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Food waste separate collection in Portugal. Building a stronger and more coherent framework

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Sumário executivo

Bio-waste management has become a key issue in the EU's plans of circular economy. Although the transposition of Directive (EU) 2018/851 has been completed, the efforts for field implementation of the separate collection of bio-waste are still ongoing. The S4P REC-SEL Project gathered information on initiatives through surveys to Portuguese municipalities and secondary research from various official sources. About half of the municipalities (152) have some kind of food waste collection initiative. The municipalities that do so are mainly located on the coast and in the south. The 196 implemented initiatives have different characteristics in terms of the sectors covered (domestic, non-domestic, or both) and the collection model (door-to-door, nearby bringpoints, or co-collection). The initiatives are still, in most cases, at an early stage, with little data available on efficiency and effectiveness. The various combinations of these characteristics result in six standard approaches. The door-to-door model is capturing more food waste, but the system that requires the least investment is co-collection. In terms of financial incentives, 7% of Portuguese municipalities use them.

The main constraints identified include: i) **lack of coordination** between key actors; ii) **difficulty in the practical application** of laws and technical standards; iii) **insufficient capacity** at the municipal level to deal with the technical complexity of the sector; iv) **scarcity of data** on the efficiency and effectiveness of collection initiatives; v) **resistance to the application of financial incentives**; vi) **lack of investment in national information campaigns**; vii) **weak enforcement and accountability**; and viii) insufficient focus on **waste reduction and innovative social solutions**.

Recommendations for addressing these constraints and strengthening public policies include: i) **strengthening coordination** between entities (local, regional, and national); ii) **monitoring and evaluating** the initiatives; iii) **improving reporting** of information; iv) **promoting the application of fair and incentivizing tariffs**; v) **communicating effectively and regularly, legislating more clearly and coherently** with the reality on the ground; and vi) **training and strengthening human resources.**

Introduction

Bio-waste management is central to the European Union's ambition to move towards a circular economy, as reinforced by Directive (EU) 2018/851, which amends the Waste Framework Directive. The Directive was transposed into national law through Decree-Law No. 102-D/2020 of December 10 and subsequent amendments (see **BOX 1**).

Collection strategies that ensure the effective separation of recyclable materials are a key

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element in closing the loop and building a truly circular system. With a reuse and recycling rate of only 37% [1], Portugal is still far from the **55% target for 2025 and the 60% target for 2030** [2]. Ensuring proper separation of bio-waste at source, as required by the Waste Framework Directive, is a decisive factor in achieving these goals.

Portugal is currently undergoing a transition. To comply with waste policies, municipalities are implementing initiatives that test different collection models (door-to-door, nearby bring-points and co-collection) and economic incentives (PAYT, etc.). However, there is **still a lack of systematic evaluation of these projects**, which is essential for generating the evidence base needed for informed policy decisions.

Key points

Governance structure

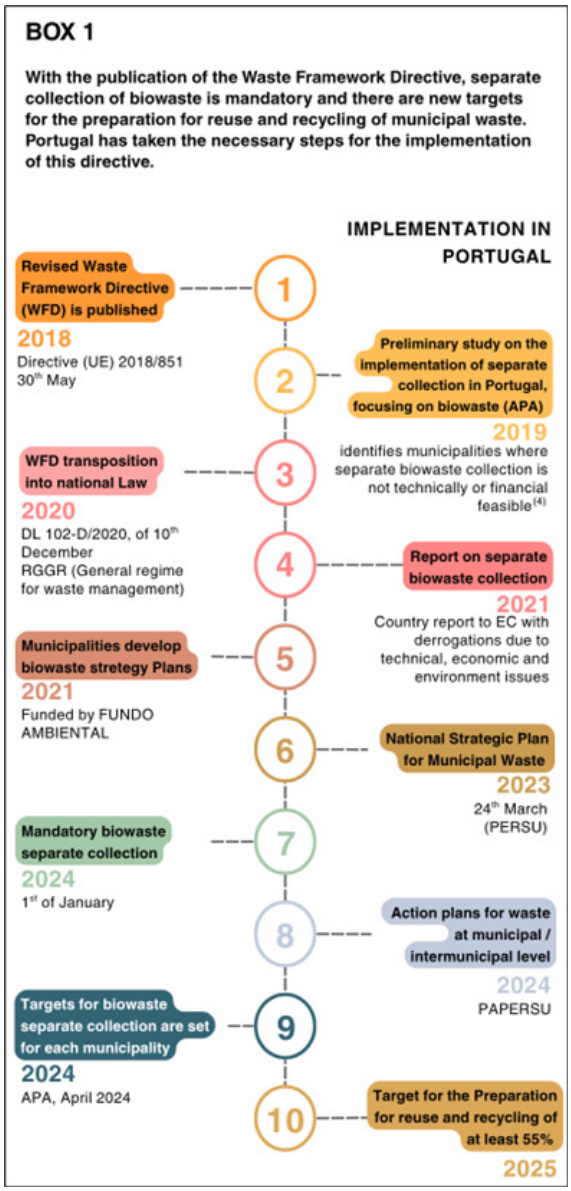
The governance structure of the waste sector in Portugal involves actors with clearly defined responsibilities at different levels, especially national and local (figure 2). The regional level has limited relevance, except in the Autonomous Regions, where regional governments assume direct powers. At the operational level (local level), the system is organized into two sub-levels:

- **Upstream systems** (SGRU - Urban Waste Management Systems): 24 intermunicipal or multimunicipal entities responsible for waste treatment and disposal.
- **Downstream systems** (municipalities): 308 local authorities responsible for waste collection (sometimes in association).

The articulation between these different levels of governance combines mechanisms:

- ***top-down:*** national entities set recycling and source separation targets, which are translated into obligations for municipalities (for biowaste) and SGRUs (for packaging waste) and stipulate the development of Local Urban Waste Management Action Plans (PAPERSU).
- ***bottom-up:*** municipalities draw up PAPERSU, detailing how separate collection will be implemented, financial planning, and an assessment of effectiveness. These plans are approved by the Portuguese Environment Agency (APA), with the opinion of ERSAR (the sector's regulatory body) and the Regional Waste Authorities (ARR), a role played by the Regional Coordination and Development Commissions (CCDR).

Figura 1. Milestones in the implementation of separate collection of bio-waste in Portugal



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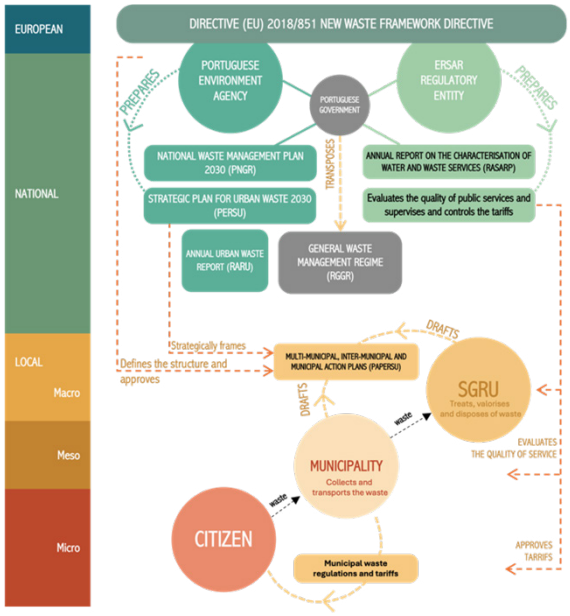
The circulation of information (data), essential for monitoring and oversight, is carried out through annual sector reports made available to civil society, ensuring access to information and transparency (figura. 2).

Figure 2. Simplified representation of bio-waste governance in Portugal



Municipalities have the autonomy to define their strategic approach for the separate collection of bio-waste, however they must coordinate with the upstream entities to ensure consistency and efficiency in the overall operation of the system.

Despite the clear definition of responsibilities among key actors, several governance constraints were identified[1]:

- Insufficient communication, collaboration, and coordination between municipalities and upstream systems (SGRU). In many cases, these entities do not communicate effectively with each other, lack collaborative practices, and have difficulty coordinating efforts. The implementation of bio-waste collection ultimately reflects this lack of communication between entities, with each unaware of the technical and logistical options that the others are taking in isolation, despite their operational interdependence.
- Lack of systematization in the reporting of information, with inconsistencies in the information made public (APA, ERSAR), despite the existence of an information gathering platform (SILIAMB).

Overall, waste sector governance in Portugal is based on a **formal structure with well-defined roles**, but **effective communication** between key actors is still lacking.

Food waste collection initiatives in Portugal

- **Geography of collection**

There are **196 initiatives for separate collection of food waste**[2], implemented by 152 municipalities (out of 308). These initiatives are concentrated in coastal and southern municipalities (Figure 3).

A statistical analysis of the drivers of separate collection at the mainland municipalities [4] suggests that:

- Setting higher (more ambitious) targets may act as a driver for broader implementation of separate collection.
- Municipalities responsible for collecting the packaging waste and municipalities with higher separation rates prior to the transposition of the waste framework directive are more likely to implement food waste collection.
- Municipalities without access to upstream treatment (currently sending waste to landfill) are less likely to adopt separate collection of food waste.
- Municipalities with higher overall budgets are more likely to implement separate collection of food waste.
- Outsourcing of waste collection services constitute a barrier to the implementation of food waste collection. Contrarily, more municipal technical staff related to waste management facilitates this collection.
- The political alignment of a municipality does not significantly influence the decision to adopt separate collection of food waste.

[1] Governance challenges were identified through formal interviews and expert consultation during the “Future workshop”. For additional details refer to section “Vision of key actors”.

[2] Information collected through surveys applied to 308 Portuguese municipalities and through secondary research (see [3]).

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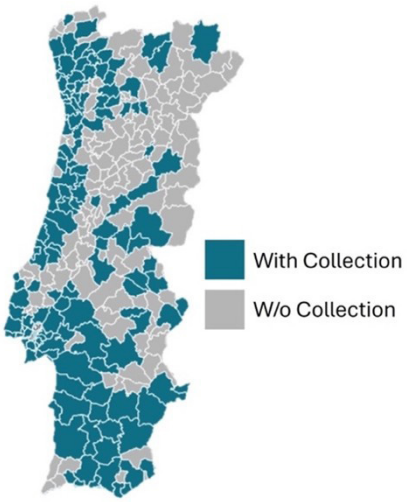
- The degree of urbanization is a significant determinant of food waste collection, with many rural municipalities without collection (65%), contrasting with only 21% of the urban municipalities. This suggests that there are logistical challenges to the implementation of biowaste collection systems in rural, sparsely populated areas.
- Artificialized area, inhabitants and food waste per unit artificialized area were found to be positively associated with the existence of food waste collection initiatives at the municipalities, meaning that an increase in any of the values increases the likelihood of existence of food waste collection and highlighting that scale plays a decisive role.

- **Sectors and collection models**

The initiatives can be analyzed in two main dimensions:

- **Sectors covered:** domestic, non-domestic, or both;
- **Collection models used:** door-to-door (DtD), nearby bringpoints, or co-collection.

Figure 3. Municipalities with initiatives for the separate collection of food waste



Most municipalities (**80%**) adopt initiatives that cover both the domestic and non-domestic sectors, while **20%** limit collection to the non-domestic sector.

DtD is the preferred collection model (59% of initiatives), followed by nearby bringpoints (34%) and, to a lesser extent, co-collection (7%) [5]. The lower representation of co-collection initiatives may be due to the need to obtain consensus among all municipalities belonging to the same SGRU and to require a commitment from all municipalities to a specific collection model, even if only partially.

Two metrics are used to assess the scope of the initiatives:

- population coverage (those for whom data collection is available).

- participation rate (the proportion of the population that has committed to using or actually uses the collection system).

In the case of co-collection, 100% of the population is included from the outset, although the reported participation rate has varied between 25% and 92%. This model does not involve changing collection equipment nor collection circuits, nor does it require significant investment by the municipality since the main investment is assumed by the upstream system (SGRU) with the installation of the optical reading and biowaste bag separation system. The cost to the municipality is associated with the purchase and distribution of optical bags for the collection of bio-waste to the population.

In the remaining collection models, DtD and nearby bringpoints, implementation is usually carried out in stages, with the initiative initially including a smaller area and gradually expanding to include the entire municipal territory. The reported population coverage ranges from 1% to 100%, showing that, in some cases, these are very limited pilot initiatives, not yet representative of the municipal territory, but which may be expanded soon. This wide diversity of coverage may lead to an overly biased interpretation of the scope of food waste collection in Portugal.

In an initial reading of the data, the type of urban area does not seem to influence the choice of collection model[3], as the distribution of models is similar across the three types (Figure 4), with door-to-door collection always being the preferred option, nearby bringpoints the second option, and co-collection the least imple-

[3] The hypothesis was statistically tested using the chi-square test of independence, and no significant association was found between the urban typology of the municipality and the collection model adopted ([5]).

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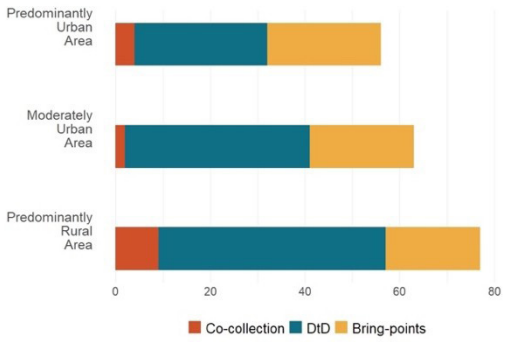
mented option, regardless of the type of urban area.

Several types of urban areas (more rural, more urban) and different types of buildings (apartment buildings, houses, mixed-use areas, etc.) may coexist within a municipality. The information reported for each initiative does not allow for the unequivocal association of a collection model with a specific type of urban area, nor for the association of the model with a type of building (except in some very specific cases - see next section).

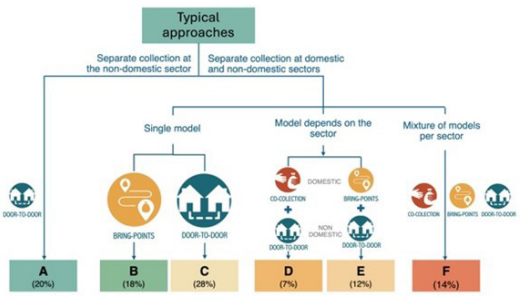
Figure 4. Collection models adopted according to the type of urban area in each municipality[4]



- **Standard approaches to food waste collection**

Considering the two dimensions mentioned above, the sectors and collection models, six standard approaches or types of approach were created (Figure 5) that reflect how municipalities are responding to the need for separate collection of bio-waste.

Figure 5. Approaches used by municipalities to implement separate collection of food waste (n=152).



[4] The types of urban areas follow those used by INE (The National Institute for Statistics), which include "predominantly urban", "moderately urban," and "predominantly rural".

In Approach Type A, the municipality chooses to collect food biowaste exclusively from the non-domestic sector. This option should not be interpreted as a definitive strategy, but rather as an initial stage of a broader municipal strategy that ultimately aims to include the domestic sector as well. In other words, the municipality begins implementation in a specific sector—where, due to the smaller number of producers, operationalization may be simpler—but intends to gradually extend separate collection to the domestic sector, even though it has not yet reached that stage of development.

These cases represent around 20% of municipalities, while the majority (80%) carry out separate collection in both sectors. Among these, two main groups can be distinguished:

- municipalities that use a single collection model (the proximity model in Approach Type B, or the door-to-door model in Approach Type C); and
- municipalities that combine different collection models depending on the sector.

In this latter group, DtD is applied to the non-domestic sector, while the domestic sector splits between those adopting co-collection (Approach Type D) and those choosing proximity collection (Approach Type E).

Finally, Approach Type F corresponds to the use of multiple collection models within the same sector. In this case, we sought to understand the reasons behind this combination of choices, identifying a tendency to associate the type of collection with the urban structure. Specifically, door-to-door collection is more prevalent in residential areas, and collection using nearby bringpoints in apartment buildings. This type of association was reiterated by experts during the "Workshops of the Future."

- **Performance and costs**

Although separate collection of bio-waste is still, in most cases, in its early stages (with some initiatives having even been launched during this project), the survey carried out allows for some preliminary comparative results, which are presented in this section.

DtD initiatives are capturing the largest amounts of food waste (Figure 6), with the

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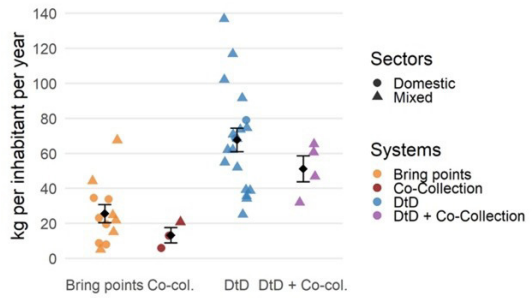
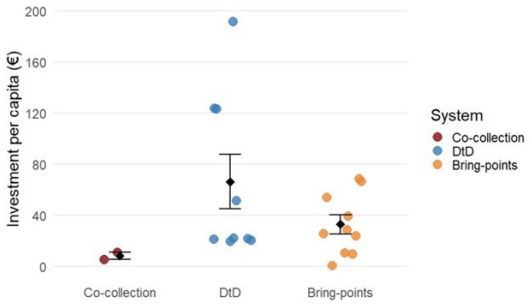
highest value of **137 kg/capita/year**[5] being close to the estimated theoretical potential of 156 kg/capita/year[6], which highlights the potential of this collection model for capturing food waste. **Co-collection** has the lowest capture values, at **17 kg/capita/y** (ranging 6-21 kg/capita/y), which improves when is associated with non-domestic DtD. Finally, collection using **nearby bring-points** falls between the other two models in terms of the amount of bio-waste captured, with **26 kg/capita/y** (5-68 kg/capita/y).

Figure 6. Food waste capture according to the collection model (black dots: group average; black bars: the standard error of the mean; the initiatives covering exclusively the non-domestic sector were excluded)



Investment costs vary considerably (Figure 7), due to economies of scale (smaller municipalities tend to have higher costs) and the diversity of different components involved in the investment made in each initiative (e.g., equipment, personnel, software, awareness campaigns, others). Installed capacity in excess also influences the amount of investment required. For example, one of the municipalities purchased a vehicle for washing bio-waste containers, while the others made use of existing resources.

Figure 7. Per capita investment costs according to collection model (black dots: group average; black bars: standard error of the mean; the initiatives covering exclusively the non-domestic sector were excluded).



Despite the small sample size, on average, investment costs per inhabitant are lower in the case of co-collection. This situation results from the investment being concentrated at the treatment plant which, although representing a high amount in absolute terms, serves several municipalities and allows all collection services to remain unchanged.

Door-to-door and collection using nearby bring-points involve higher investment costs, but this may only be the case during the start-up phase. In the future, with the expected reduction in the quantities to be collected in the unsorted waste fraction due to its diversion to food waste collection, it may be possible to optimize the collection service in an integrated manner. In a scenario of total replacement, the collection service would tend towards the costs currently incurred with unsorted collection alone.

The number of responses received stating operating costs was too low to obtain reference values with any degree of confidence (Figure 8). However, co-collection also seems to be the most economical solution, as it only involves the distribution of dedicated bags. The additional cost of treatment appears to be negligible given the population served, but the lack of data does not yet allow to infer any higher maintenance costs that may occur in the future.

As with investment costs, it is possible that, with the stabilization of mixed waste and food waste streams, overall operating costs and collection costs in the DtD and nearby bringpoints models will decrease compared to current levels. It is expected that the increase in operating costs

[5] The wide dispersion in food waste collection in the door-to-door model (from 25 to 137 kg/inhabitant/year) may be due to a combination of factors related to the specific characteristics of each municipality, the prior existence of door-to-door collection for the collection of packaging waste, the relative weight of the non-domestic sector, the scope of the initiative, and/or the degree of maturity. However, the reported data did not allow to validate or exclude these assumptions.

[6] Estimated national average, considering a per capita rate of 519 kg/inhabitant/year, of which 75% is mixed waste (unsorted) [1]. Within mixed waste; 46.69% is biowaste [1], of which 80% is food waste. To the amount collected as unsorted waste, one must add the separately collected food waste, which amount to 2% of urban waste [1].

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for the collection of food waste will be offset, at least in part, by the decrease in the collection of unsorted waste.

Figure 8. Operating costs per capita according to the collection model (black dots: group average; black bars: standard error of the mean; the initiatives covering exclusively the non-domestic sector were excluded).

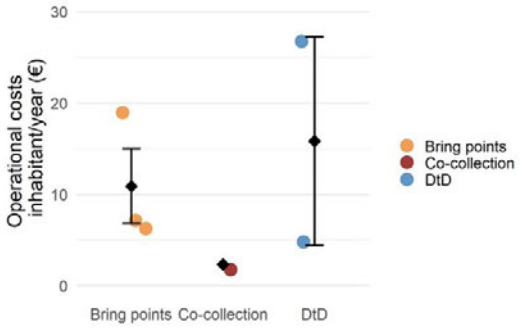
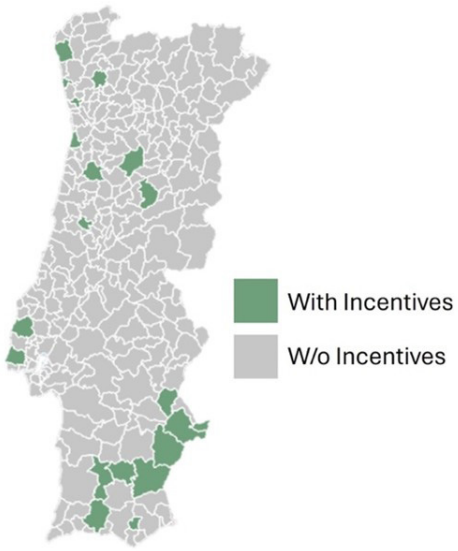


Figure 9. Municipalities with financial incentives in place [7].



Use of financial instruments

Twenty-one municipalities were found to offer incentives for waste separation (Figure 9). Of these, 71% refer to PAYT tariffs in the following variants: i) pre-purchased bags (7 municipalities); ii) door-to-door with container identification (3 municipalities); and iii) nearby bringpoints with access card (5 municipalities).

There are also discounts on water/waste bills for those participating in separate bio-waste collection or home composting (4 municipalities) or participating in separate packaging waste collection (1 municipality). GAYT (Gain-As-You-Throw) is also being used, with a machine that accepts used packaging (glass, metal, and PET) and issues a voucher in exchange for admission to municipal swimming pools or museums (1 municipality).

Considering the recommendations made to Portugal to intensify the use of financial incentives to support separation at source [6], the percentage of municipalities that do so (7%) is still very low.

The following constraints on the application of financial incentives, particularly the introduction of PAYT systems, have been identified[7].

For municipalities that have **not yet implemented PAYT tariffs**, there is a notable lack of knowledge about the best technical solutions and an inability to respond to the complexity of designing a tariff. Added to this is resistance from policymakers, who tend to avoid measures that are likely to generate negative perceptions among the population, especially when non-compliance with legal obligations regarding public waste policies does not entail immediate consequences.

In municipalities that **have already moved forward with financial incentives**, the constraints reported are more related to legal inconsistencies and gaps in the regulatory framework. Current building regulations, for example, prevent municipalities from imposing the creation of specific compartments (zones) for waste[8] disposal, which increases the cost of technological investment and hinders the implementation of PAYT systems. In addition, the limitations imposed by the legal framework and the GDPR make enforcement particularly difficult, raising questions about the legality of the municipality opening garbage bags, even if they are deposited irregularly on public roads, which makes it impossible to hold citizens directly accountable. Added to this is the lack of clarification of municipal powers in this area, leaving local au-

[7] These constraints were identified in interviews with key stakeholders and through expert consultation during the Future Workshops.

[8] Article 20 of Decree-Law No. 555/99, which establishes the legal framework for urbanization and construction (current version), states that when assessing architectural projects, the municipal council is prohibited from considering the existence of compartments or locations for waste bins.

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thorities without effective tools to act on illegal dumping in public spaces. There is also a lack of clear mechanisms for monitoring and penalizing non-compliance, which should include holding citizens accountable.

The vision of key actors

The Future Workshops were attended by 12 experts from different fields and entities (municipal technicians, technicians from waste management entities, NGOs, other experts, and university students) who came together in a participatory and co-creative model to explore visions of the future for separate waste collection (biowaste, packaging waste, and its articulation with the PAYT system).

At this meeting, the main constraints in the sector were identified, and solutions and future scenarios for the different urban types mentioned above were discussed. It was noted that there is widespread recognition of the progress made in separate collection in Portugal. However, there is also frustration among those working in the field for not being able to do more and better due to several critical issues identified during the workshops (**BOX 3**).

BOX 3 Critical issues in the waste sector identified during the "Workshops of the Future"

Organization and training → Disarticulation.

Lack of coordination between municipalities, upstream entities and legislative and regulatory bodies. Lack of technicians in municipalities trained to deal with the technical complexity of the sector.

Communication and Education → Disinvestment.

Weak campaigns, persistent myths, little involvement of schools, lack of national campaigns to mainstream waste.

Enforcement and Accountability → Fragile.

Lack of penalties and anonymity in the waste disposal process, resulting in waste producers (domestic and non-domestic) not being held accountable.

Legislation and Regulation → Inadequate.

Laws that are difficult to apply in the field and in everyday life, legal contradictions, lack of municipal regulations.

Incentives and Tariffs → Resistance.

"Waste tourism" as a potential means of avoiding tariffs, resistance from local politicians to the implementation of PAYT tariffs (for fear of it being an unpopular measure), lack of benefits for municipalities with good practices.

Prevention and social innovation → Absent.

Little focus on waste reduction and innovative social solutions.

Recommendation for stronger and more coherent waste management

1. Strengthen coordination between entities (local and national)

Separate collection benefits from a partnership between entities (in line with SDG 17), **in which communication, transparency, knowledge sharing, and collaboration** are key aspects to be integrated into organizational cultures.

It is recommended that municipal and SGRU technicians be involved in the preparation and discussion of national strategic plans to integrate the contributions of these key actors in the field, who have a major impact on achieving the goals set by public policies.

It is also recommended to analyse (maybe through consultation to the municipalities) the best way to create an interface structure within the Portuguese Environment Agency (APA) to facilitate more direct communication with municipalities and SGRUs, for example through a municipal support office. This interface would allow for the clarification of doubts and the provision of more specialized services to municipalities, so that they can contribute, with concrete actions on the ground, to the fulfilment of national policies and strategies, thus allowing for more con-

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certed action on the ground. (Sections – Governance structure, The vision of key actors)

2. Monitor and evaluate

Current indicators do not allow for a systematic comparison of the efficiency and effectiveness of initiatives and different separate collection models.

It is recommended that indicators or metrics be created to monitor the implementation of bio-waste collection (especially food waste) in Portugal and compare different municipalities and collection models. In addition, each indicator should be associated with realistic success metrics for each of the standard approaches or collection models, which should also incorporate the urban structure (a component that is practically absent from the current project due to the lack of robust data).

In this way, the municipality will be able to assess its own success, on a case-by-case basis, in the different initiatives it implements, while facilitating national monitoring and evaluation of compliance with targets. (Section – Performance and costs)

3. Improve information reporting:

Review the current information reporting and data processing system, making it more functional, intuitive, and transparent, developing unified databases, avoiding duplication in data requests and inconsistencies that arise between data reported by different entities (INE, ERSAR, APA). (Sections – Governance Structure and Performance and costs)

4. Promote the application of fair and incentivizing tariffs:

It is recommended to strengthen efforts to promote the use of financial incentives, more specifically, the actual application of PAYT tariffs, to make the system financially balanced, with economic benefits for citizens and systems that have good practices and penalties for non-compliance. (Section – Use of financial instruments)

5. Communicate effectively and regularly

To simplify the daily task of separating this new waste stream, both in the domestic and non-domestic sectors, and to facilitate the achievement of national targets, it is necessary to standardize information across the country on what bio-waste is (avoiding ambiguity and confusion with other designations such as green waste, organic waste, biodegradable waste, compostable waste, etc.) and how it should be disposed of.

It is recommended that regular nationwide campaigns be developed using various media, bringing the importance of waste management, especially bio-waste, to the public agenda.

6. Legislate clearly and consistently

Review legal inconsistencies that hinder enforcement and the integration of new obligations, and provide for clear mechanisms for monitoring and penalizing non-compliance, which should include holding citizens (or waste producers) accountable (Section – Use of financial instruments)

7. Empower and strengthen human resources

It is recommended that human resources at the municipal level be strengthened and specifically trained, for example through specialized training, capacitating them on the bio-waste collection and treatment at source, on the relevant indicators for monitoring these activities, to develop technical collection solutions associated with the PAYT system, and to establish the respective tariff structure.

Conclusions

The final assessment shows that, despite the progress made, Portugal is still far from achieving its goal of ensuring the separate collection of food waste. Of the country's 308 municipalities, 152 have this type of collection, totalling 196 initiatives that fall into six standard approaches. The evaluation of the results of these types of approaches is crucial for the future, but many initiatives have not yet reached the maturity necessary to allow a consistent analysis of the main indicators (quantities collected, user satisfaction, quality of separation, costs, among others). It is therefore premature to compare the results between different models, especially when it comes to recent and limited pilot experiences compared to more comprehensive and consolidated systems. The S4P REC-SEL Project itself faced difficulties in obtaining consistent, reliable,

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and comparable data.

For Portugal to move closer to its desired future, it is essential to **strengthen coordination** between entities (local, regional, and national), **monitor and evaluate** initiatives, **improve information reporting, promote the application of fair and incentivizing tariffs, communicate effectively and regularly, legislate more clearly and coherently** with the reality on the ground, and **train and strengthen human resources**. The path forward involves a collective transformation, in which people, communities, and policies converge towards a more efficient, fair, and sustainable waste system

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