

Bridging the Gap Between Policy and Practice: Bio-Waste Management in Slovakia²

Abstract

Using a comprehensive analysis of the legal and practical dimensions of bio-waste management in Slovakia, this article highlights the relevant EU directives and national strategic documents and evaluates their transposition into the Slovak legal order. The article focuses on the implementation of separate bio-waste collection systems to reveal discrepancies in municipal performance, public engagement, and infrastructure availability. The study highlights key governance challenges, including legal vagueness, fragmented responsibilities, and insufficient oversight, while also presenting successful local practices to demonstrate the potential for improvement. Based on data from national authorities, academic research, and case studies, the article identifies critical barriers and offers recommendations for strengthening policy coherence, citizen participation, and the overall effectiveness of Slovakia's bio-waste management in line with circular-economy objectives.

Keywords: Bio-Waste, Slovakia, Waste Management, Separate Collection, Environmental Policy, Composting, Municipal Waste

1. Introduction

Bio-waste management is a critical component of sustainable waste governance in the European Union (EU), particularly in the context of transitioning toward a circular economy, which emphasises the continual use of resources to minimise waste and promote sustainability. However, in the case of bio-waste, this circularity

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is often narrowly limited to the use of biogas and compost or digestate as fertiliser. Bio-waste, which primarily consists of biodegradable kitchen and garden waste, represents a substantial fraction of municipal solid waste, and its potential to be transformed from an environmental liability into a valuable resource³ recognised. In 2013, Slovakia generated approximately 2,560,970 tonnes of municipal waste, of which about 461,960 tonnes were separately collected biodegradable municipal waste, constituting approximately 18% of the total municipal waste. The fact that biodegradable waste (including garden, kitchen, and food bio-waste) during the years 2020–2023 constituted approximately one-third of the total weight of mixed municipal waste in Slovakia⁴ is both remarkable and problematic.

In line with this shift, the EU legal framework, including Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, as amended (hereinafter referred to as “Waste Framework Directive”) and the new circular-economy action plan under the title For a Cleaner and More Competitive Europe (hereinafter referred to as “CEAP2”) have introduced progressively stricter obligations for the separate collection, treatment, and quality assurance of bio-waste. As Vodička observes, “the rate of secondary material usage has not escalated as expected and packaging waste volumes continue to rise, indicating that the economy retains a predominantly linear character despite these measures”⁵

Slovakia, as an EU Member State, has transposed relevant directives into its national legal framework, most notably through Act No. 79/2015 Coll. on Waste and on Amendments of Certain Laws, as amended (hereinafter referred to as “Act on Waste”). However, despite these formal transpositions, the practical implementation remains significantly deficient. As Dufala stated, “the system of municipal waste management in the Slovak Republic is obviously flawed, in as much as municipal waste management lacks long-term management in accordance with the waste hierarchy”.⁶

Empirical evidence suggests that while legal obligations exist on paper, their translation into functional, environmentally meaningful systems is inconsistent and, in many cases, merely symbolic. A large portion of bio-waste continues to reach mixed municipal waste streams and is, therefore, mainly landfilled without adequate treatment, undermining both national recycling targets and broader EU sustainability objectives.

This study provides a comprehensive, multidisciplinary analysis of the legal and institutional framework governing bio-waste management in Slovakia, critically evaluating gaps between the normative design and practical outcomes. Drawing on national legislation, EU directives, strategic policy documents, and empirical data from APVV-funded research, municipal reports, and technical analyses,

3 | Ministry 2024, 178–181.

4 | Institute for Environmental Policy 2023, 13.

5 | Vodička 2024, 264.

6 | Dufala 2020, 30.

the study identifies key regulatory ambiguities, enforcement weaknesses, and systemic obstacles. Simultaneously, it highlights local innovations, including door-to-door collection, community composting, and the Pay-As-You-Throw schemes (hereinafter referred to as “PAYT scheme”).

The central argument of the paper is that effective bio-waste governance in Slovakia will require a transition from fragmented legal obligations of conduct to enforceable obligations of result⁷ supported by quality assurance mechanisms, institutional accountability, and citizen-centred policies. Through this lens, the article offers concrete recommendations for legal reform, strategic planning, and programmatic investments for the 2025–2030 period, aligned with the current EU law and the anticipated revision of the Waste Framework Directive.

2. Legal and policy framework governing bio-waste in Slovakia

This chapter provides an overview of the legal framework regulating bio-waste management, beginning with key legislative instruments and strategic policies at the EU level, followed by their transposition into Slovak national law. Understanding these regulations is essential, as they form the basis for all subsequent analysis of Slovakia’s implementation practices, compliance challenges, and overall effectiveness of bio-waste management policies.

Before analysing the legal and policy framework governing bio-waste in detail, the use of terminology in both EU and Slovak legislation should be clarified. The legal framework distinguishes between ‘biodegradable waste’, ‘bio-waste’, and ‘biodegradable municipal waste’, each of which has a specific legal definition and scope of application.

At the EU level, bio-waste is defined in the Waste Framework Directive as follows: “biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants.”⁸ This definition clearly extends the scope of bio-waste management beyond private households, encompassing commercial, institutional and food-processing actors. However, this study focuses primarily on household-level bio-waste management, as it represents the most regulated and visibly implemented component of the system under national legislation. Moreover, most of the available data, pilot projects and policy interventions in Slovakia to date, have been aimed at the residential sector, making it the most analytically accessible starting point for evaluating bio-waste governance.

In contrast, the Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (hereinafter referred to as “Landfill Directive”), established the term

7 | See Moravcová 2023.

8 | Article 3 para. 4 of the Waste Framework Directive.

biodegradable waste and defined it as “any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard”⁹. Moreover, the EU legislation does not provide a legal definition of the third most important term in this area. However, we can find the definition of biodegradable municipal waste in non-binding documents, which describe it as “biodegradable waste from households, as well as other biodegradable waste, is similar to biodegradable waste from households”¹⁰.

These distinctions are mirrored in the Slovak legal framework. The Act on Waste defined the terms,¹¹ and biodegradable was¹², almost identically as the EU directive did, which became the main legal basis for implementing separate collection systems. The Act on Waste also defined biodegradable municipal waste as “all types of biodegradable waste that can be classified into group 20 Municipal waste”.¹³

2.1. EU legal framework on bio-waste

Several key policy documents and directives aimed at minimising environmental impacts, promoting resource efficiency, and enhancing circular-economy practices primarily govern the management and handling of bio-waste within the EU. The most critical legislative acts are the Waste Framework Directive, the Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (hereinafter referred to as “Landfill Directive”), and strategic policy initiatives like the CEAP2,¹⁴ European Green Deal. The key aspects and specific obligations of these legislative acts and policies, particularly concerning bio-waste management, are analysed in greater detail in the following sections

2.1.1. Waste Framework Directive

Fundamental concepts and principles concerning waste management, including definitions of key terms such as ‘waste’, ‘bio-waste’, and ‘recycling’, are established by the cornerstone of bio-waste legislation in the EU, the Waste Framework Directive.¹⁵ A crucial development was the 2018 amendment of the directive, which introduced significant improvements related to the management of bio-waste.

9 | Article 2 letter (m) of Landfill Directive.

10 | European Environmental Agency 2002.

11 | Provision of § 2 para. 7 of the Act on Waste.

12 | Provision of § 2 para. 6 of the Act on Waste.

13 | Provision of § 2 para. 8 of the Act on Waste.

14 | Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and The Committee of the Regions – the European Green Deal (COM/2019/640 final).

15 | Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste.

Among the most relevant amendments, Article 22 explicitly mandates Member States to separately collect or recycle biowaste¹⁶ 2023. According to the article, Member States should implement measures encouraging the recycling of bio-waste, including composting and digestion processes, to achieve high-quality outputs that meet environmental protection standards, support home composting practices, and promote the use of materials derived from bio-waste.¹⁷

Additionally, starting from 2027, compost produced from mixed municipal waste will not be eligible to contribute towards municipal waste¹⁸ recycling targets. The amending directive emphasises recycling bio-waste and urges Member States to implement measures to facilitate the production of high-quality compost and digestate, thus fostering a circular economy. This aligns with findings presented in 'Bio-waste Management in the European Union: Policies and Practices', highlighting separate collection as waste as a resource in a circular way.¹⁹

2.1.2. Landfill Directive

Complementing the Waste Framework Directive, the Landfill Directive also significantly influences bio-waste management strategies across the EU and in Member States. The directive sets stringent conditions for reducing landfill waste volumes and specifically targets the diversion of biodegradable municipal waste from landfills to reduce environmental impacts, such as methane emissions and groundwater pollution. This directive mandates Member States to progressively reduce the amount of biodegradable municipal waste deposited in landfills, using 1995 levels as a benchmark. The requirement, established by Article 6(a) of the Landfill Directive, that only waste which has undergone treatment may be land-filled will be discussed in greater detail in the subsequent sections of this study, as this represents a significantly problematic aspect in Slovakia. Furthermore, Directive (EU) 2018/850 amending the Landfill Directive introduces a strict ban on landfilling separately collected bio-waste starting from 2030.

2.1.3. EU circular economy policies

Policy frameworks, notably the CEAP2, strongly influences the strategic direction of bio-waste management in the EU. Introduced by the European Commission in March 2020, CEAP2 prioritises waste prevention, resource efficiency, and the closing of the material loop. Given its potential for recovery and reuse as compost or bioenergy, bio-waste occupies a central position in achieving these circular-economy objectives. Generally, CEAP 2 complements the binding targets established

16 | Article 22 para. 1 of the Waste Framework Directive.

17 | Article 22 para. 1 of the Waste Framework Directive.

18 | Article 11a para. 4 of the Waste Framework Directive.

19 | European Environmental Agency 2020, 17.

by the Waste Framework Directive concerning bio-waste recycling and separate collection in its objective. A more comprehensive review of the circular economy approach, including bio-waste management, can be found in *Towards a Circular Economy: Business Rationale for an Accelerated Transition*²⁰.

2.1.4. European Green Deal and bio-waste management

Building upon, *inter alia*, circular-economy initiatives, ‘The European Green Deal’, launched by the European Commission in December 2019, strengthens the EU’s long-term commitment to sustainability by setting the ambitious goal of achieving climate neutrality by 2050. Within this broader environmental vision, the proper management of bio-waste emerges as significant for reducing greenhouse gas emissions and mitigating environmental pollution. The European Green Deal specifically promotes transforming waste streams into valuable resources, underlining the importance of bio-waste recycling for achieving the climate and sustainability targets of the EU.

Overall, the combination of binding legislative frameworks and ambitious policy targets at the EU level creates a robust structure for significantly enhancing bio-waste-management practices across all Member States, including Slovakia, which collectively aim to facilitate a sustainable transition towards a circular economy, maximising environmental benefits and minimising waste-related impacts.

2.2. National strategic documents

The strategic direction for bio-waste management in Slovakia is guided primarily by three key national documents: the Waste Management Program of the Slovak Republic 2021–2025 (POH SR 2021–2025), the Waste Prevention Program of the Slovak Republic 2019–2025 (PPVO SR 2019–2025), and the Strategy of the Environmental Policy of the Slovak Republic until 2030 with title “Greener Slovakia”. These documents collectively define objectives, measures, and tools necessary to align Slovakia’s waste policies with EU circular-economy goals, particularly that of reducing, separately collecting, and sustainably treating bio-waste.

2.2.1. Waste management program of the Slovak Republic for 2021–2025

In this strategic document, bio-waste is identified as a priority waste stream, and its potential for energy recovery is emphasised. The key objectives outlined include increasing the efficiency of separate bio-waste collection systems, ensuring compliance with EU recycling targets, reducing dependency on landfill

20 | Ellen MacArthur Foundation 2015.

disposal, and enhancing bio-waste recycling and recovery through composting and anaerobic digestion. Concrete targets for bio-waste management, including the reduction of biodegradable municipal waste in mixed municipal waste to 25% by the year 2025, have been set in the document. The effectiveness of these measures is monitored using indicators such as the proportion of separately collected bio-waste, recycling rates, and the number of operational composting and anaerobic digestion facilities. However, in September 2024, the Ministry of Environment of the Slovak Republic (hereinafter referred to as “Ministry”), supported by the Slovak Environmental Agency, published the Interim Evaluation of the Achievement of the Objectives of the Waste Prevention Programme of the Slovak Republic for the Years 2019–2025, in which three indicators were identified. The conclusions of the evaluations are briefly presented below:

- | Amount of biodegradable municipal waste: The amount of separately collected biodegradable municipal waste increased by nearly 178% over the monitored period (2016–2023) from 166.343 tonnes to 461.960 tonnes.
- | Number of municipalities supporting home composting: 1.837²¹
- | Number of municipalities supporting community composting: 648.
- | Share of biodegradable waste in mixed municipal waste: However, the author disagrees with the announcement of the Ministry in the document that this indicator cannot be precisely evaluated, as the methodology for mixed waste analysis aimed at determining the composition of municipal waste was only approved and published in July 2020, and the Ministry currently does not have the necessary data at its disposal.²²

As highlighted by Valeníková and Marišová, Slovakia’s failure to meet its bio-waste targets is often linked to the fragmented implementation of proposals in strategic documents and insufficient coordination between municipalities and national authorities, which impedes consistent performance across regions.²³

2.2.2. Waste prevention program of the Slovak Republic 2019–2025

This strategic document in the area of waste management also complements the above approach by prioritising measures aimed at reducing bio-waste generation at the source.

Home composting, responsible consumption, and food waste prevention are identified in the document as major ways to reduce the volume of biodegradable municipal waste in line with the waste hierarchy described in the Waste Framework Directive. Key objectives include limiting total bio-waste generation and

21 | Out of the total number of municipalities (2.887) in Slovakia. *Author’s note.*

22 | Ministry and Slovak Environmental Agency 2024,

23 | Valeníková and Marišová 2023.

its share as part of the municipal waste, thus easing environmental pressures. Crucially, it also emphasises that such measures will require cross-sectoral partnership and that the guiding principles behind waste prevention must be reflected in wider economic and consumer-policy agendas, since solid waste management and sustainable environmental futures are intrinsically linked.

2.2.3. *Envirostrategy 2030*

The Slovak Republic's long-term strategic environmental policy, *Envirostrategy 2030*, *inter alia*, frames bio-waste within a broader vision of achieving a circular economy and minimising landfilling. Among its headline objectives is a commitment to reducing municipal waste landfilling to 10% by 2035, which would be impossible to achieve without large-scale diversion of bio-waste from the mixed waste stream. The strategy directly highlights the insufficient rate of bio-waste separation as a key obstacle to improving municipal waste recycling. It sets as a target the full implementation of the separate collection of biodegradable waste, including kitchen waste, across the country. It also demands smart waste-management systems, public involvement tools, and investment in local infrastructure, particularly composting and biogas facilities.

Moreover, the latest analysis provided by the Institute for Environmental Policy emphasises that meeting bio-waste-related targets will bring practical and economic challenges for Slovakia, namely the capacity of its bio-waste treatment infrastructure. This analysis highlights large regional disparities in the provision of treatment facilities, indicating a necessity for strategic investments in infrastructure and improvements in bio-waste-management capabilities at municipal levels. This correlates well with the strategic aims of the Waste Prevention Program of the Slovak Republic 2019–2025 and the Waste Management Program of the Slovak Republic for 2021–2025 highlighting the necessity of implementing complex and regionally balanced approaches for achieving qualitative and quantitative shifts in the bio-waste management system towards greater efficiency and sustainability.

In conclusion, Slovakia's strategic approach to bio-waste management is robustly articulated in these national-policy documents, clearly aligning with broader EU policy frameworks. However, for the implementation of these strategies, consistent political will, sufficient financial resources, and coordination across multiple governance levels are required to address persistent gaps in infrastructure and public participation. These aspects will be further explored in the subsequent sections of this study.

2.3. Transposition and national legislation in Slovakia

Slovakia, as an EU member state, is required to transpose and implement all relevant EU waste management legislation into its national legal system. The cornerstone of the Slovak legal framework in this area is the Act on Waste, which transposes key provisions of the Waste Framework Directive and almost every other piece of EU waste legislation. This legislation establishes fundamental definitions, legal principles, and detailed obligations concerning waste management, including bio-waste. The Act on Waste obligated municipalities in Slovakia to introduce separate collection systems for biodegradable waste, including both kitchen and garden waste, since 1 January 2021. This is not merely about placing bins on the street—it reflects a more fundamental principle: sorting waste at its source to enable meaningful recovery and recycling. As laid out in the Act on Waste, the definition of bio-waste at the national level is very much aligned with legislation set out at the EU level, providing a clear basis in terms of legislation that has been the bedrock of a rollout of separate nationwide collection systems.

To support the practical implementation of these obligations, the Slovak government has adopted several pieces of secondary legislation, notably the Decree of the Ministry of Environment of the Slovak Republic No. 371/2015 Coll. which Implements Some Provisions of the Act on Waste, as amended (hereinafter referred to as “Ministerial Decree 371/2015”), which specifies the classification and catalogue of wastes, including bio-waste, as well as details on management practices. Additionally, Decree of the Ministry of Environment of the Slovak Republic No. 382/2018 Coll. on the Landfilling of Waste and the Storage of Waste Mercury, as amended, provides technical requirements and standards for waste treatment facilities; ensures that waste management operations, including composting and anaerobic digestion; complies with established environmental-protection criteria.

Institutionally, responsibility for bio-waste management at the national level is vested primarily in the Ministry. Conversely, the Slovak Environmental Inspectorate holds primary responsibility for compliance monitoring and the enforcement of environmental regulations. At the local level, municipalities bear significant responsibilities, particularly regarding the practical implementation of separate bio-waste collection systems, public education, and compliance with regulatory requirements.

Despite the clearly defined legislative and institutional responsibilities, Slovakia still faces significant challenges in effectively enforcing bio-waste collection regulations. This study will critically assess and discuss in detail specific practical issues, enforcement shortcomings, and related legal disputes in detail in subsequent sections.

3. Implementation in practice

The 2019 amendment to the Act on Waste²⁴ obligated municipalities to ensure the collection of biodegradable kitchen waste from households and significantly influenced separate bio-waste collection in Slovakia. This obligation entered into force on 1 January 2021, and the transition period of this amendment ended in July 2021. Starting in January 2023, even Bratislava and Košice—the two largest cities in Slovakia—lost their exemptions and were required to fully implement the separate collection of biodegradable kitchen waste. Currently, only specific areas within a municipality where it can be conclusively demonstrated that 100% of households home composting of their bio-waste are legally exempted from this obligation.²⁵

Despite the uniform legal obligation, the actual rollout has revealed a fragmented and uneven pattern of implementation across the country. A key instrument shaping implementation at the municipal level is the principle of subsidiarity—municipalities are legally obligated to organise the collection systems but are granted a degree of discretion in how they fulfil these duties. As of 2022, only approximately 37,000 tonnes of kitchen bio-waste were separately collected, averaging just 14 kg per capita, which accounted for only 23% of the estimated total potential kitchen bio-waste present in mixed municipal waste.²⁶

The disparities are even more pronounced when housing types and collection models are disaggregated. In municipalities where basic systems were deployed, typically involving shared containers for multiple households, the average recovery rate was significantly lower. Conversely, more sophisticated collection models, such as door-to-door schemes with individual household distribution of small bins and compostable bags, consistently yielded higher separation efficiency. According to a detailed waste-composition analysis, municipalities with a predominance of family houses using door-to-door collection systems or home composting achieved significantly higher bio-waste separation rates—up to 40% of the estimated potential—than²⁷, which remained below 20%. Case studies from Slovak municipalities confirm these trends: for example, in and Nitra, the combination of tailored public education and the provision of user-friendly collection equipment (like kitchen caddies and biodegradable bags) has led to substantial increases in bio-waste recovery²⁸.

24 | Act No. 460/2019 Coll. Amending and Supplementing Act No. 79/2015 Coll. on Waste and on Amending and Supplementing Certain Acts, as Amended, and Amending and Supplementing Certain Other Acts.

25 | Article 81 para. 21 of the Act on Waste.

26 | Institute for Environmental Policy 2023, 22.

27 | Zväz odpadového hospodárstva 2024.

28 | Fehér 2024.

A significant implementation gap persists in urban environments with a high share of apartment housing. For example, in Bratislava, where over 90% of the population lives in apartment buildings, the operational and logistical challenges are amplified, including limited space for bin placement and low levels of household participation. Analysis conducted by the municipal waste company OLO estimates that around 17% of mixed municipal waste in Bratislava is composed of kitchen bio-waste²⁹.

In conclusion, while Slovakia has taken substantial legislative steps toward implementing separate bio-waste collection, the actual practice remains inconsistent and hindered by logistical, infrastructural, and behavioural challenges. This study will analyse these practical obstacles in greater detail in the next section, drawing on both quantitative data and case studies from selected regions.

4. Public engagement and financial instruments

Effective bio-waste management depends not only on legislation but also on active public participation and adequate financial support provided through initiatives such as subsidies for composting infrastructure and community-education programs that have proven effective in increasing public awareness and participation. This section examines how public education and economic incentives influence the success of separate collection systems in Slovakia. Despite existing legal obligations, limited outreach and underused financial tools hinder performance and public involvement.

4.1. Public education and awareness campaigns

The transformation of Slovakia's bio-waste management system hinges not only on legislation and infrastructure but fundamentally on public awareness and behavioural change. Legal obligations cannot replace informed engagement; therefore, public education must be recognised as a cornerstone of effective waste policy.

Although the Act on Waste had already mandated the separate collection of biodegradable municipal waste, many municipalities failed to prepare in advance, assuming further legislative delays. Consequently, large segments of the population were left uninformed (or poorly informed at best) about upcoming changes, which critically undermined early-implementation efforts.³⁰ It is difficult to determine who is responsible for this undesirable state. On the one hand, the Ministry explicitly obligated municipalities to conduct information campaigns

29 | Institute for Environmental Policy 2020, 20.

30 | Valenčíková 2022, 204.

by publishing relevant content on municipal websites and distributing informational materials³¹. On the other hand, from the authors' perspective, the Ministry could have supported municipalities more actively—particularly in preparing the content and visual materials for such campaigns. Eventually, this support materialised in 2022, when the Ministry issued a manual for municipalities on ensuring the separate collection of biodegradable waste. This guidance, *inter alia*, stresses the importance of using multiple outreach tools—printed materials, local media, community events, and house-to-house education. It also emphasises families.³²

Successful local examples cannot be overlooked, such as the municipality of Horná Ves³³ or Partizánske³⁴, which showed that raising awareness and general decentralised outreach through municipal websites and broader community campaigns can help awareness and, overall, significantly decrease municipal waste volume. These actions were geared to encourage zero-waste living using positive reinforcement and immediate feedback.

Education is recognised as an important policy tool for achieving these objectives at the national level in the Programme of Waste Prevention 2019–2025 and in the Waste Management Programme of the Slovak Republic 2021–2025. However, mechanisms and budgets for municipalities to determine strategic priorities and frequently conduct tangible campaigns do not exist. A key limitation lies in the institutional fragmentation of responsibility. In practice, public education activities are often left to the discretion of organisations with the responsibility of producers, who only spend around 1.3% of their budget for raising awareness among citizens.³⁵ Slovakia currently lacks any mandatory minimum threshold for communication spending by these entities, which could be very useful in increasing the amount of sorted bio-waste, which will be essential if Slovakia wants to achieve the goals set by EU legislation. To ensure success, campaigns must be designed not only as information tools but also as engagement strategies. This means investing in two-way communication, cultural relevance, and transparency about what happens to the waste once it is separated. Only with trust and inclusion can citizens be transformed from passive participants into active agents in the circular economy.

4.2. Financial instruments and economic incentives

Not only legislative obligation but also a well-balanced mix of economic incentives and financial instruments are required to encourage the public to meaningfully participate in bio-waste separation and treatment in Slovakia. Despite the

31 | See Provision of § 14 para. 14 of the Ministerial Decree 371/2015.

32 | See Moňok and Masničáková 2021, 32.

33 | Horná 2022.

34 | Kazda 2023.

35 | Institute of Environmental Policy 2023, 31.

existence of several funding mechanisms and policy tools, their implementation remains fragmented, inconsistently applied, and underfunded.

At the national level, municipalities may access the Environmental Fund and utilise calls under the Operational Programme Quality of Environment. These sources have been used primarily for the procurement of home composters, the establishment of brown-bin collection systems, and the construction of composting infrastructure. The Environmental Fund has also supported pilot projects aimed at decentralised composting or educational campaigns. Yet, these efforts lack continuity and scale and are not governed by a long-term national funding strategy. Moreover, local authorities are not systematically encouraged—either legally or financially—to invest in high-quality awareness campaigns or reward households for active participation. As Máčaj argues, the way municipalities regulate residual waste collection can become a decisive tool for influencing citizen behaviour and reducing overall waste generation.³⁶

A key systemic gap lies in the limited use of economic incentives at the household level. Slovakia currently lacks widespread implementation of pay-as-you-throw (PAYT) schemes, in which citizens are financially rewarded for reducing mixed waste and increasing separated collection. Although PAYT scheme is recommended by the EU as a best practice for driving behavioural change, its rollout in Slovakia has been minimal, with only a few municipalities experimenting with such models. In 2023, only 10.6% of municipalities had implemented a quantity-based municipal waste collection system, and just 5.6% had applied a combined approach.³⁷

The Ministry, in cooperation with civil society partners, has developed manuals and model practices to support local authorities, including providing guidance on informing the public and organising³⁸ events. However, these tools are voluntary and not systematically linked to financial support schemes. For example, municipalities are not incentivised to appoint local trainers or ‘compost masters’ to lead community workshops and demonstrate abroad.³⁹

To close these gaps, experts have proposed integrating public engagement requirements directly into legal and financial frameworks. This includes:

- | setting minimum thresholds for producer responsibility organisations’ spending on education,
- | linking municipal subsidies to performance indicators (e.g. diversion rates),
- | earmarking funds for PAYT scheme implementation and local composting initiatives.⁴⁰

36 | Máčaj 2021, 38.

37 | Ministry 2024, 180.

38 | See Moňok, Masničáková and Záhorský 2016.

39 | See e.g. Interreg Europe 2023.

40 | Proposals were developed within the academic project APVV-20-0076 titled Waste and Buildings – Modeling Efficiency of Alternative Opportunities for Public Authorities Cooperation, of which the author of the study was a member.

In sum, Slovakia possesses the legal architecture and selected financial instruments to support household bio-waste engagement, but these tools remain underutilised. Without targeted investment in programs and incentives addressing citizens, legal obligations alone are unlikely to produce the behavioural change needed to achieve circularity in the bio-waste sector.

5. Bio-waste treatment methods and associated health and environmental risks

The effectiveness of bio-waste management is closely linked to the quality and safety of its treatment. This section outlines main treatment methods used in Slovakia and examines their associated environmental and health-related risks. It also highlights key challenges such as inadequate infrastructure, quality-control gaps, and the limited role of anaerobic digestion in the current system.

5.1. Overview of treatment options in Slovakia

Based on the country's geographic, demographic, and institutional diversity, the treatment of bio-waste in Slovakia is characterised by a dual approach: heavy reliance on decentralised home composting in rural and suburban areas and supporting municipal-level collection and centralised treatment systems, including both composting and, to a much lesser extent, anaerobic digestion.

Home composting remains the most common method for addressing bio-waste in family housing zones. The state has supported this method by financing the distribution of domestic composters, primarily through the Slovak Environmental Fund and EU-supported calls under the Operational Programme Quality of Environment. However, this decentralised model has limitations in terms of quality control, environmental monitoring, and data transparency. Municipalities often rely on self-reporting or blanket assumptions about composting behaviour, because the sorted amount of kitchen bio-waste will not be included in the municipal-waste register, which will only result in a decrease in mixed municipal waste (which, however, can be caused by a number of other factors).

Municipal centralised bio-waste collection systems, in particular brown-bin schemes, have expanded since the introduction of mandatory separate collection obligations in 2021. These systems are generally more prevalent in urbanised and densely populated municipalities, where home composting is less feasible. Brown-bin collection enables better control over material quality, facilitates treatment at industrial composting plants, generates additional operational costs; however, public cooperation is required for source separation. A detailed analysis of municipal waste management in 212 Slovak municipalities revealed that the average cost of handling one tonne of kitchen bio-waste amounts to 405 EUR, whereas the

average cost of managing garden-derived biodegradable waste in 256 municipalities was just 50 EUR per tonne.⁴¹

Centralised treatment infrastructure for biodegradable kitchen and catering waste in Slovakia remains relatively limited in terms of coverage, though available facilities offer substantial nominal capacity. As of 2023, 73 authorised facilities were in operation nationwide, consisting of 54 composting plants and 19 biogas stations. The combined processing capacity of the composting facilities reached 503,544.3 tonnes, while the biogas stations had an additional⁴² capacity. Anaerobic digestion, while identified as an effective treatment method for its dual benefits (waste reduction and energy recovery), remains underdeveloped. Barriers include high investment costs, regulatory complexity, and public opposition to the perceived industrialisation of waste treatment in peri-urban zones.

In conclusion, while Slovakia's treatment landscape offers multiple options, it remains fragmented and inconsistent. The system relies predominantly on decentralised solutions, while investment and oversight of centralised technologies—especially anaerobic digestion—lags behind. A more integrated strategy that balances household responsibility with municipal capacity will be necessary to achieve environmental and policy targets under the Waste Framework Directive.

5.2. Environmental and health-related risks of bio-waste treatment

The treatment of bio-waste in Slovakia entails a complex mix of environmental and health-related risks, depending on the technology used, the level of operational oversight, and the consistency of source separation. Despite existing legislative obligations, the reality of implementation reveals several weak points in terms of both environmental protection and public health.

5.2.1. Environmental risks

The widespread treatment method in Slovakia remains home composting, especially in rural areas. Although the distribution of home composters has been widely supported through national programmes, their actual use and effectiveness in households remain largely undocumented. Municipalities often lack mechanisms to verify⁴³ correct usage or the environmental outcomes of home composting. This creates uncertainty regarding the real contribution of such decentralised systems to waste diversion and environmental protection. The author has observed that a certain municipality was distributing home composters to residents and in

41 | Zväz odpadového hospodárstva 2024.

42 | Zväz odpadového hospodárstva 2023.

43 | Fehér 2024.

the same month, people from that municipality were selling these composters on internet portals, which is problematic.

At municipal composting facilities, problems may arise when installations are operated with outdated technology or without proper site protection. Further, citizen complaints related to odours and technical inadequacies are commonly associated with such facilities, especially in warm months. Here, the need for strict environmental guarantees and registration of facilities must be emphasized to avoid uncontrolled impacts on air, water, and soil quality.

Furthermore, Slovakia landfills significant amounts of biodegradable waste, particularly in municipalities lacking full brown-bin infrastructure. This leads to avoidable methane emissions, undermining climate goals under the Waste Framework Directive.

5.2.2. Health-related risks

Health-related risks of bio-waste treatment are most acute in improperly maintained open composting systems. Poor composting conditions cause the spread of pathogenic microorganisms, especially when kitchen waste is mixed with animal by-products or contaminated inputs. According to expert guidance, compost must reach specific temperatures and retention times to eliminate health threats that many backyard or poorly managed municipal sites do not reliably reduce.

Additional health concerns relate to the attraction of rodents and insects, without proper storage of kitchen waste or adequate collection frequency. Finally, the fact that home composting is never submitted to any hygiene requirements (unlike industrial composting plants) creates the following issue for health protection. While industrial plants require adherence to technical standards, backyard composting is largely self-regulated, creating a challenge for the safe handling of household food waste, particularly in densely populated environments.

But if Slovakia is serious about its environmental and climate objectives and about safe bio-waste management, the country needs improved technical supervision, enforcement of composting standards, and a wider turn toward emission-abating technologies, like anaerobic digestion. A holistic approach to mitigating these risks is critical for protecting both ecosystems and public health.

5.3. Quality control and monitoring gaps

Persistent gaps in quality control and performance monitoring significantly constrain the effectiveness of Slovakia's bio-waste management system. These weaknesses are evident at multiple levels of the system—from decentralised household composting to municipal collection and centralised treatment.

Though home composting is one of the most commonly promoted solutions, no standardised mechanism for verifying composting practices or assessing

outcomes exists. Municipalities that distribute composters often rely solely on the assumption that households will use them properly and have no actual means to verify how bio-waste is composted in the household. This limited oversight is partially explained by the fact that municipalities are responsible for supervising compliance with bio-waste obligations among individual residents, as national authorities (mainly the Slovak Environmental Inspectorate) do not maintain such controls over natural persons. This absence of oversight makes it impossible to assess compliance with basic environmental or hygienic criteria, such as the maturity of the compost, the exclusion of inappropriate materials, or the maintenance of aerobic conditions. Without performance data, the real contribution of home composting to separate collection targets remains uncertain.

At the municipal level, brown-bin collection schemes and communal composting plants are, in most cases, subject to basic reporting obligations. However, aspects related to quality, such as the cleanliness of collected material, contamination rates, and output quality are not systematically monitored or publicly reported. While composting facilities must fulfil general environmental protection requirements, the environmental performance of many small and local facilities is not regularly evaluated. Moreover, neither a national registry nor a centralised database on composting installations exists to evaluate the operational status, input-output data, and environmental impacts. The absence of standard metrics and third-party audits limits the state's capacity to assess the impact of its waste-diversion efforts.

The Slovak Environmental Inspectorate also carries out controls in the waste-management sector, but it focuses mainly on formal compliance rather than the actual environmental results of biological treatment processes. Also, according to publicly available annual inspection plans, bio-waste composting receives little targeted attention in the structure of environmental inspections.

In practice, this means that failures in treatment quality may go undetected, especially in rural or peri-urban areas with limited technical capacity and political attention. Without clear rules for output quality, testing frequencies, or sanctions for non-compliance, the system lacks basic safeguards necessary to ensure a circular and safe material loop.

6. Bio-waste management in practice: gaps, barriers, and exemplary responses

Despite a solid legal framework, Slovakia's bio-waste system faces persistent barriers at the implementation level. This section explores structural, legal, and operational gaps that hinder progress and contrasts them with good practice examples from selected municipalities. The section also identifies where the system fails—and succeeds—to deliver effective, sustainable bio-waste management.

6.1. Fragmentation of responsibilities between national and local authorities

The bio-waste governance framework in Slovakia is institutionally fragmented, with responsibilities divided across several administrative levels and actors. At the national level, the Ministry formulates the legal and strategic direction and policy papers such as the Waste Management Programme or Waste Prevention Plan or legislation. Conversely, the operational responsibility virtually rests with municipalities, which must establish collection schemes, maintain infrastructure, and implement public communication.

This division of labour and responsibilities leads to systemic coordination gaps. Municipalities frequently lack the technical capacity, human resources, or financial means to implement and monitor complex systems like the separate collection of all types of bio-waste. However, national authorities often provide only general guidance or late-stage technical support without consistent capacity-building or enforcement oversight. This institutional disconnection has been repeatedly identified as a key factor undermining uniformity and effectiveness in municipal waste services, including those related to bio-waste. As a result of the APVV-funded project, a study had already been conducted to evaluate the efficiency of waste governance in Slovak municipalities and concluded that “the independence of local waste policies within and between districts can result in significant disparities in effectiveness” – a conclusion that was supported by quantitative indicators showing large inter-regional differences in recycling, landfilling, and bio-waste recovery rates.

In short, Slovakia’s multi-level governance framework in the area of bio-waste is defined more by legal decentralisation than by cooperative governance. A clearer division of responsibilities, accompanied by capacity-building, minimum quality standards, and performance-based financing, is essential for overcoming fragmentation and aligning national ambitions with local realities.

6.2. Gaps in legal framework and performance-based oversight

Though Slovakia has transposed key EU waste legislation into its national legal framework, it faces significant structural and legal challenges in governing municipal bio-waste. These gaps are most visible in the vagueness of legal obligations, the fragmentation of enforcement responsibilities, and the absence of strategic, performance-based monitoring tools.

The Slovak Act on Waste and implementing Ministerial Decree 371/2015 establish formal requirements for municipalities to ensure that biodegradable municipal waste is collected separately. However, in the author’s view, these provisions lack measurable performance criteria related to contamination levels, collection effectiveness, or treatment outcomes. Legal obligations are primarily procedural,

as they require the provision of containers or a collection schedule without addressing whether the collected material is actually suitable for high-quality composting or whether it is ultimately processed in such a way as to meet circular-economy objectives. Furthermore, neither national legislation gives acceptable limits for contaminants nor classes for municipal waste-derived compost. The Waste Management Programme for the years 2021–2025 defines no performance indicators for benchmarking or systemic evaluation. This form of normative vagueness enables municipalities and processors to nominally comply with their legal obligations, even when this compliance fails to yield environmentally meaningful outcomes. At the national level, no centralised mechanism exists to evaluate the quality and effectiveness of municipal bio-waste systems. The Ministry does not collect data on contamination rates, compost quality, or the final use of treated bio-waste. Municipal reports focus mainly on the collected quantities and have hardly any information on the functional outcomes of collection and treatment.

Institutionally, enforcement responsibilities are divided among municipalities, district offices, the Slovak Environmental Inspectorate, and the Ministry. However, these roles are distributed without effective coordination. The district environmental departments often lack technical staff, while municipalities are not provided with centralised methodological guidance or feedback on the quality of their collection and treatment systems. In many cases, oversight is limited to administrative formality, and no authority is tasked with assessing whether the collected bio-waste is suitable for composting or if the final compost meets hygienic and agronomic standards.

The Slovak Environmental Inspectorate, as confirmed by the Supreme Audit Office of the Slovak Republic,⁴⁴ is under-resourced and lacks the personnel, analytical capacity, and strategic-planning tools to perform risk-based inspections in the bio-waste sector. The abolition of annual inspection-planning documents and the absence of an internal analytical unit have led to a reactive enforcement culture with a focus on low-risk citizen complaints. Systemic risks, such as persistent contamination in certain municipalities, can go undetected and unaddressed. This leads to the conclusion that the Slovak Environmental Inspectorate, which oversees and enforces, emphasises formal compliance with permit obligations over functional outcomes or the quality of performance of composting facilities. The institutional model, characterised by widely dispersed accountability and weak performance incentives, creates a governance vacuum that neither supports local initiatives nor ensures national policy coherence. These structural deficiencies were further confirmed in a 2024 performance audit by the Supreme Audit Office, which emphasised the Slovak Environmental Inspectorate's growing burden of both permitting facilities.⁴⁵

44 | Najvyšší kontrolný úrad 2025.

45 | Ibid.

Studies using technical-efficiency models confirm that Slovak municipalities vary significantly in their bio-waste management. For instance, Fandel and Marišová used a DEA Assurance Region model to show that even among municipalities with similar population sizes and budgets, performance differs dramatically because of operational inefficiencies and strategic neglect.⁴⁶ Yet no system exists to identify and support the replication of good practices. Overall, the Slovak system currently facilitates widespread formal compliance with minimal guarantees of environmental effectiveness. Without clearer legal definitions, better mandatory coordination of oversight, and the establishment of national performance monitoring, bio-waste governance in Slovakia risks remaining bureaucratically active but strategically problematic.

6.3. Practical implementation problems observed in municipalities

While Slovakia has formulated the legal and strategic framework for bio-waste management, municipalities are mainly responsible for its daily implementation. At municipalities, policy meets reality and the system either functions or fails. Based on field data, audit findings, and academic studies, several recurring implementation problems have been identified, including inconsistencies in collection practices, infrastructural limitations, and issues related to the quality of the collected material. These challenges, though often underestimated, directly affect the environmental performance of the whole bio-waste chain. These challenges are listed in the following section.

6.3.1. Variability and inflexibility in collection practices and service frequency

The primary challenge in bio-waste management across Slovak municipalities is variability in collection practices and service frequency. For example, some municipalities offer weekly collection services all year round, while others only organise collections for some seasons of the year, like spring or autumn. This variability is mostly influenced by local conditions, population concentration, and financial capabilities, resulting in a distinct waste management system in different regions. Variability, which might appear to be deleterious at first, is central to the whole system. Simple one-size-fits-all solutions in bio-waste collection do not work effectively.

The introduction of rigid regulations⁴⁷, such as the mandatory use of perforated bins, has added complexity to an already inconsistent system. These regulations were implemented without prior consultation with municipalities, which led to

46 | Fandel and Marišová 2024.

47 | This happened by adopting The Decree of the Ministry of Environment of the Slovak Republic No. 259/2023 Coll., which amends and supplements the Decree of the Ministry of Environment of the Slovak Republic No. 371/2015 Coll., implementing certain provisions of the Act on Waste, as amended.

unintended consequences. Municipalities that could not purchase the required bins faced increased costs owing to the need for more frequent collections. Mayors and municipal leaders criticised this approach, pointing out that it failed to consider the unique circumstances of each municipality. According to the Union of Slovak Cities constraints.⁴⁸

6.3.2. Infrastructural deficiencies and operational bottlenecks

The Slovak bio-waste management system faces persistent structural barriers, mainly because of inadequate end-treatment infrastructure and uneven access of municipalities to it. Consequently, local governments often encounter operational difficulties that compromise the overall effectiveness of separate bio-waste collection systems. A critical issue is the limited availability of final treatment facilities for collected bio-waste, particularly in regions without composting plants or biogas stations in relative proximity to the origin of the waste. As explicitly stated in an expert analysis, Since final facilities for the collected bio-waste are lacking, municipalities are forced to transport the collected bio-waste over long distances, which increases the cost of the entire system.”⁴⁹

Another serious issue is the fact that a rather large portion of municipal waste still ends up in landfills—in 2023, it was still 38.⁵⁰ A problematic aspect in the Slovak context is the absence of concrete data on the proportion of bio-waste that ends up in landfills together with mixed municipal waste. The situation is further aggravated by persistent implementation delays and the lack of effective institutional response, particularly in the fulfilment of legal obligations and the development of essential infrastructure. For example, the obligation to pre-treat municipal waste prior to landfilling by stipulating that only the output of mixed waste treatment may be accepted at landfills was originally scheduled to be enforced on 1 January 2021. However, this obligation has since been repeatedly postponed—first to January 2023, then to 2024, next postponement was to 2025. Currently it is set to take effect only in January 2027. On the one hand, the author acknowledges the need to avoid imposing obligations that would, within a relatively short timeframe, place municipalities in difficult and potentially unmanageable situations. On the other hand, a six-year postponement of this obligation is, in his view, excessively long. Interestingly, the most recent extension of the deadline was adopted through an amendment to the Act on Waste passed by the National Council⁵¹, which reportedly surprised even the Association of Towns and Communities of Slovakia, which had previously been assured that no further postponements would occur. These delays, rooted in infrastructural gaps, generate long-term uncertainty and weaken local-level implementation. For

48 | Únia miest Slovenska 2023.

49 | Šimková, Bednárová, Prčík 2024, 16.

50 | Ministry 2024, 169.

51 | Čachová 2024; Potočár 2024.

example, a decree supporting the development of municipal composting and biogas infrastructure, which was planned under the Waste Management Programme of the Slovak Republic for 2021–2025, was to be adopted by the Ministry by the end of 2022. However, this legislative act had not yet been adopted.⁵²

The overall picture is further complicated by the absence of a fully functional national waste data system. Although the Integrated Waste Management Information System (ISOH) has been under preparation since 2017, its launch remains uncertain. Without a reliable, centralised digital registry of treatment capacities and material flows, strategic planning remains limited and fragmented.

6.3.3. *Quality issues and contamination*

The efficiency, cost, and environmental outcome of bio-waste treatment is strongly influenced by the quality of the separation of such waste. This remains a major concern in Slovakia, even though collection rates across municipalities are rising. Improper sorting, inadequate equipment, and a lack of public awareness often result in contaminated or poorly managed waste streams, which reduce the effectiveness of downstream processes, such as composting and anaerobic digestion.

Separation of bio-waste has been reported to be highly contaminated in places without specific collection equipment for separate collection of bio-waste and where compostable bags are not used. According to the official guidance issued by the Ministry, contamination with non-biodegradable components, such as plastics, remains a serious issue. The quality of the collected material is significantly influenced by the design of the collection system. The more direct the collection (0 meters walking distance), and the smaller the containers used, the cleaner the.⁵³

Poor quality is also associated with improper handling and unsuitable containers, especially during the warmer months. In systems that fail to ensure sufficient ventilation or use inappropriate collection frequencies, the material often becomes acidic and mouldy, which not only complicates treatment but also increases health risks. A study cited by the Ministry found that “low pH and mold formation significantly prolong the composting and sanitisation processes, increasing treatment costs⁵⁴” Furthermore, contamination compromises marketability and the agronomic value of the resulting compost or digestate. As noted in expert materials, only high-quality input can produce compost suitable for agricultural use. Therefore, source separation, container hygiene, and continuous education of residents should be emphasised in local collection schemes.

In conclusion, the contamination and quality issues in collected bio-waste constitute a significant operational barrier. While they may not always be as visible

52 | Šimková, Bednářová, Prčík 2024, 16.

53 | See Moňok, Masničáková and Záhorský 2016.

54 | Ibid.

as infrastructural shortcomings, their impact is equally critical. Addressing them requires a combination of technical measures (such as container design and optimised frequency) and soft interventions (including awareness-raising, feedback systems, and incentives for proper sorting).

6.4. Examples of good practice from slovak municipalities

This section explores effective strategies for managing bio-waste collection and treatment at the municipal level. It highlights innovative approaches implemented in Slovak municipalities, focusing on specific examples such as Partizánske, Bratislava, and Halič. These municipalities have successfully integrated bio-waste management systems that contributed to a more sustainable approach to waste separation and recycling.

6.4.1. Partizánske

The author chose to use the city of Partizánske with a population of 20,397 residents, which serves as an excellent example of how bio-waste collection and treatment can be effectively managed at the municipal level. In the following, three main aspects will be described—home composting for single-family houses, door-to-door kitchen waste collection for apartment buildings, and robust community engagement and education. These efforts have not only helped reduce waste but contributed to a more sustainable approach to managing bio-waste within the region.

The Home Composting Development Programme, which started in 2014, is one of the most effective bio-waste management initiatives in Partizánske. Based on a pilot project in one of the districts, the initiative was designed to encourage residents in single-family houses to compost at home and manage their bio-waste. The city offered free composters and educational materials to ensure that the community was provided with necessary tools and information. The results have been remarkable: between 2016–2023, in single-family houses, adopted home composting, resulting in a 36% reduction of mixed waste (118 kg per capita).⁵⁵

Another significant approach was chosen for residents living in apartment buildings to participate in the so-called ‘door-to-door collection’ for kitchen waste. In apartment buildings with elevators, residents place the compostable bags with baskets in front of their apartment doors on collection days, which the municipal staff picked up. In buildings without elevators, the staff collects the bags from baskets only on the ground floor, where residents drop off the baskets from their apartments. After being emptied, the baskets are returned to the residents. In 2023, approximately 18 kg of kitchen bio-waste was collected capita.⁵⁶

55 | Moňok and Beznáková 2024.

56 | Kazda 2023.

The spirit of success of Community Engagement and Education Partizánske in bio-waste treatment is underpinned by a strong emphasis on community involvement and education. Holding public lectures, door-to-door campaigns, and promoting the importance of bio-waste separation and composting through brochures and media articles, the city trains citizens towards greener living.

6.4.2. Bratislava

As noted earlier, the capital of Slovakia—Bratislava—initiated a kitchen-waste collection system in line with the EU legislative requirements a little later than other cities. In 2021, the kitchen and garden waste represented approximately 45% of the total residual waste in the city. The pilot project for separate kitchen waste collection began in 2021 in the smallest district of Bratislava – Lamač, which served as the testing ground before a city-wide rollout. Residents of Lamač were provided with compostable bags and vented kitchen baskets for collecting kitchen waste, which was then placed into designated 120- and 240-litre brown bins provided for the entire building.

For the successful implementation of the system, effective communication with residents and ensuring their involvement was crucial. As part of the project preparation, a readiness survey was conducted to assess citizens' willingness to adapt to the new waste-sorting behaviour. Approximately 38% of respondents expressed a strong interest in using the brown bins, with 31% of households already practicing home composting.⁵⁷

This system will become citywide following the successful implementation the pilot project in Lamač. Bratislava has gradually implemented a kitchen bio-waste collection system throughout all districts. In 2022, the system was adopted in all 17 urban districts and in more than 140,000 households. Unlike full-scale operations, a phased rollout enables processes to be optimised and potential issues to be addressed before the system is fully deployed. Based on the pilot project results in Lamač, the levels of contamination in waste (non-compostable materials in bio-waste) were very low and amounted to only 0.57% in apartment buildings and 0.25% in single-sector housing.⁵⁸

6.4.3. Halič

One of the systems that directly increases the rate of municipal waste separation, thereby likely increasing the amount of the separately-collected bio-waste, is the quantity-based collection system, commonly referred to as Pay-As-You-Throw (hereinafter referred to as "PAYT"). This model offers several alternative

57 | Jourdan and Favoino 2024.

58 | Ibid.

configurations, which, however, are beyond the scope of this study. As an example of best practices, it is pertinent to highlight an exclusive case of a municipality where such a PAYT scheme was introduced, resulting in unexpected outcomes.

The municipality of Halič, a small town with a population of only 1,675 inhabitants implemented this system in 2020. The municipal-waste recycling rate before the implementation of PAYT was only 41.94% in ⁵⁹⁶⁰. In contrast, by 2024, the municipality achieved a recycling rate of 66.06%, marking a significant increase. Notably, while the introduction of the PAYT scheme in Halič likely significantly contributed to the improvement, other factors such as the overall increase in public awareness about recycling may also play an important role.

7. Conclusion and future outlook

Despite the formal transposition of the EU waste acquis into Slovak law, the country's bio-waste management system remains fundamentally misaligned with the practical objectives of the circular economy⁶¹. Despite legal obligations, their implementation is often symbolic rather than substantively effective. The increasing gap between formal compliance and functional outcomes has been evident not only in low separation rates and high contamination but also in the absence of measurable quality indicators, coordinated enforcement, and community-level ownership. Slovakia's bio-waste policy is not underperforming owing to the lack of legislation but because of an insufficiently integrated system of legal, institutional, and behavioural mechanisms capable of delivering meaningful environmental results.

To rectify this, a shift from obligations of conduct to obligations of result is imperative. As detailed in Section 6.2, legal obligations under § 81 of the Act on Waste are framed procedurally and lack substantive performance benchmarks. Based on this observation, the current wording should be revised to include enforceable separation targets and maximum contamination thresholds. These benchmarks must be adapted to municipal capacities, for example, by introducing a tiered system where municipalities over 5000 inhabitants are legally required to achieve minimum separation rates (e.g. 55% by the end of 2028) and contamination levels below 3%. This approach reflects the principle of proportionality while moving towards substantive compliance with EU targets, especially the next benchmark for preparing for re-use and the recycling of municipal waste—65% by 2035⁶². Strategically, in its next waste management programme, the Slovak

59 | Halič 2020.

60 | Halič 2025.

61 | For more about Slovakia's approach to circular economy, see: Michalovič 2024.

62 | Article 11 para. 2 letter (e) of the Waste Framework Directive

Republic must integrate these reforms into binding performance indicators, not only for collection rates but also for quality metrics and final treatment outputs.

The codification of standards for compost and digestate quality is also important. As proposed in an ⁶³Kompostverordnung. This includes hygiene requirements (e.g. minimum temperature and retention time), contamination limits (particularly plastic content), nutrient value ranges, and heavy metal thresholds. Regular testing and transparent reporting must be made mandatory, particularly for facilities processing kitchen waste.

Legal reforms must be complemented by a reconfiguration of governance structures. Section 6.2 documents the lack of targeted and risk-based inspections. The Slovak Environmental Inspectorate currently lacks the analytical capacity and strategic mandate to monitor performance-based indicators in bio-waste treatment. A dedicated bio-waste unit within it should be established, with competencies for facility inspection, contamination audits, and enforcement. This should be supported by the creation of a centralised national register of composting and anaerobic digestion facilities and its integration into the ISOH system, tracking-treatment capacities, contamination rates, and output flows.

From an operational perspective, Slovakia must reconsider its reliance on passive collection models. As shown in Section 6.3, municipalities implementing door-to-door systems (e.g. Partizánske) achieve demonstrably better results in both quantity and quality of separated bio-waste. The adoption of door-to-door collection systems should be standardised, particularly in municipalities with mixed housing and a population over 1,000. Financial support for rollout could be made available through the Environmental Fund. The applicability and cost-efficiency of this model depend significantly on local conditions, such as population density, existing waste infrastructure, and administrative capacity. The lack of a universally applicable solution suitable for all municipalities should also be acknowledged. Therefore, for standardisation, a strong element of subsidiarity and flexibility should be incorporated into locally adapted implementation strategies.

Additionally, the mandatory introduction of PAYT schemes should be considered for all municipalities with more than 5000 inhabitants by 2028. It was calculated that the PAYT scheme is among the most effective economic tools for reducing waste generation and improving separation rates. Slovak data suggest that municipalities using quantity-based fees reduce mixed municipal waste per capita by approximately 22%.⁶⁴ Yet, as noted in Section 4.2 and supported by quantitative data, fewer than 11% of municipalities had implemented any form of quantity-based collection⁶⁵. Through legislative changes, minimum thresholds for

63 | BGBl. II Nr. 292/2001 – Kompostverordnung.

64 | Institute for Environmental Policy 2019.

65 | Ministry 2024.

variable fees should be introduced, while technical guidance and financial support should be provided to facilitate local implementation.

A particularly underdeveloped component in Slovakia's bio-waste policy is community composting. Section 6.4 points to the absence of regulatory mechanisms supporting neighbourhood-scale initiatives. Legal recognition of 'community composting sites' as a specific category of low-threshold facilities (e.g. <20 t/year) would enable citizen-driven solutions in schools, urban neighbourhoods, and housing cooperatives. Simplified permitting, combined with methodological support and targeted grants, could unlock local circular loops with minimal regulatory burden. A recent study concluded that "community-based compost programs are a promising strategy to improve household-level awareness, knowledge, and confidence in reducing food waste and bolster a circular food system in a target area."⁶⁶

Notably, while this study has focused primarily on household-level bio-waste, where legal obligations were clearly defined and implementation is more visible, bio-waste, as defined under EU law, also includes waste generated by restaurants, offices, food processing plants, and similar sources. The lack of complex data makes it difficult to assess the relative contributions of these sectors. Nonetheless, integrating household and non-household streams in shared treatment systems could improve cost-efficiency, raise output quality, and strengthen the viability of composting and anaerobic digestion infrastructure.

Finally, Slovakia must prepare for anticipated EU-level reforms. The expected revision of the Waste Framework Directive may introduce mandatory compost-quality standards, food-waste-prevention targets, and broader integration with EU climate and biodiversity frameworks. Rather than waiting to react, Slovakia should proactively align its legal and institutional architecture with these expected developments. An inter-ministerial coordination body could be tasked with legislative adaptation and the preparation of joint applications for funding under Horizon Europe, LIFE+, or the Cohesion Fund.

In conclusion, the transformation of Slovakia's bio-waste management system will not be achieved through fragmented amendments or short-term pilot projects, but a systemic recalibration of legal design, governance accountability, economic signals, and citizen engagement is required for it. The current bio-waste management system in Slovakia remains locked in a reactive and fragmented mode of operation, as legal compliance is often equated to formalistic fulfilment rather than substantive environmental progress. The key findings of this study point to the urgent need to redesign regulatory content and institutional arrangements not only through *ad-hoc* adjustments but through structural reform.

A robust bio-waste strategy for the 2025–2030 period must be grounded in enforceable quality standards (e.g. national thresholds for compost contamination),

performance-based oversight (e.g. audits of municipal separation rates and treatment outcomes), and targeted investment in local capacity (e.g. PAYT, community composting hubs, ISOH analytics). Municipalities must no longer be treated as passive implementers but empowered as central actors provided with tools, data, and legal clarity. The recommendations put forward in this article—ranging from legislative amendments to governance realignment and citizen engagement—are not aspirational add-ons. They are a functional precondition for achieving the EU's 65% recycling target by 2035 and for reversing Slovakia's historical over-reliance on landfill disposal. Without this shift, Slovakia risks remaining trapped in a cycle of symbolic reforms, rising infringement exposure, and unfulfilled climate and circularity goals. Political will, administrative leadership, and a legal framework that transforms compliance into performance are all required now.

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