reuse, recycling, recovery, disposal) and the Extended Producer Responsibility (EPR) principle form the foundation of both systems.

Slovakia: Centralized and Codified Legal Structure
Slovakia's waste management framework is defined by Act No. 79/2015 Z. z. on Waste, which has undergone numerous amendments to remain aligned with evolving EU standards. The act codifies roles and responsibilities, establishes an information system for waste reporting, and provides the legal basis for national strategic documents such as the Waste Management Programme and Waste Prevention Programme.

Sicily: Regional Autonomy within National Framework
Italy's Environmental Code (Legislative Decree 152/2006) provides the legal structure for Sicily's waste management policies. However, Sicily exercises significant regional autonomy. The Urban Waste Plan (2024) sets regional targets, including reducing landfill usage to 10% by 2035, promoting waste-to-energy plants, and extending the lifecycle of products through circular economy principles.

5.2. Waste Generation and Classification

Shared Classifications
Both regions categorize waste into Municipal Solid Waste (MSW), hazardous waste, construction and demolition waste, and special waste in accordance with EU waste codes.

Slovakia: Moderate Generation with Regional Disparities
Slovakia generates 420–460 kg/person/year of MSW. While recycling infrastructure has improved since EU accession, rural regions still face infrastructural and logistical challenges.

Sicily: High Volume, Uneven Management
Sicily generates approximately 2.3 million tonnes of MSW annually. Waste management is complicated by limited infrastructure, administrative fragmentation, and inconsistent service delivery, particularly in smaller municipalities.

5.3. Recycling and Waste Separation Practices

Infrastructure and Practice

Aspect	Slovakia	Sicily
Recycling Rate (2020)	42.2%	17%
Biowaste Processing	Composting & Biogas	Limited to Composting
Anaerobic Digestion	Available	None
Incineration	Used selectively	Not practiced
Color-Coded Bins	Widespread	Limited adoption
Public Participation	Moderate	Low and uneven

Slovakia has invested in separate collection, pay-as-you-throw systems, and urban biowaste bins, supported by EPR-funded services. Sicily lags in infrastructure and coordination, and fragmented governance has hampered progress toward national and EU targets.

5.4. Handling of Special and Hazardous Waste

Both Slovakia and Sicily comply with EU directives regarding hazardous and special waste. However, operational capabilities vary significantly.

Slovakia: Systematic and Regulated
Hazardous waste in Slovakia is managed through authorized entities, mandatory reporting, and specialized landfill cells or incinerators. The Slovak Environmental Inspectorate oversees compliance and tracking through national systems.

Sicily: Infrastructure Gaps and Out-of-Region Disposal
Sicily faces a shortage of treatment facilities for hazardous waste, often relying on transport to mainland Italy. Tools like RFID tracking and the RENTRI system (in development) aim to improve traceability. Nevertheless, the risk of illegal dumping remains high, especially in construction and demolition sectors.

5.5. Organizational Structures and Governance

Administrative Hierarchies

Function	Slovakia	Sicily
Policy-making	Ministry of Environment	Ministry + Regione Siciliana
Operational Responsibility	Municipalities	Municipalities + SRRs
Enforcement	Environmental Inspectorate (SIŽP)	ARPA Sicilia + Carabinieri NOE
Data Reporting	ISOH, Statistical Office	MUD, ISPRA, RENTRI (in progress)

Slovakia's centralized yet tiered model ensures uniformity and legal clarity, while Sicily's multilevel and fragmented governance causes inefficiencies and inconsistent outcomes across municipalities.

5.6. Key Challenges

Slovakia

- High landfilling rate (49.7%), especially in rural regions.
- Recycling below EU targets (goal: 55% by 2025).
- Gaps in public engagement and rural infrastructure.
- Illegal dumping, though more limited than in Sicily.

Priority Measures recommended by EC for 2025:

- Introduce and expand a pay-as-you-throw system for businesses and households.
- Introduce, harmonize, and gradually increase landfill taxes with the aim of phasing out landfilling of recyclable or recoverable waste.
- Complete the closure of non-compliant landfills.
- Increase capacity for the treatment of biological waste and support home composting.
- Introduce and expand a pay-as-you-throw system for businesses and households

Sicily

- Very high landfilling rate (69%), despite national policy shifts.
- Severe infrastructure shortages, especially for bio and hazardous waste.
- Fragmented service delivery and high operational costs.
- Low public compliance, frequent illegal dumping, and delayed infrastructure investments.

5.7. Circular Economy and Strategic Direction

Slovakia has adopted a Circular Economy Roadmap (2022), outlining actionable goals in sustainable construction, food waste, and eco-design. Sicily, while echoing circular economy principles in its Urban Waste Plan, still lags in practical implementation, and green jobs or reuse networks remain underdeveloped.

Conclusion

Although both regions operate within a shared European legal framework, their approaches to waste management differ substantially in implementation, efficiency, and outcomes. Slovakia, with a more centralized and coordinated system, has made measurable progress but still faces challenges with public participation and rural infrastructure. In contrast, Sicily's decentralized and often fragmented governance, combined with severe infrastructural deficits, has led to persistent reliance on landfilling and weak recycling performance.

Strengthening regional coordination, investing in infrastructure, and increasing citizen engagement will be critical for both regions to meet EU waste management goals and realize a truly circular economy.

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