

D6.2 – Policy Roadmap

ITB



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List of Acronyms

EC – European Commission

LL – Living Labs

SRH - Stadtreinigung Hamburg

CCPs: Critical Control Points

Executive Summary

This Policy Roadmap identifies the main regulatory, governance and implementation barriers affecting the valorisation of bio-waste into safe and marketable soil improvers and translates them into practical recommendations for policymakers. It draws on regulatory analysis, evidence from the BIN2BEAN Living Labs in Amsterdam, Egaleo and Hamburg, stakeholder and expert interviews, and the project's work on Critical Control Points (CCPs). Preliminary findings were also presented through a BIN2BEAN Policy Brief and discussed at EUBCE 2026, supporting the validation and refinement of the final recommendations.

The analysis highlights recurring challenges related to feedstock quality, municipal implementation capacity, charging and source-separation systems, end-of-waste status, regulatory inconsistencies across policy areas, and the disproportionate burden placed on smaller actors and innovators. At the same time, the Living Labs evidence shows that these barriers vary substantially depending on local conditions and the maturity of the bio-waste system. The roadmap therefore proposes actions differentiated by governance level and time horizon, ranging from improved collection and quality-management practices and stronger stakeholder coordination to longer-term regulatory harmonisation at national and EU level. The overall aim is to support more coherent and practically implementable bio-waste-to-soil-improver value chains while allowing solutions to be adapted to different local and national contexts.

1. Introduction

BIN2BEAN addresses the collection and valorisation of bio-waste as a connected system, linking the way bio-waste is generated and separated with its treatment, transformation into soil improvers and eventual use. Within this broader project framework, this Policy Roadmap focuses specifically on the policy and governance conditions that influence how these value chains can be implemented and scaled in practice.

The roadmap builds on the different situations represented by the BIN2BEAN Living Labs in Amsterdam, Egaleo and Hamburg. Rather than treating these cases as models to be replicated directly, they are used to examine how similar policy objectives can lead to different implementation challenges depending on local infrastructure, institutional arrangements, collection systems and the maturity of the bio-waste sector. This local evidence is considered together with the wider European and national regulatory context and with the technical requirements associated with the production of safe and reliable soil improvers.

The roadmap was also developed as an iterative process, as preliminary findings from the regulatory analysis, Living Labs and stakeholder interviews were synthesised in a BIN2BEAN Policy Brief and presented and discussed at the EUBCE conference in May 2026. This exchange provided an opportunity to test whether the emerging governance gaps and recommendations were recognised beyond the consortium and to refine the final roadmap accordingly. The analysis was further informed by exchanges with the sister projects bioSOILUTIONS and FENIX, which brought additional perspectives on field validation, innovative soil improvers and barriers to market uptake.

The document moves from the evidence base to progressively more operative outputs. Chapters 2-4 describe the methodological and technical inputs and the experience of the Living Labs. Chapter 5 brings these together to identify the main regulatory and implementation gaps. Chapter 6 translates them into recommendations organised by time horizon and governance level, and Chapter 7 provides practical guidance that policymakers can use when designing or reviewing bio-waste and soil-improver policies.

The roadmap should therefore be read as a framework for identifying the most relevant points of intervention in a given context, rather than as a single policy model to be applied uniformly across Europe.

2. Methodology

The Policy Roadmap was developed through a combination of regulatory analysis, stakeholder engagement and technical evidence generated within BIN2BEAN. Four complementary sources were used: desk research on the European, national and regional policy frameworks relevant to bio-waste management and soil improver valorisation; Policy Forums and wider engagement within the three Living Labs; semi-structured interviews with technical and policy experts; and the Critical Control Point (CCP) framework developed under WP3.

These evidence streams were considered together rather than as separate exercises. Desk research provided the regulatory baseline, while the Living Labs and expert interviews helped identify how these frameworks operate in practice, including implementation barriers, governance gaps and differences between local contexts. The CCP work added a technical perspective by linking policy and regulatory requirements to concrete quality- and safety-management needs along the bio-waste-to-soil-improver value chain. The findings were then compared across sources and governance levels to identify recurring gaps and context-specific challenges, which form the basis of the analysis in Chapter 5 and the recommendations presented in the Policy Roadmap in Chapter 6.

2.1 Desk research

The desk research expanded the policy and regulatory mapping developed in BIN2BEAN's [Report on the regulatory framework at the European, national, and regional levels of biowaste](#) (2026), covering EU, national and regional frameworks relevant to bio-waste management and soil improver valorisation in Germany, Greece and the Netherlands.

The starting point was a systematic identification of relevant legislative instruments and policy documents. At the European level, this meant reviewing primary legislation, directives, regulations, and implementing decisions, alongside frameworks such as the Circular Economy Action Plan, the European Green Deal, the Farm to Fork Strategy, and the Soil Strategy for 2030. The work was carried out directly by the consortium partners rather than centrally and covered seven Member States: Denmark, Finland, France, Germany, Greece, Italy and the Netherlands. In each country, one or more partners acted as the national reference point, identifying and cataloguing the relevant instruments and translating national legislation where necessary to make it accessible to the rest of the consortium. Each country file included binding legislation, plans and programmes at national level and, where relevant, at the regional level of the Living Lab city-regions.

This distributed approach was particularly useful because many of the rules affecting bio-waste management are found in secondary legislation, municipal by-laws and

technical annexes. These documents can be difficult to identify from outside the country and are often not available in English. Partners working within their own national and linguistic context were therefore best placed to locate and interpret this material. Bringing the seven national perspectives together in a common database then allowed the consortium to compare how the same EU requirements are implemented across countries and to identify the main differences between national approaches. The collaborative approach broadened the reach of the research but also brought in knowledge that would have been difficult to obtain through desk research alone, especially for countries where regulatory documents are not published in English or where implementation diverges significantly from what the law formally requires.

The collected material was then analysed, structured around the main stages of the value chain from bio-waste to soil improvers. Particular attention was paid to how consistently EU directives had been transposed into national law, to the existence and stringency of quality standards for products such as compost, digestate, and biochar, and to the regulatory barriers. The desk research also drew on findings from related EU-funded projects, including [VALUEWASTE BIO CIRCULAR CITIES](#), and [LIFE-BIOBEST](#), to contextualise BIN2BEAN's analysis within the wider landscape of biowaste innovation in Europe.

2.2 Policy forum and LL engagement

Policy Forums were used as a flexible stakeholder-engagement format across the three Living Labs. Following an initial cross-fertilisation meeting, their scope and structure were adapted to the different stages of bio-waste valorisation and the specific policy challenges emerging in Amsterdam, Hamburg and Egaleo.

Policy forums are a tool on the local level that facilitates open discussion between stakeholders on political issues and decisions, particularly useful when there are divergent opinions on the subject in question and when there are sensitive issues and ambiguities in the public domain. If in-depth technical or legal questions need to be discussed, experts in the relevant fields should be invited to join the meeting. The policy forum should yield results based on the in-depth discussion of different alternatives, which can be used as basis for further considerations in the administration and potentially as a preparation of council decisions. Typical themes for a policy forum cover:

- Introduction of the bio bin
- Remarkable quality problems (bio-waste and/or compost)
- Amendment of the charging system
- Marketing of soil improvers

Policy Forums should be organised flexibly around the issue being addressed, the actors involved and the type of decision expected from the process. The convenor should normally be an organisation with a recognised role in the value chain and the capacity to act on the outcomes, such as the city administration or waste operator, while the choice of participants should reflect the specific topic under discussion. Political representatives should therefore be involved only where the issue requires a formal political decision, rather than as a standard feature of every forum.

It is also useful to distinguish the role of the convenor from that of the facilitator and rapporteur: while the convenor retains ownership of the process and responsibility for follow-up, facilitation and documentation can be assigned to another project partner or, where trust between stakeholders is limited, to an independent external facilitator, helping to create a more open discussion without weakening local ownership.

Participants should receive the agenda and relevant background information in advance so that the discussion can start from a shared understanding of the issue. The forum itself should be structured around a limited number of guiding questions and give all participants the opportunity to contribute, using complementary tools such as questionnaires, surveys or participatory mapping where these are useful.

The overall format should remain adaptable to the local context and purpose of the forum. In-person meetings and site visits can support discussion and provide useful practical context, but they should be used where they add value rather than treated as fixed methodological requirements. The discussion should be structured so that all stakeholders can contribute, either verbally or non-verbally (e.g. via electronic surveys or short questionnaires). The 'house rules' for the discussion should be clear:

- respectful wording,
- no phone call disruptions,
- a time limitation for contributions,
- the character of the documentation (example: are the [Chatham House Rules](#) used)

The documentation should cover:

- the agenda,
- the list of participants,
- the conclusions, including dissenting votes,
- expert judgement of potential alternatives and their implementation,
- results of surveys, questionnaires etc.,
- the presentations.

The timetable for a policy forum covers about 2-3 months: Definition of the targets and Internal preparation: 3 weeks; list of invited stakeholders and contacting experts:

1 week; final agenda, invitation: 1 week; time slot for preparatory work of the invited persons: 2-4 weeks; minutes and evaluation of the forum: 2 weeks; information of all participants about the results: 1 week.

A Policy Forum is not a decision-making body and does not replace formal administrative or council procedures. Its success should also not be measured by whether consensus is reached, since clearly documenting unresolved disagreement can be equally valuable. The forum should instead produce a set of practical outputs:

- **A shared problem definition.** A clear description of the issue, including which parts of the value chain are controlled by the different actors. In Amsterdam, for example, the discussion highlighted the gap between the national obligation for separate collection and the lack of an effective municipal enforcement mechanism.
- **An assessment of alternatives.** A comparison of the realistic options, including their main advantages, disadvantages, expected costs and any differing views. This provides the administration with a clearer basis for further action.
- **A distinction between local and higher-level barriers.** The forum should clarify which obstacles can be addressed locally and which require action at national or EU level. In BIN2BEAN, this helped translate local experience into broader policy recommendations, including on end-of-waste criteria, fertiliser legislation and the way collection rates are measured.
- **Concrete follow-up actions.** The discussion should lead to a short list of next steps, with responsibility and indicative timing assigned where possible. In Hamburg, this included establishing a separate sales company for compost-based products, while in Egaleo it included the phased introduction of PAYT for restaurants, the creation of a recycling office and revision of the departmental waste regulation.
- **Documented evidence for comparison.** Using a consistent structure for meeting minutes makes it possible to compare findings across cities and increases the value of the forum beyond the local case.

2.3 Technical and expert interview

Technical and expert interviews were conducted in collaboration with the [DESTINY](#) project (GA nr 101119940) to gather in-depth qualitative insight from actors directly involved in, or closely familiar with, the bio-waste value chain and its links to soil-related policy and governance. Where desk research established what the rules say, and the Living Lab Policy Forums showed how those rules play out in three specific urban contexts, the interviews were intended to capture how practitioners and experts across Europe experience the governance system as a whole. Before this

policy roadmap was finalized, the preliminary synthesis of the evidence gathered from these interviews (six recurring governance gaps and six corresponding recommendations) was included in a Policy Brief and presented at the EUBCE conference in May 2026. The purpose was to expose the emerging conclusions to a wider professional audience and to test whether the gaps identified through the interviews, the Living Labs and the desk research were recognized beyond the consortium. Reactions and discussion from that session were taken into account when refining the recommendations set out in this report.

The starting point for recruitment was the BIN2BEAN Stakeholder Forum, the project stakeholder database maintained by Consorzio Italbiotec, which brings together representatives of cities, coordinating partners, solution providers, research institutions, civil society organisations and NGOs, and standardisation and testing bodies. Candidates were screened for their relevance to the bio-waste value chain and contacted subject to availability.

Because the Forum did not cover every profile and governance level needed, the sample was then widened in two further steps: through the professional networks of the consortium partners, and through referrals from the first interviewees (snowball sampling). Participants were approached because of their direct professional involvement in the bio-waste valorisation–soil policy nexus, not to constitute a representative sample. The objective was breadth of perspective so that technical, institutional, policy-oriented and implementation-focused viewpoints were all reflected in the material. The sample was also broadened through collaboration with BIN2BEAN's sister projects, [bioSOILUTIONS](#) and [FENIX](#). The three projects exchanged contacts and preliminary findings, which gave access to respondents working on the field validation of soil improver prototypes and on novel bio-waste-derived formulations, perspectives only partially covered by the BIN2BEAN Stakeholder Forum. The same collaboration extended to dissemination: the preliminary synthesis of the interview evidence was presented and discussed alongside the sister projects at the policy session held at EUBCE 2026

Twelve semi-structured interviews were conducted online via Microsoft Teams over a five-month period, from February to June 2026. Interviews lasted between 20 and 45 minutes depending on the respondent's availability and followed a common interview guide. The guide kept the material comparable across a deliberately heterogeneous set of respondents, while leaving room to pursue in depth the issues each interviewee was best placed to speak to.

The interview guide was structured around the **Good Governance framework**: a set of principles, established in EU and international governance practice, for assessing how public decisions are taken and implemented rather than only what those decisions contain. The framework was adopted for two reasons. First, evidence gathered earlier in BIN2BEAN from the regulatory mapping, the Living Labs and the Policy Forums consistently indicated that the principal barriers to bio-waste

valorisation are institutional and regulatory rather than technical, which called for an analytical lens focused on process, responsibility and interaction between actors. Second, the bio-waste-to-soil-improver chain is governed across several administrative levels and several policy domains at once (waste, fertilising products, agriculture, soil health and energy) and the framework provides a vocabulary that travels across those levels, making it possible to compare the experience of a municipal waste manager with that of a national regulator or a product developer.

Five dimensions were used, each translated into a small set of open questions:

Transparency: how information about rules, procedures, quality requirements and permitting decisions circulates among actors; whether stakeholders know where to find authoritative guidance; and how long it takes to obtain an answer when the interpretation of a rule is unclear.

Accountability: how responsibilities are distributed between EU institutions, national ministries, regional authorities, municipalities and implementing bodies; whether actors can identify who is competent for a given decision; and whether decisions can be questioned, reviewed or appealed.

Participation: who is consulted, at what point in the policy cycle, and whether formal inclusion translates into genuine influence, with particular attention to farmers, small operators and municipal authorities.

Effectiveness: whether current governance arrangements actually support bio-waste valorisation in practice: the proportionality of administrative requirements, the coherence between waste, fertiliser, agricultural and soil legislation, and whether existing targets and incentives produce the intended outcomes, notably as regards feedstock quality rather than collected volume.

Equity: how costs, risks and benefits are distributed along the chain; whether compliance burdens fall disproportionately on smaller actors; and whether uneven implementation between Member States creates unequal operating conditions.

Organising the guide in this way produced material that could be compared across very different professional roles while still capturing the specific circumstances of each respondent. It also allowed the interview evidence to be read alongside the Living Lab and Policy Forum findings, which were examined through the same five dimensions.

Following data collection, a thematic analysis was conducted to identify recurring patterns, key issues, and cross-cutting governance challenges emerging from the interviews. Interview notes and transcripts were reviewed systematically and coded according to both deductive and inductive categories. Deductive codes were derived from the Good Governance framework, including transparency, accountability, participation, effectiveness, and equity. Inductive codes were also developed during the analysis to capture themes that emerged directly from the

interview material, such as regulatory uncertainty, stakeholder coordination, technical barriers, market uptake, trust among actors, and the need for clearer standards and policy alignment.

The thematic analysis involved comparing responses across different stakeholder groups and stages of the bio-waste value chain. This made it possible to identify areas of convergence, such as shared concerns regarding fragmented governance and the need for improved communication, as well as areas of divergence, for example differences between technical actors and policy-oriented stakeholders regarding implementation priorities. The results of the thematic analysis informed the interpretation of governance strengths, weaknesses, and opportunities within the bio-waste valorisation–soil policy nexus.

2.4 CCPs

The methodological approach to Critical Control Points (CCPs) builds on the work carried out during the BIN2BEAN project, which focused on improving the safety, quality and market acceptance of soil improvers produced from bio-waste. The results are contained into a dedicated guideline ([D3.4 - Strategy to identify Critical Control Points](#)).

Critical Control Points (CCPs) are the steps in a production process at which a significant biological, chemical or physical hazard can be prevented, eliminated or reduced to an acceptable level through monitoring and control measures. The concept originates in HACCP (Hazard Analysis and Critical Control Points), the preventive, systematic risk-management method long established in food safety. HACCP is not mandatory for recycled fertilising products, but its logic transfers well to the production of soil improvers from bio-waste, where heterogeneous input material makes systematic and traceable quality management essential.

Two features distinguish a CCP from ordinary process monitoring. First, control at that point must be both possible and necessary: the step has to offer genuine leverage over a hazard that matters. Second, the point must be defined operationally, with a stated hazard, a monitoring procedure, a measurable critical limit, a corrective action to be taken when that limit is breached, and the documentation needed to demonstrate compliance afterwards. Temperature and retention time during hygienisation is a typical example: if the threshold is not reached, pathogens survive, the deviation is detectable, and the batch can be reprocessed before it moves on.

Not every step in the chain meets this test. Steps that support process stability and product quality without addressing a specific significant hazard are treated as Control Points (CPs) rather than CCPs. The distinction matters for policy as much as for operators, since it separates the small number of points where verification is indispensable from the wider set of good operational practices.

The process started with a review of the relevant EU legislation, standards and existing quality-assurance approaches applied to composting, anaerobic digestion and fertilising products derived from organic waste. On this basis, the biological, chemical and physical hazards associated with each stage of the production chain were identified, together with the corresponding monitoring parameters, critical limits and possible corrective actions.

Identifying CCPs required first mapping the full production chain, from biowaste reception through pre-treatment, biological processing, maturation and storage to final product handling. At every stage, the significance of potential hazards was assessed alongside the monitoring and control measures already in place or realistically achievable.

This HACCP-inspired approach was developed and refined in close dialogue with the BIN2BEAN Living Labs. The Living Labs in Amsterdam, Egaleo and Hamburg contributed first-hand knowledge of local bio-waste collection systems, treatment processes, quality-management practices and end-user perspectives, gathered throughout earlier phases of the project. Operational experience and stakeholder feedback collected during these activities directly informed the selection of relevant hazards, process stages and monitoring needs reflected in the guideline and in the accompanying decision-tree tool.

Based on this evidence base, a draft guideline and decision tree were developed to help operators identify process-specific control points, define critical limits and set out appropriate corrective actions. Both were reviewed internally by the project consortium and subsequently validated and refined through further Living Lab feedback, ensuring that the resulting framework is grounded in practical, on-the-ground experience rather than purely desk-based analysis.

3. Technical Framework: Critical Control Points (CCPs)

3.1 Overview of Critical Control Points (CCPs) for bio-waste to soil improver value chains.

Section 2.4 introduced the CCP concept and described how it was developed within BIN2BEAN. This chapter revisits that work from a policy perspective. The technical findings are reported here only to the extent needed to support the regulatory and governance arguments developed in Chapters 5 and 6; the complete hazard analysis, the full CCP catalogue and the underlying methodology are set out in Deliverable [D3.4 - Strategy to identify Critical Control Points](#). Although no specific HACCP requirements exist for recycled fertilisers and soil improvers, this approach can be applied to structure process description, raw material management, hazard assessment, monitoring, corrective actions, documentation and verification in a consistent way.

A decision-tree approach to CCP identification

To support operators in applying this framework to their own processes, BIN2BEAN developed a decision-tree tool. The tool guides operators through a sequence of questions concerning the significance of an identified hazard, the availability of preventive or control measures, the possibility of monitoring the process step, and the potential impact of a deviation on product safety or quality. This structured questioning helps distinguish CCPs from general operational Control Points and supports consistent, transparent decision-making across different operators and operational contexts. The tool was tested with Living Lab stakeholders in Amsterdam, Egaleo and Hamburg, who confirmed its practical value while requesting clearer guidance on deviation management and a concluding summary of identified CCP/CP candidates, feedback that has informed the refinement of the final guidance.

Hazard categories across the value chain

The production of soil improvers from bio-waste involves biological, physical and chemical hazards that may affect occupational health, product safety, quality, environmental performance and market acceptance. Effective risk management requires that these hazards are identified, monitored and controlled throughout the production chain.

Physical hazards are mainly related to impurities and unwanted materials entering with the incoming biowaste. Raw biowaste can contain plastics, glass, metals, stones

and other foreign objects, which, if not properly removed during sorting and pre-treatment, may reduce product quality, damage processing equipment and limit the suitability of the final product for agricultural or horticultural use. Microplastics and visible plastic residues are a particular concern in mixed municipal biowaste streams, and excessive dust or unsuitable particle size distribution can affect handling, spreadability and occupational safety.

Biological hazards concern microbiological safety and the presence of unwanted organisms. Inadequate hygienisation may allow the survival of pathogenic microorganisms such as *Salmonella* spp. and *Escherichia coli*, which are commonly used as hygiene indicators in regulatory testing. Animal-derived pathogens or parasites can also remain viable if animal by-products are not treated under the validated thermal conditions required by Regulations (EC) No 1069/2009 and (EU) No 142/2011, and weed seeds can survive in compost that has not reached sufficient sanitisation temperatures, contributing to their unintended spread in agricultural fields.

Chemical hazards include heavy metals, organic contaminants and nutrient-related risks. Heavy metals such as cadmium, lead, mercury, nickel and zinc may enter the process through contaminated input material and accumulate in the final product. Organic contaminants, including PAHs, PCBs, phthalates and flame retardants, may also be present depending on the origin of the biowaste. Chemical risks can additionally arise from excessive salinity, high ammonium concentrations or nutrient imbalances that negatively affect plant growth or soil quality.

Table 1 summarises the main hazards and quality parameters relevant to each stage of the value chain, together with the reason each is monitored.

This is a selection from the full list of 22 hazards and parameters in D3.4 (as mentioned before), restricted to those that are subject to a legal limit or to mandatory testing under Regulation (EU) 2019/1009, the Animal By-Products rules or national quality-assurance schemes, or that were repeatedly raised in Living Lab and interview evidence as affecting market uptake.

Table 1. Hazard categories and quality parameters relevant to CCP identification.

Hazard category	Hazard / quality parameter	Why important
Physical	Plastics, metals, glass, stones	Quality and legal compliance; environmental contamination and littering risk
Physical	Cross-contamination, machinery contamination	Quality assurance and machinery lifespan
Physical	Particle size / dry matter content	Spreadability and compostability

Biological	Pathogens: E. coli, Salmonella, Legionella	Regulatory compliance and user safety
Biological	Incomplete degradation / insufficient sanitisation	Hygiene and product usability
Biological	Weed seeds and propagules	Prevention of weed spread and product usability
Chemical	Heavy metals (Cd, Pb, etc.)	Legal limits and environmental contamination
Chemical	Organic contaminants (PAH, PCB, phthalates)	Agricultural and environmental quality
Chemical	C/N ratio, EC, mineralisation potential	Maturity, salt tolerance and nitrogen release control

CCPs across the process chain

In systems coping with the collection of bio-waste and processing to soil improvers CCPs span the full value chain, from bio-waste collection and reception through to final product verification. Collection and reception are focused on input material quality and contamination control, including raw material acceptance criteria and supplier verification. Sorting and pre-treatment are aimed at the mechanical removal of physical contaminants such as glass, metal and plastics. Biological treatment stages, namely composting and anaerobic digestion, include key CCPs related to hygienisation and process parameters such as temperature, retention time, moisture and pH. Maturation and storage address compost stability and the prevention of cross-contamination between treated and untreated material, while final processing and product control verify compliance with quality, safety and regulatory requirements before market release. Table 2 illustrates how this translates into concrete CCPs, drawing on the full CCP catalogue developed in BIN2BEAN's D3.4 (Strategy to identify Critical Control Points).

Stage of the process	Critical Control Point (CCP)	Critical limits (indicative)	Corrective actions
Collection and reception	CCP1: Raw material acceptance and sampling	Heavy metals below legal thresholds; plastics < 0.5%	Reject batch, trace source, notify supplier
Sorting and pre-treatment	CCP2: Mechanical separation, visual inspection	>99% of particles <40 mm	Re-sort, remove contaminants
Composting / digestion	CCP3: Temperature–time control	Minimum 55°C for 14 days (or regional equivalent)	Extend treatment, remix pile
Maturation and storage	CCP5: Maturity and stability testing	OUR < 10 mmol/kg OM/h	Extend curing, reprocess or reject

Final product	CCP7–CCP8: Final product testing	Pathogens absent; heavy metals below legal thresholds	Re-sanitise, restrict use, or reject batch
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Table 2. Illustrative Critical Control Points (CCPs) across the bio-waste-to-soil-improver value chain.

3.2 Relevance of CCPs for regulatory compliance, quality, safety and market uptake

CCPs support compliance with Regulation (EU) 2019/1009 on EU fertilising products and relevant national requirements, by enabling systematic monitoring, traceability and documentation across the production process. Although HACCP has not been designed for recycled fertilisers and soil improvers, a HACCP-inspired approach helps operators demonstrate product safety and regulatory compliance in a structured, auditable way, a capacity that is likely to become increasingly important as end-of-waste and product-status requirements are clarified across Member States.

CCPs contribute directly to controlling biological, chemical and physical hazards throughout the production chain, thereby supporting product safety and consistent quality. Effective hazard management at defined points in the chain reduces contamination risks and supports the production of stable, safe and fit-for-purpose soil improvers, addressing what stakeholder interviews and market analysis across BIN2BEAN's Living Labs consistently identify as the single greatest barrier to uptake: poor and inconsistent feedstock quality, particularly contamination with plastics, which makes processing costly and can render the final product non-compliant or unacceptable to farmers.

CCP-based approaches also support market acceptance and user confidence more broadly. Transparent monitoring, documentation and quality control increase trust in recycled soil improvers, particularly with respect to contamination risks that have historically undermined confidence in compost and digestate as agricultural inputs. Because input material quality, especially at the collection, sorting and reception stages, is a key determinant of final product quality, early-stage CCPs have a disproportionate influence on whether the end product can meet both regulatory thresholds and end-user expectations. This reinforces a recurring theme in BIN2BEAN's market and policy analysis: that success in scaling up circular soil improver production depends on securing clean feedstock as much as on downstream processing capacity.

3.3 Policy implications of CCPs

The CCP framework has several implications that extend beyond individual operators to the broader policy and regulatory environment for bio-waste valorisation.

First, CCPs provide a harmonised framework for hazard-based quality management that can be applied across different operational contexts, plant sizes and Member States. This supports comparability between systems and may contribute to the harmonisation of quality assurance practices across the EU, an outcome directly relevant to the fragmented national implementation of the Waste Framework Directive and the Fertilising Products Regulation identified elsewhere in BIN2BEAN's policy analysis.

Second, the framework highlights the importance of clear monitoring procedures, critical limits, corrective actions and documentation as the operational backbone of regulatory compliance. It also underscores the need to strengthen quality management at the earliest stages of the value chain, particularly bio-waste collection and sorting, since deficiencies at this point cannot easily be corrected downstream and directly affect whether later CCPs can be met at all.

Third, the decision-tree-based approach offers a practical, replicable tool that can facilitate alignment between operators, quality systems and regulatory requirements. Because it can be adapted to different local operational contexts while preserving a common underlying logic, it offers policymakers a model for supporting harmonisation without imposing a rigid, one-size-fits-all system on operators of very different scales and technologies.

Taken together, these implications point to CCPs not simply as a technical quality-management tool, but as a potential policy lever: a way of translating high-level EU objectives on circular economy, waste recycling and soil health into concrete, verifiable practices at plant level, while giving regulators and market actors a shared basis for assessing product safety and quality.

4. Evidence from Living Labs Policy Forums

4.1 Overview of the LL and the policy forum objectives: Hamburg

SRH

The city of [Hamburg](#) has more than thirty years of experience in the valorisation of bio-waste. Stadtreinigung Hamburg AöR (SRH) is responsible for waste management for private households and public entities, as well as city cleaning. SRH owns and operates two incineration plants and one biogas and composting plant. SRH manages the entire value chain, including marketing soil improvers. The differentiated charging system, which was agreed by the City Council, motivates citizens to separate their waste. Bio-waste is processed in a combined anaerobic and aerobic facility that only accepts input material with less than 2% impurities. As there were no actual political problems to be discussed, the forum shared experiences from the last three decades and made recommendations for municipalities struggling to introduce bio-waste valorisation.¹

Value chain: Even if the municipality does not operate the entire value chain (as it is the case in Hamburg), it is necessary to consider all the steps involved. The demands of farmers for suitable soil improvers set the standard for the quality of bio-waste entering the process, as well as the management of the facility, from pre-sorting to sieving ripe compost. In Hamburg's case, establishing a marketing company ("vkn", owned by SRH) enables SRH to present "one face to the customer". A business cannot be successful without satisfied customers.

Convenience: SRH provides compostable, waterproof bags for the temporary storage and transportation of bio-waste. Citizens can collect the bags from many drugstores, recycling yards and dispensers attached to large bio-waste containers. The bags are widely used and have proven to be highly effective in increasing the amount of bio-waste collected separately.

Charging policy: There are many ways to encourage citizens to sort waste at source. It is important to raise awareness among waste producers of the link between bio-waste and soil. Financial incentives are just one tool among many. It must be managed carefully to yield the intended results. In Hamburg, for example, charges for bio-waste are only about 20% of those for residual waste. If the bio bin contains

¹ "There is generally no intervention from the political arena as the system as a whole works." (Minutes of the SRH policy forum, 12/02/2026)

severe impurities, it will not be emptied and the responsible waste producer will have to pay for additional residual waste disposal.

But how can polluters be detected? Allocating waste to specific households is difficult in multi-family houses, particularly in large housing complexes where bio-waste is collected in underground containers. To avoid contamination, keys or key cards can be distributed only to households interested in waste sorting. The to solve this problem is the focus of LL Hamburg in the Bin2Bean-Project. However, even in these cases, impurities (residual waste and plastic bags) still appear.

End of Waste (EoW): The composting of bio-waste can lead to confusion due to the various ways in which it can be processed to achieve product status, depending on its subsequent use or recovery. Product status must be achieved when the compost leaves the plant for recovery purposes (rather than being sent to landfill). This needs a clarification in European and national legislation (European Waste Framework Directive, German Kreislaufwirtschaftsgesetz).

Should legal requirements be introduced for per-capita bio-waste quantities? This subject is under discussion in Europe. It is necessary to prioritise quality over quantity. Therefore, legal requirements for per capita bio-waste quantities would be disastrous for the quality of the compost.

Fertilising product regulation: The current fertiliser legislation in Germany, particularly the Fertiliser Ordinance (Düngeverordnung - DüV), does not adequately consider the nitrogen actually available to plants in compost.

- For nutrient balancing (according to German law), compost is primarily evaluated based on its total nitrogen content, even though a significant portion of this nitrogen is organically bound and becomes available to plants slowly. The primary function of compost is to reproduce humus in the long term, rather than providing immediate nitrogen fertilisation. Due to short-term nitrogen surpluses (Nitrates Directive), positive effects such as humus formation and improved nutrient and water retention capacity are overlooked.
- According to the Bioabfallverordnung (BioAbfV), compost made from bio-waste cannot be used on grassland. This severely hinders the level playing field for soil improvers.

CE mark for compost hardly available. SRH (biogas and composting plant Bützberg) is attempting to obtain CE marking for all products. The problem is currently being processed by the German QA/QS organisations. The biggest hurdle is the recognition of hygiene measures in accordance with the EU Hygiene Regulation. According to this, the material must currently be shredded to 12 mm and heated to 70°C for 1 hour, which is only the case with wet fermentation. Plants of this type are normally not used for processing municipal bio-waste. Furthermore, this is

technically unnecessary or even problematic for pure composting, because shredding to 12 mm would interfere with the composting process. It would be sufficient to meet the EU composting standard, i.e. 55° over a period of two weeks. Far higher temperatures destroy the organisms, which are needed for humus production.

4.2 Overview of the LL and the policy forum objectives: Amsterdam

AMS

The [Amsterdam Living Lab](#) is led by AMS Institute in collaboration with the City of Amsterdam. Separate collection of bio-waste has been obligatory in the Netherlands since 1 January 2024 under the Waste Framework Directive, and national legislation requires cities to connect households to a collection system. Amsterdam is a dense city with a large share of multi-family and high-rise housing, a building stock that makes conventional bin-based collection difficult to organise and, as in comparable European cities, harder to keep free of impurities. The city is preparing a new Waste Management Plan for 2025–2030, and its *Kader Schoon & Afvalvrij 2025–2028* provides the current municipal framework for waste and resources. Community-driven composting is working quite well in Amsterdam, whereas municipal collection of bio-waste has only been introduced in a few housing areas. The city of Amsterdam does not have its own composting plant, as the facility processing Amsterdam's bio-waste is owned and operated by neighbouring cities. The replacement of the flat fee with a charging system was recommended; however, this could not be discussed due to the municipal elections and their follow-up until mid-2026. Therefore, the forum focused on the frame of alternative collection and processing methods, particularly on the kitchen grinder system as part of the BIN2BEAN project.

Kitchen Sink Grinder System (KSG): The effectiveness of traditional bio-waste collection methods in areas with high population density (high-rise buildings) is low. The city of Amsterdam is struggling with quality problems of the separately collected bio-waste in densely populated areas. Kitchen Sink Grinders (KSG) in newly build high-rises seem to be an appropriate technical solution in a semi-decentralised form: the KSG will be used to collect the bio-waste (effectively: food waste) on a household level and the ground food waste will be separated in a liquid stream and in a solid stream. The liquid stream is envisioned to be discharged on the sewage system (potentially after an additional on-site pre-treatment) and the solid stream is to be collected and processed at a centralised anaerobic digestion facility. Building developers fear the system is too complicated to be maintained easily and too expensive and thus remain hesitant in accepting the system. Policy makers have not been able to introduce alternative options like the KSG in the contemporary waste charging system. Therefore, the legal frame and the allocation of costs were discussed in the policy forum. When considering alternative solutions, the objectives of the valorisation of bio-waste should be considered: minimising residual waste,

improving soils and mitigating climate change. The costs of alternative systems should be reasonable in relation to the current bio-bin collection system.

Section 5.2.3 of [D6.1](#) provides a comparison of four different systems (separate collection and anaerobic processing, community composting, KSG and anaerobic processing, and “wet bin” followed by anaerobic processing) with regard to agro-ecology, circularity, climate impact and socioeconomic conditions.

European and Dutch policy – stumbling stones for the valorisation of bio-waste?

Participants at the forum discussed whether European and Dutch legislation on waste management, soil protection, food hygiene and climate protection could potentially hinder the optimal utilisation of bio-waste. Novel bio-waste separation and collection methods like kitchen sink grinder-based separation and collection and the ‘DRY/WET’ system do not fit yet with European and Dutch legislation. In the case of the KSG this is in principle due to the unit in which the collection rate is expressed (wet weight). In the case of ‘WET/DRY’ separation and collection the low TRL makes it unclear if it adheres to European and Dutch legislation. Furthermore, digestate is considered waste in the Netherlands, so it cannot contribute to reducing residual waste. The future Circular Economy Act may address bio-waste reduction and prevention and eliminate these types of problem. It is necessary to continue the research to improve these techniques and to discuss their potential merits with regard to amendments of the present legal frame.

Enforcement of the local governments? The Waste Framework Directive is an important driver for bio-waste collection and valorisation, setting targets for 2030 and 2035. However, it only enforces MS to collect waste separately, not cities. In the Netherlands, national legislation requires cities to connect households to separate bio-waste collection systems, but there is no law enforcement.

Identification of polluters hampered / impeded by the GDPR? A case from Amsterdam and similar issues reported by SRH suggest that user identification in waste management may conflict with the current GDPR. Since user identification is highly relevant for improving the quality of bio-waste from households, especially in larger housing complexes where residents have a lot of anonymity and thus have the opportunity to misbehave and dispose of waste incorrectly, there is a great interest in examining the topic of data protection in more detail. In general, the GDPR does not protect against violations of local statutes. If the meaning of the GDPR is properly understood and the necessity of monitoring for environmental protection is taken seriously, the identification of users by personal chip cards or similar means does not have to be ruled out. (See D6.1, Section 4.2.) An appropriate interpretation of the GDPR by the COM would facilitate the implementation of PAYT, even in densely populated areas.

4.3 Overview of the LL and the policy forum objectives: Egaleo

EGL

The [city of Egaleo](#) (in the Attica region, bordering Athens) introduced the first bio bins during the BIN2BEAN project, in 2024. Only a few municipalities in the Attica region collect bio-waste separately, as Greece is advancing slowly towards the recycling of organic waste. However, the introduction of landfill taxes by the Greek government has motivated cities to consider the valorisation of bio-waste. Furthermore, PAYT systems must be installed in cities within a defined timeframe.

Currently, waste service costs are covered by a tax, the income from which is also used to pay for street cleaning and lighting. Only two main waste fractions are collected via street containers²: residual waste and recyclable waste (e.g. paper, cardboard and plastics). Therefore, the city faces two challenges: implementing a new collection system and introducing charges, which are not longer based on apartment size. The LL leader organised three policy forums. There was also a meeting with representatives from cities that had already introduced bio-waste collection ("Good practices and challenges in the BW management across the Municipalities of Attiki"). The first PF brought together all the relevant administrative departments, with the aim of establishing a common basis for future discussions. The most important results and recommendations from this meeting were discussed at the second PF, which was also attended by one of the deputy mayors and the general secretary. This meeting agreed on several practical steps to enhance the bio-waste collection and created a timeline for introducing a charging system. The third PF involved citizens and responsible persons from the waste and public spaces departments in a brainstorming session. The participants generated numerous ideas and recommendations for successfully implementing the bio-waste collection, including financial incentives. They also developed a vision for bio-waste valorisation, which shall be realised between 2030 and 2035.

How to organise the value chain? According to national legislation, municipalities are responsible for waste collection, while regional authorities organise waste recycling and disposal. During the lifetime of the project, several attempts to coordinate with the company responsible for waste management in the region failed. Consequently, the city does not receive valuable feedback on the quality of the bio-waste. Conversely, integrating schools and kindergartens into the project was useful from the outset. Around a dozen schools and nurseries were provided with composters and are taking part in a competition to produce the best compost.

The compost can be used on site or in public spaces, e.g. the former Egaleo grove. This activity combines education and raising public awareness and produces some compost for use in the city.

Who is the waste producer? A real PAYT system is extremely difficult to establish due to a lack of door-to-door collection and houses inhabited by many residents. It was unanimously recommended that the city starts with large waste producers, such as supermarkets and restaurants. These commercial sources should be provided with locked bins, and the owners could be offered discounts if their bio bins are filled correctly. Fines should be imposed on restaurants that do not comply with the brown bin scheme. The Solutions for the identification of waste producers have not yet been found.

National legislation: Although national legislation implements EU targets (see above), municipalities lack proper management advice. How can cities best fulfil their tasks? How should local statutes be structured and enforced? Furthermore, regional authorities should be required to cooperate with municipalities to achieve a high volume of high-quality compost.

4.4 Lessons learned

The policy forums proved a useful tool for discussing complex and often contested subjects in bio-waste valorisation, and the fact that Hamburg, Amsterdam and Egaleo used the format for three quite different purposes (knowledge-sharing from an established system, technical/legal problem-solving around a novel collection technology, and building institutional consensus from scratch), shows how adaptable the model is. Where the general format did not fit the situation at hand, it was straightforward to customise it to the local context, whether that meant reducing the political weight of the discussion or sequencing several forums to build up stakeholder buy-in gradually (as in Egaleo). Several cross-cutting recommendations emerge:

- **Establish a visual representation of the discussion in real time**, for example by projecting notes or theses onto a screen, so that participants can see their input reflected immediately and disagreements can be surfaced and clarified as they arise, rather than only in the minutes afterward.
- **Use co-creation methods** for encouraging interaction and participation from all stakeholders. Egaleo's approach of engaging schools and kindergartens directly, rather than treating them as passive recipients of information, shows that co-creation can extend usefully beyond the "usual" institutional stakeholders and generate both public awareness and practical outputs (compost, in this case) as a by-product.

- **Invite external experts** if providing scientific evidence and sharing experiences from other cities is needed, particularly when a forum is dealing with genuinely novel technical questions, such as Amsterdam's assessment of the Kitchen Sink Grinder system, where independent technical input helped ground the discussion beyond the interests of any single stakeholder.
- **Identify the relevant stakeholders** and ensure they have all necessary information for a fair and fruitful discussion, including, where relevant, actors outside the immediate waste-management chain (regional authorities, housing corporations, building developers) whose cooperation may ultimately determine whether a solution can be implemented at all.
- **Manage complexity** by allowing policy forums to build on each other, with an increasing number of stakeholders becoming involved as the discussion matures. Egaleo's sequencing of three forums, moving from an internal administrative meeting to one including elected officials to a citizen-facing brainstorming session, illustrates how staging the process can build institutional consensus before opening the conversation to a wider audience.
- **Anticipate that political and institutional timelines will not always align** with the project's own. Amsterdam's experience, where a planned reform of the charging system had to be shelved because of municipal elections, suggests that a policy forum's agenda and expected outputs should be treated as adaptable to external political cycles rather than fixed in advance.
- **Recognise that a policy forum can surface a governance gap** but cannot substitute for it. Egaleo's repeated attempts to obtain feedback from the regional waste-management company were unsuccessful during the project, a reminder that forums are most effective at generating recommendations and local alignment but depend on functioning institutional channels beyond the forum itself to be acted upon.

5. Regulatory gaps and inconsistencies, barriers to deployment and market uptake

The evidence gathered from BIN2BEAN's Living Labs (Amsterdam, Egaleo/Athens and Hamburg), from the policy forums held in the LLs, from the stakeholder interviews and the peer discussion at EUBCE May 2026, from the technical analysis of Critical Control Points (Chapter 3), and from the validation activities through which LLs tested the decision-tree tool against their own processes points to the same conclusion, which is that the EU's legislative ambition for a circular, soil-healthy bioeconomy is not matched by an equally coherent implementation.

5.1 Alignment with EU targets on waste recycling, circular economy and soil health

The EU policy framework for bio-waste is well developed on paper. It is not a single instrument but a set of rules that, taken together, do two distinct jobs.

The first group of policies ensures that the material exists. The Waste Framework Directive has required Member States to collect bio-waste separately since January 2024, and the Landfill Directive restricts its disposal. Together they divert bio-waste from landfill and incineration and make it available as feedstock (**supply-side instruments**).

The second group determines whether the resulting product can be sold. Regulation (EU) 2019/1009 on EU fertilising products sets the conditions under which compost and digestate may be CE-marked and placed on the internal market, while national end-of-waste criteria determine the point at which the material legally ceases to be waste (**demand-side legislation**).

One set of rules therefore generates the raw material, and the other decides whether anything can lawfully be done with it. The framework works only when the two move in step.

Supply-side instruments

- **Waste Framework Directive (WFD) 2018/851:** Since December 2023, Member States have been required to ensure either separate bio-waste collection or recycling at source, a measure that is essential for meeting EU municipal waste recycling targets of 60% by 2030 and 65% by 2035. However, the Directive creates a governance gap. Its obligations apply to Member States, not directly to cities. This means that municipalities are often responsible for implementation but lack the legal powers to enforce separate

sorting, particularly in multi-family buildings, where individual compliance cannot easily be monitored or enforced. This mismatch between EU-level obligations and municipal-level enforcement capacity was raised repeatedly across BIN2BEAN's Policy Forums, including in Amsterdam in April 2026, where participants noted that flat-rate payment schemes, for example, offer little scope to enforce waste separation, whereas PAYT systems can at least incentivise citizens to separate correctly.

- **Landfill Directive 2018/850:** It requires Member States to reduce landfilled municipal waste to 10% or less by 2035 and prohibits the landfilling of separately collected bio-waste. However, implementation remains uneven across the EU. In Greece, for example, around 80% of municipal waste is still landfilled, leading to significant uncontrolled methane emissions. This highlights both the urgency of stronger bio-waste management and the gap between EU targets and national implementation.
- **Industrial Emissions Directive (IED 2.0):** It sets emission rules for larger bio-waste treatment facilities. It generally applies to biological treatment plants above 75 tonnes per day, although different thresholds apply in some cases, such as anaerobic digestion. Some Member States also apply stricter rules to smaller facilities, which can create uneven conditions across the EU. VKU (Verband kommunaler Unternehmen, the German Association of Local Public Utilities) working groups therefore support more consistent EU-wide emission standards, rather than further national differences.
- **Renewable Energy Directive III (RED III) 2023/2413:** Promotes the use of bio-waste for renewable energy, including biogas and biomethane. This supports anaerobic digestion plants by allowing them to generate value from both energy production and digestate use. Hamburg's Bützberg plant illustrates this integrated model, as it treats bio-waste while feeding biomethane directly into the city gas network.

Demand-side legislation

- **Fertilising Products Regulation (FPR) EU 2019/1009:** The Fertilising Products Regulation (FPR) creates a harmonised EU market route for CE-marked fertilising products, including qualifying compost, digestate and biochar. In practice, however, conformity assessment can be time and resource-intensive, and uptake remains limited. VKU working groups unanimously agreed that independent quality assurance organisations accredited at EU level (following ECN criteria) should be authorised to carry out conformity assessments under the FPR, removing the current administrative bottleneck.

Today, national schemes (Germany's RAL, Italy's CIC) continue to dominate, which limits the development of a truly integrated single market.

- **EU Soil Strategy for 2030:** Targets at least 75% of EU soils being healthy by 2030 and positions bio-based soil improvers as a key restoration tool. The urgency is real: scientific assessments indicate that 24% of all EU soils are already affected by water erosion, with total soil losses reaching around 1 billion tonnes per year (EASAC, 2024), a figure central to the bioSOILUTIONS project's rationale. However, the strategy remains mainly a political framework rather than a fully binding implementation tool. In practice, its objectives are not always aligned with nutrient rules that can limit the use of compost and digestate on agricultural land. This issue is already visible in the Netherlands, as National fertiliser law applies a reduced “working coefficient” to compost, meaning that only 10% of its nitrogen and 50% of its phosphorus (up to 3,5 kg / ton WW compost) are counted toward legal application limits, reflecting the fact that nutrients in compost are released slowly. This could undermine the soil-health benefits the measure is intended to support because it could result in higher manure application rates.

A similar problem may be developing in Belgium, Germany and Denmark, where high levels of nitrogen and phosphorus from livestock slurry already make compost less attractive to farmers.

- **Circular Economy Action Plan (CEAP):** Frames bio-waste as part of the EU's wider shift towards a circular and resource-efficient economy. It supports the recovery of nutrients and organic matter from waste, helping to reduce pressure on natural resources and dependence on synthetic inputs. However, its implementation depends on more specific legislation, including waste, fertilising product, soil, and agricultural policies.
- **EU Emissions Trading System (ETS):** Since 2024, larger municipal waste incineration plants have been required to monitor and report their emissions, and from 2028, they may also become subject to full carbon pricing. This would increase the cost of incineration and could strengthen incentives for waste prevention, reuse, and recycling. However, without simultaneously including landfills in the scheme, there is a risk that waste currently going to waste-to-energy plants is diverted to landfill, generating more methane emissions. VKU working groups supported including methane from landfills in the ETS as a matter of urgency to avoid perverse incentives. At the same time, the reverse risk applies in North-Western European countries, where landfilling is already marginal and incineration effectively functions as the default floor of the waste hierarchy. Tightening landfill rules without also addressing the relative cost of waste-to-energy incineration risks

reinforcing this default, rather than encouraging separate collection and the biological valorisation of bio-waste.

5.2 Regulatory gaps and inconsistencies

1. Fragmented governance and obligations that stop at the national level

The WFD places its obligations on Member States, not on the cities and municipalities that organise collection. This creates a structural mismatch between legal responsibility and operational capacity, as municipalities are expected to deliver on national commitments without always holding the legal mandate, enforcement tools or financing needed to secure household compliance. In Greece, municipalities can introduce local charges such as PAYT (pay-as-you-throw) schemes, which the law requires to be rolled out at local level, and can use revenue from the local service tax to fund waste management, while EDSNA supplies Egaleo with collection trucks. In practice, several of the difficulties observed in Egaleo appear to stem less from a lack of legal tools and more from internal coordination gaps, political reluctance to change. By contrast, Hamburg's municipal operator, SRH, controls the full value chain from collection to product sales, a degree of vertical integration that is legally and financially out of reach for most municipalities. The general lesson learned across several Living Labs, including Amsterdam's experience with high-density housing, is that the WFD's Member-State-level mandate needs a clearer chain of delegation, information transfer, resourcing and enforcement authority down to the municipal level if separate collection obligations are to be met consistently.

2. Collection targets that reward volume rather than quality

EU and national targets are still framed predominantly around the quantity of bio-waste collected, which can inadvertently encourage municipalities to maximise tonnage without sufficient regard for contamination or feedstock quality. Stakeholders convened through the VKU working groups explicitly rejected binding per-capita collection targets on these grounds, warning that they risk pushing cities, particularly in dense urban areas, toward poorer quality bio-waste, higher processing costs and greater enforcement difficulty. Evidence gathered across more than twenty European cities points to a more promising direction: cities that use differentiated charging systems, such as pay-as-you-throw (PAYT) or tiered models like Flex+, tend to collect more bio-waste with lower contamination than cities relying on flat fees. The regional approach adopted in Rhineland-Palatinate (German

State), which sets targets for reducing the share of bio-waste left in residual waste rather than simply increasing collection quotas, offers a model worth considering at EU level.

3. Charging systems that do not incentivise source separation

Flat-fee waste charges give households and businesses little financial incentive to separate bio-waste correctly. This is not fully consistent with the polluter-pays principle, which is a key element of EU waste policy. However, charging users according to the amount of waste they produce can also be difficult to implement in practice.

In multi-family and high-rise housing, PAYT-style systems often require individual users to be identified, raising practical and data-protection concerns. Several Living Labs report that data-protection considerations have been used, sometimes too cautiously, to avoid introducing identification systems or have made existing systems more difficult to manage. This suggests that GDPR compliance and effective charging are not inherently incompatible, but that clearer EU-level guidance on GDPR-compliant identification systems would help municipalities implement these approaches with greater confidence.

4. Inconsistent end-of-waste status across Member States

Rules on when a material derived from bio-waste stops being “waste” and becomes a “product” are applied unevenly across the EU. In Germany, for example, compost is generally treated as remaining waste until it is actually applied to land. Several Living Labs and stakeholders, including participants in the Hamburg policy forum, argue that the material should be considered a product when it leaves the treatment facility for recovery, as at this stage its quality can be properly checked and guaranteed.

Digestate can present an even sharper version of the same problem in the Netherlands, and in some other Member States, it retains **waste** status, which excludes it from counting toward recycling targets and removes a meaningful incentive for its valorisation. This inconsistency prevents the FPR from creating harmonised rules across the EU. As a result, producers may face different requirements for similar (or even the same) products depending on the Member State in which they operate.

Hamburg's experience with the Bützberg plant shows the same pattern on the treatment side: EU hygiene rules require shredding to 12 mm and heating to 70°C for one hour, conditions that apply naturally to wet fermentation but actively interfere with pure composting, where far higher temperatures than the composting standard (55°C for two weeks) destroy the organisms needed for humus formation.

A related version of this gap concerns not the recovered material itself, but the collection technologies used to gather it. Amsterdam's experience with new collection systems shows that current end-of-waste criteria and collection-rate definitions can themselves limit innovation, even for systems that could improve separation and recovery. The kitchen sink grinder system, for example, does not fit easily within current legislation because collection rates are defined and measured in wet weight, while the system's output is measured differently, and because existing rules were developed before this type of technology existed, its legal status remains unclear. Additionally, after separating the liquids from the solids in pre-treatment, the liquid stream is not allowed to be discharged on the sewage because of its waste status. Literature does not suggest a negative effect from discharging ground food waste (streams) in the sewage. The ban therefore seems to be based on principles and not on substantiating. In each case, a rule written with one technology in mind is being applied to a different one it was never designed for, and promising systems risk being held back not by how well they perform, but by definitions that don't fit them.

5. Contradictions between soil-health ambitions and nutrient-management rules

A broader tension exists between the EU's goal of increasing the use of organic soil improvers (which is supported by the Soil Strategy, Farm to Fork and CAP eco-schemes), and nutrient-management rules that limit how much compost or digestate can be applied to land. In several Member States, compost is assessed mainly on the basis of its total nitrogen content, but much of this nitrogen is organically bound and released slowly. Compost is also valuable because it builds soil organic matter and improves water and nutrient retention, rather than simply providing an immediate supply of nitrogen. Rules based only on total nitrogen can therefore underestimate its benefits and make it less attractive than faster-acting fertilisers.

In the Netherlands, only part of the nitrogen and phosphorus contained in compost counts towards the legal application limit, to reflect its slow-release characteristics. However, if the nutrient value assigned to compost is reduced without adjusting the rules for synthetic fertilisers and livestock slurry, farmers may be able to apply compost on top of the maximum permitted dose of these other inputs. In this case, the actual nutrient load on the soil could increase even though the farm remains formally compliant. This issue is particularly relevant in parts of North-Western Europe, where large amounts of livestock slurry already provide farmers with a cheap (or sometimes even income-generating) source of nutrients, making compost a less attractive alternative.

6. A disproportionate compliance burden on smaller actors and innovators

Compliance costs (like CE marking, permitting, documentation, quality monitoring etc.) can fall heavily on smaller municipalities, SME processors and individual farmers. Stakeholder interviews consistently identified slow regulatory responses, unclear guidance from authorities and complex administrative procedures as the main barriers they face in practice.

These difficulties are especially significant for innovative products. Evidence from the FENIX project shows that products combining biochar and digestate do not always fit clearly within existing FPR categories, creating uncertainty about their classification, labelling and REACH registration requirements. Because the FPR applies stricter, so-called "super-REACH" obligations to raw materials used in fertilising products, even substances produced below the standard one-tonne registration threshold may need to be registered, adding cost and delay for SMEs and project demonstrators. FENIX's experience also shows that regulatory assessment carried out too late in a project's lifecycle becomes a barrier in itself. Evidence from bioSOILUTIONS further shows that even soil improvers developed and tested together with farmers may struggle to achieve wider adoption, as farmers may be reluctant to use them when this involves extra costs, labour or agronomic risks without adequate support.

The problem is therefore not only technical but also related to governance, as current EU and national frameworks provide limited support for the trust-building, co-creation and risk-sharing mechanisms that are needed to encourage adoption in practice.

6. Policy Roadmap

6.1 Recommendations

This section translates the regulatory and governance gaps identified in Chapter 5 into a practical roadmap for policy action. The recommendations are intended to help policymakers identify where intervention is needed along the bio-waste-to-soil-improver value chain, which level of governance is best placed to act, and whether the required response can be implemented through existing instruments or requires broader regulatory change.

The recommendations should not be read as a single package to be implemented uniformly across Europe. Their relevance will depend on the maturity of the local or national bio-waste system, the regulatory responsibilities of the authority concerned and the specific bottlenecks affecting the value chain. Some measures can be introduced relatively quickly through implementation guidance, charging systems, quality-control practices or targeted support, while others depend on coordinated national or EU-level reform. The roadmap therefore distinguishes responsibilities across governance levels and, in the summary that follows, also indicates the expected time horizon for action.

For policymakers, the practical starting point is the barrier that needs to be addressed. Each recommendation links a specific implementation problem to a possible policy response, while also highlighting where action at one level depends on changes at another. This is particularly important for bio-waste valorisation, where municipalities may control collection and enforcement, national authorities determine many implementation rules, and issues such as market access and harmonisation ultimately require EU-level intervention.

1. Close the governance gap between EU obligation and municipal capacity

The implementation of the WFD should ensure that Member States translate EU bio-waste separation obligations into clear responsibilities at municipal level and provide municipalities with the legal mandate, enforcement tools and adequate funding needed for effective implementation. This would help close the gap, documented across all three Living Labs, between obligations established at EU and national level and the operational capacity of municipalities to put them into practice. A long-term solution to this challenge is to establish multi-level governance platforms for regular coordination and exchange between EU, national, regional and local authorities working across waste, agriculture, soil and energy policy. These platforms would not replace existing decision-making structures, but would provide a structured forum for sharing experience, identifying implementation gaps and improving coordination across governance levels. BIN2BEAN's own Policy Forum model provides a practical example of what such a platform can look like at local level, as

described in chapter 4. Rather than leaving its replication to individual initiatives or local circumstances, this model should be deliberately promoted and scaled up, and the same applies to other Living Lab practices that have demonstrated positive results, including Hamburg's approach to engaging farmers and Egaleo's gradual source-separation model based on initial implementation in schools and nurseries.

Two lessons from the BIN2BEAN experience are especially important when considering how to make this type of governance platform a more permanent part of the institutional system. First, policy forums can help to find and discuss gaps in governance, but they cannot replace effective communication, coordination and decision-making between institutions outside the forum. Second, the forum's agenda should remain flexible so that it can respond to political developments and changing policy priorities, rather than being fully defined in advance.

2. Reframe collection policy around quality, not just quantity

Collection policy currently rewards volume over quality, and Member States report how much bio-waste they collect, but not what it contains. Reporting requirements should close that gap, as Member States should report contamination rates alongside tonnage figures. At EU level, per-capita collection targets should be replaced (or at least complemented) with targets for reducing the share of bio-waste left in residual waste. Rhineland-Palatinate shows what this looks like in practice: by targeting residual-waste composition rather than collection volume, the region has improved separation without pushing municipalities toward large volumes of low-quality material.

Quality targets in general only work if there is a mechanism to enforce them at the receiving end, and a minimum EU quality standard for bio-waste accepted at processing facilities would provide exactly that. Precedents already exist, as Germany and Austria reject deliveries above roughly 2–3% impurities, and the Netherlands applies a standard rejection threshold of 3%, with 5% as an absolute ceiling. In each case, facilities can turn away or surcharge poor-quality material instead of processing whatever arrives, and an EU standard would simply extend that principle to all Member States.

This is also where the Critical Control Point (CCP) framework described in Chapter 3 becomes relevant, as CCP1 (raw-material acceptance during collection and reception) is the single point in the value chain with the greatest influence on everything downstream. Once plastics, heavy metals or pathogens get past this first checkpoint, later stages such as sorting, composting or testing may not fully remove them, and some hazards can persist into the final product. That is why CCP1 pairs sampling and laboratory analysis with acceptance criteria, as material that fails is turned away, traced back to its source and reported, rather than blended in and processed regardless. A quality-based collection policy and a CCP-based quality system are, in effect, the same principle applied at different scales, as one defines

what "clean enough" means, the other verifies whether each batch actually meets it. EU guidance should make that connection explicit, pointing to CCP1 as a practical mechanism for putting quality targets into effect, and verifying them at the point of reception.

3. Reform charging systems to incentivise source separation

Member States should be encouraged to move away from flat-fee waste charging and toward differentiated systems, like pay-as-you-throw (PAYT) schemes, or tiered models such as Flex+, that charge households and businesses according to how well they separate their waste, rather than a fixed amount regardless of behaviour. Because the main obstacle to this shift is usually not the pricing model itself but the practical difficulty of identifying individual users in shared housing, EU co-funding should be directed specifically at pilot projects that tackle this barrier in multi-family and high-rise buildings.

Hamburg's municipal waste operator, SRH, offers one working example of how the pricing side of this can work in practice. Bio-waste is charged at roughly 20% of the residual-waste rate, and the main enforcement tool is not a fine issued after, but simply leaving contaminated bins uncollected. This makes the consequence of poor sorting immediate and visible, rather than something that turns up later as a bill.

Egaleo's policy forums point to a different, complementary lesson. Where identifying individual households' door-to-door is not realistic (as for example in dense, multi-storey urban areas), it is more practical to start enforcement with large commercial producers such as supermarkets and restaurants instead of households. These are easier to identify and monitor and can be brought into a system of locked bins, discounts for correct sorting, and fines for non-compliance well before full residential PAYT becomes feasible. So rather than waiting for one scheme that works for everyone at once, this phased approach (commercial producers first, households later) may be the more realistic path for cities that lack Hamburg's degree of control over the full waste chain.

On the GDPR question, the evidence gathered across BIN2BEAN's Living Labs points to something more specific than a general reassurance that "GDPR is not a problem." Several Living Labs report that data-protection concerns have, at times, been used as a reason not to introduce identification systems at all, sometimes reaching further than the law itself actually requires. This suggests the real issue is less about what GDPR permits in principle, and more about the uncertainty municipalities face when trying to apply it in practice. What would help most, then, is not a blanket statement that GDPR poses no obstacle, but clearer EU-level guidance, and ideally a model legal framework, that gives municipalities a ready and GDPR-compliant template for identification systems, rather than leaving each one to work out the answer on its own.

4. Establish harmonised EU-wide end-of-waste criteria

End-of-waste criteria for compost, digestate and biochar should be harmonised at EU level, with the same rules applying in every Member State rather than being left open to national derogation. Product status should be reached once material leaves the treatment facility for recovery, and not, as under the current German interpretation, only once it has actually been applied to land. That distinction matters more than it might first appear, as tying "waste" status to end-use rather than to treatment quality creates uncertainty for producers and slows market entry, even for material that already meets safety and quality standards.

Digestate is the clearest case where this needs to change, as in several Member States, including the Netherlands, digestate still counts as waste even after processing. The 2026 Fertiliser Action Plan already commits to presenting measures to facilitate the use of digestates (with appropriate environmental safeguards), so this recommendation is not a call to open a new policy process, but a call to make sure that when those measures arrive, they deliver genuinely harmonised end-of-waste status across the EU.

Harmonised EoW criteria should be designed with emerging technologies in mind from the start, rather than built around today's systems and amended later once new ones mature. On hygienisation specifically, composting should be allowed to demonstrate safety against the existing EU composting standard (55°C sustained for two weeks), rather than being required to meet shredding and heating conditions designed for wet fermentation. Building this flexibility in now would spare the next generation of collection and treatment technologies the same legal uncertainty that digestate, the grinder, WET/DRY systems, and composting operators like Bützberg face today.

5. Resolve cross-sector policy contradictions

Stronger coordination is needed between DG Environment, DG Agriculture, DG SANTE and DG CLIMA, as rules on bio-waste, nitrates, organic farming, soil health and climate are often developed separately, even though they directly affect one another, and requirements in one area can unintentionally create barriers to bio-waste valorisation in another. The Fertiliser Action Plan's (May 2026) commitment to clarify Nitrates Directive implementation, following its upcoming evaluation, offers a concrete opening to address this but only if the use of compost and other bio-waste derived products is explicitly considered in that process.

On nutrient accounting, Gap 5 highlights the risk of changing the rules for compost without making corresponding changes for synthetic fertilizers and livestock slurry. In the Dutch system, only 10% of the nitrogen and 50% of the phosphorus in compost counts toward legal application limits, up to a threshold of 3.5 kg of phosphorus. Addressing this risk means revising the accounting for synthetic fertiliser and slurry

in parallel, rather than adjusting compost's treatment in isolation, for example counting slurry at a higher percentage of its nominal NPK content, as an illustrative starting point, so that more favourable treatment of compost does not translate into a net increase in the real nutrient load applied to the soil.

On climate and waste pricing, the risks of including waste-to-energy in the ETS without matching landfill-methane measures (and the reverse risk in North-Western Europe, where incineration already functions as the default floor of the waste hierarchy) are set out in Section 5.1. What would help resolve this in practice is a more targeted approach, for example by increasing the cost of incinerating organic waste specifically. This could be done through an incineration levy applied to the organic fraction of waste or through limits on the amount of organic material allowed in incinerator feedstock. Such measures should clearly distinguish conventional incineration from anaerobic digestion and biomethane production, which are already supported under RED III.

Implementation would nevertheless be challenging, as the organic/biogenic share of mixed waste is difficult to measure accurately, and many municipalities are tied to existing incinerators through long-term contracts, which may require municipalities to pay for a fixed amount of waste, reducing their incentive to divert bio-waste toward separate collection.

Finally, the current Landfill Directive target, which requires Member States to reduce municipal waste sent to landfill to 10% or less by 2035, could be reviewed. A faster phase-out focused specifically on biodegradable waste, without exemptions for residual waste, may deliver quicker progress than the current general landfill target.

6. Reduce the disproportionate compliance burden on smaller actors and innovators

Compliance costs do not affect all organisations equally. Large producers can often afford the time and expertise needed to deal with unclear rules or lengthy certification procedures.

Smaller processors, municipalities and project demonstrators usually have fewer resources and may struggle to bring new products to market.

Three changes could help reduce this imbalance.

First, CE marking. Independent, EU-accredited quality assurance organisations (following ECN criteria) should be authorised to issue CE marks and allowed to operate across Member State borders rather than being confined to one national market. This would end reliance on the current patchwork of national schemes (Germany's RAL, Italy's CIC) that smaller actors struggle to navigate.

Second, product classification rules need to be clearer. The relationship between the Fertilising Products Regulation and the Animal By-Products Regulation should be

clarified for household bio-waste that has already been sanitised according to FPR standards. Harmonised guidance is also needed for innovative bio-based products that do not fit clearly within existing categories, such as the biochar–digestate formulations tested in the FENIX project.

Third, clearer guidance is needed on when REACH registration requirements apply to innovative bio-based materials used in fertilising products, including how substance identity, production process, applicable exemptions and existing registrations should be assessed. This would help pilot projects and SMEs determine their regulatory obligations early in product development and avoid unnecessary uncertainty or duplication.

The CCP framework described in Chapter 3 could help apply all three recommendations in practice. A common and auditable system for monitoring, setting critical limits and keeping records would help smaller operators demonstrate compliance without having to create their own quality system from scratch. It would also give regulators a consistent basis for assessing new products, rather than starting from zero each time.

Two remaining gaps concern funding rather than unclear rules. First, regulatory assessment covering the FPR, REACH and national fertiliser rules should be funded from the beginning of Horizon Europe projects. The FENIX experience shows that leaving this work until the final stages can delay market uptake, especially for demonstrators without their own regulatory experts.

Second, innovation funding should directly support farmer involvement in product development, field trials and risk-sharing. This could include support through CAP Strategic Plans, particularly cooperation, innovation, investment and relevant environmental interventions, alongside Horizon Europe funding. BioSOILUTIONS found that even well-tested products may struggle to reach the market when farmers must take on additional costs, labour or agronomic risks without support. Established suppliers may be able to cover these risks, but developers of new products often cannot.

7. Develop a certification pathway for carbon removals delivered by soil improvers

The carbon sequestration potential of soil improvers is not currently covered under the EU Carbon Removals and Carbon Farming Certification Framework (Regulation 2024/3012), because no validated methodology yet exists for certifying temporary carbon removals of this kind. This is not a minor omission: the Framework is intended to create standardised, tradable carbon credits that could open a genuine new revenue stream for compost, digestate and biochar producers, on top of their existing role in soil health and waste recovery. The model calculations for soil carbon sequestration exist, but achieving the predicted values reliably remains difficult in

practice, which is exactly why no certification methodology has yet been validated for it.

The Fertiliser Action Plan creates an opportunity to address this gap, as it proposes using CAP funding, the European Competitiveness Fund and EU ETS revenues to support carbon farming and carbon removals. However, funding alone will not solve the problem. A reliable and widely accepted method is still needed to measure how much carbon soil improvers store, for how long, and under which conditions.

Some of the necessary tools already exist at national level. For example, the Dutch BodemC/BodemCarbon system estimates changes in a farm's soil carbon balance over a period of 10-15 years. Systems like this could provide a useful starting point, but they still need to be developed into a common methodology that can be recognised and applied across the EU. The recommendation is therefore not to create a new policy process, but to build on existing models and research capacity to develop a credible EU certification method for carbon stored through soil improvers.

6.2 Summary of recommendations by time horizon

Time horizon	Roadmap recommendation	Type of action needed
Short term (0–1 year)	Pilot GDPR-compliant identification and differentiated charging systems in multi-family housing (Rec. 3); fund FPR/REACH regulatory assessment from the start of new Horizon Europe projects (Rec. 6)	Pilot funding; funding-rule change
	Clarify the boundary between the Fertilising Products Regulation and the Animal By-Products Regulation for sanitised household bio-waste (Rec. 6)	Interpretative guidance
Medium term (1–3 years)	Require Member States to report bio-waste contamination rates alongside tonnage, and set an EU minimum quality standard for material accepted at treatment facilities (Rec. 2)	Reporting requirement; standard-setting

	Authorise EU-accredited quality-assurance organisations to issue CE marks across Member State borders; phase in REACH obligations for pilot-scale biochar producers (Rec. 6)	Regulatory recognition
	Align nutrient accounting for compost with that of synthetic fertiliser and slurry; target the organic fraction of incinerated waste specifically (Rec. 5)	Cross-DG coordination
Long term (3+ years)	Amend the Waste Framework Directive, or its implementing guidance, to give municipalities the mandate, tools and funding for bio-waste separation; scale up Policy Forum-type governance platforms (Rec. 1)	Legislative amendment
	Harmonise EU-wide end-of-waste criteria for compost, digestate and biochar, designed to accommodate emerging collection and treatment technologies (Rec. 4)	Legislative harmonisation
	Develop a validated EU methodology for certifying temporary carbon removals delivered by soil improvers, building on national tools such as the Dutch BodemC/BodemCarbon system (Rec. 7)	New certification framework

Table 3. Policy Roadmap actions by time horizon.

6.3 Recommendations by governance level

EU level

Policy asks

- **Amend the Waste Framework Directive**, or its implementing guidance, to give municipalities a clear mandate, enforcement tools and funding for bio-waste separation.
- Require Member States to **report contamination** rates alongside tonnage; set a common minimum quality standard for material accepted at treatment facilities; reference CCP1 explicitly in guidance.

- **Issue guidance**, ideally a model legal framework, on GDPR-compliant household identification systems; co-fund pilots in multi-family and high-rise housing.
- **Harmonise EU-wide end-of-waste criteria** for compost, digestate and biochar, designed to accommodate emerging collection and treatment technologies.
- **Strengthen coordination** between DG Environment, DG Agriculture, DG SANTE and DG CLIMA; use the Fertiliser Action Plan's Nitrates Directive clarification to explicitly consider compost; assess a targeted incineration levy on the organic waste fraction; review the Landfill Directive target for biodegradable waste specifically.
- **Authorise EU-accredited quality-assurance bodies** to issue CE marks across Member State borders; clarify the FPR/Animal By-Products Regulation boundary; make REACH requirements proportionate to production volume; fund regulatory assessment from the start of Horizon Europe projects.
- **Validate and standardise** the analytical and sampling methods used to verify CCP critical limits, so cross-border recognition of quality-assurance bodies is workable in practice.
- **Develop a validated EU methodology** for certifying temporary carbon removals from soil improvers, drawing on CAP, European Competitiveness Fund and ETS revenues as foreseen in the Fertiliser Action Plan.

National level

Policy asks

- **Translate the EU mandate** into enforceable national law, not only a collection obligation on paper, and fund municipal implementation.
- **Transpose the EU quality standard** into binding national acceptance criteria for treatment facilities.
- **Adapt national data-protection** guidance to give municipalities legal certainty for identification systems.
- **Remove national derogations** that tie product status to end-use rather than to treatment quality (for example, digestate's status in the Netherlands, or the grassland restriction under Germany's Bioabfallverordnung).

- **Revise national nutrient accounting rules** for synthetic fertiliser and slurry in parallel with any more favourable treatment of compost.
- **Reform national quality-assurance schemes** (Germany's RAL, Italy's CIC) so accredited bodies can operate beyond a single national market.
- Build on existing national **tools**, such as the Dutch BodemC/BodemCarbon system, as an input to the EU carbon removal methodology.

Local / regional level

Policy asks

- **Scale up Policy Forum-type governance** platforms bringing together waste, agriculture, soil and energy departments; keep the agenda flexible.
- **Apply CCP1-based acceptance criteria** and sampling at the point of reception; reject and trace non-compliant loads back to source.
- **Move from flat-fee to differentiated charging** (PAYT, Flex+); where household identification is not realistic, start enforcement with large commercial producers.
- **Flag long-term incinerator contracts** that reduce the incentive to divert bio-waste when waste contracts come up for renewal.
- **Direct available funding** and advisory support toward smaller processors, municipalities and project demonstrators navigating certification.

7. Practical guidelines for Policymakers

7.1 Key steps for policy design and implementation

The steps below provide a practical sequence for designing, implementing and reviewing bio-waste and soil-improver policies. They are not intended as a rigid checklist: policymakers can enter the sequence at the point that best reflects the maturity of their local or national system and return to earlier steps as technologies, market conditions or regulatory requirements change. The table below provides a first indication of where to start, while the seven steps identify the main issues to consider throughout the policy cycle.

Which starting point matches your context?

Profile	Typical situation	Priority actions	Where to look
Early stage (Egaleo-type)	Separate bio-waste collection is new or being piloted. Input material is relatively clean, but volumes are still low and no formal quality-management system is in place.	Establish systematic monitoring, documentation and HACCP-inspired practices early, while the system is still small enough to adjust; use a Policy Forum to build institutional buy-in before scaling collection city-wide.	Section 4.3; steps 1 and 3 in 7.1; section 3.1 on CCPs
Growth stage (Amsterdam-type)	Collection is established but quality is uneven, particularly in dense, high-rise housing; alternative collection technologies are being considered but do not yet fit existing legislation.	Pilot alternative collection or treatment technologies at manageable scale before mandating them; revisit charging and identification systems; flag where end-of-waste or other rules need to accommodate the new technology.	Section 4.2; step 5 in 7.1; Chapter 6, Recommendations 1, 3 and 4
Mature stage (Hamburg-type)	Treatment, quality assurance and differentiated	Review and harmonise existing monitoring and	Section 4.1; the flexibility point in 7.2; Chapter 6,

	charging are already well established; the main challenges are harmonisation, CE marking and adapting to new regulatory or technical developments.	documentation practices; contribute evidence to EU-level standard-setting; extend engagement to farmers and land users.	Recommendation 2
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Table 4. Starting point examples for matching context.

1. Start from a value-chain map

Before drafting new rules, map how bio-waste is currently collected, treated and marketed locally: which technologies are in use, where contamination typically enters the chain, and how existing rules are actually applied rather than how they read on paper. BIN2BEAN's own policy framework ([Report on the regulatory framework at the European, national, and regional levels of biowaste.](#)) show what this kind of mapping can look like in practice, and the same logic applies at municipal or national scale, as a policy built on an accurate picture of the local value chain is more likely to target the right point of intervention than one built on the text of the directive alone.

2. Define targets around quality, not only volume

As Chapter 6 recommends (Recommendation 2), collection targets expressed purely in tonnes collected reward volume over cleanliness. Wherever possible, targets should be paired with, or replaced by, a measure of contamination or residual-waste composition, following the model already applied in Rhineland-Palatinate.

3. Bring stakeholders in early and keep the process open to revisit

BIN2BEAN's Policy Forum model (Chapter 4) shows that structured, transparent dialogue between administrations, waste operators, farmers and citizens surfaces governance gaps that a purely internal drafting process would miss. Stakeholders interviewed for this deliverable specifically asked that consultation go beyond formal notice-and-comment procedures, and that smaller actors, farmers, small processors, municipalities, be given a realistic opportunity to shape the outcome rather than simply react to a finished text.

4. Make requirements proportionate to the size of the actor

A single set of obligations calibrated for large, well-resourced actors will systematically disadvantage smaller processors, innovators and municipalities. At regional and local level, proportionality can be supported through practical guidance, technical assistance, training and shared services that help smaller actors meet new bio-waste collection, monitoring and quality requirements.

5. Pilot before mandating at scale

Several of the practices BIN2BEAN recommends scaling up (pay-as-you-throw charging, household identification systems, kitchen sink grinders) were tested as pilots before any recommendation was made about a wider rollout. The Amsterdam KSG pilot and the phased, commercial-producers-first approach trialled in Egaleo both show the value of testing a mechanism at a manageable scale and adjusting its design based on what surfaces in practice, rather than legislating before its practical constraints are known.

6. Build in monitoring, reporting and review from the outset

A policy that is not designed to be checked and revised is difficult to correct once problems appear. Bio-waste and soil-improver policy should include a defined review point, an indicator to review against, for example contamination rates or the CCP-based monitoring, and a mechanism for feeding operational experience back into the rules, such as the Fertiliser Action Plan's periodic evaluations or the EU-level technology assessment group that stakeholders suggested during BIN2BEAN's interviews.

7. Communicate clearly and invest in shared understanding

Interviewees repeatedly linked weak market uptake and public scepticism of recycled soil improvers to a lack of accessible information rather than to any technical shortcoming of the products themselves. A harmonised glossary of bio-waste terminology, targeted training for farmers, municipalities and small operators, and public awareness campaigns explaining the safety and value of recovered soil improvers are, on the evidence gathered in this project, at least as important to market uptake as the underlying regulation itself.

The seven steps above can be condensed into a short checklist for use when a new bio-waste or soil-improver policy is being drafted or reviewed:

Checklist item

☐	Have we mapped the local value chain and identified where contamination or quality loss actually occurs, rather than assuming it from the legislative text?
☐	Are our targets defined around quality and contamination, not just collection volume alone?
☐	Have stakeholders, including farmers, small processors and municipalities, been consulted before the policy was drafted, not only after?
☐	Are requirements proportionate to the size and resources of the actors affected?
☐	Has the approach been piloted at a manageable scale before being proposed for wider rollout?

☐	Does the policy include a defined review point, an indicator to review against, and a route for operational feedback to reach the rule-makers?
☐	Is there a communication or training plan for the actors who will have to apply the policy day to day?

7.2 Integration of CCPs into policy and regulatory frameworks

The guidance below outlines how the CCP approach can be embedded into existing policy and regulatory frameworks, providing a common reference for quality management across the bio-waste value chain rather than leaving individual producers or quality-assurance bodies to define their own control systems.

1. Anchor collection-stage requirements in CCP1

Because raw-material acceptance and sampling at collection and reception (CCP1) has the greatest influence on everything downstream, EU or national guidance on collection quality should point explicitly to CCP1 as the mechanism through which a minimum quality standard is verified in practice, rather than leaving “acceptable quality” undefined at the point of reception.

2. Recognise CCP-based systems as a route to demonstrating FPR compliance

HACCP is not currently a mandatory framework for recycled fertilisers and soil improvers, but guidance under Regulation (EU) 2019/1009 and national implementing rules could formally recognise a HACCP-inspired CCP system, covering monitoring, critical limits, corrective actions and documentation, as an accepted way of demonstrating compliance. This would give producers, particularly smaller ones without an in-house quality department, a structured template to build from.

3. Support harmonised, validated analytical methods

CCP1 has a contamination limit, CCP3 has a hygienisation limit (time and temperature), and CCP7-8 have final product limits (heavy metals, pathogens, and so on). Establishing whether a batch is within those limits depends on sampling and laboratory testing, and different countries or laboratories do not always test the same parameter in the same way.

This creates a problem for cross-border recognition: if laboratories in different countries test differently, the same batch could pass in one country and fail in another purely because of how it was sampled or analysed.

Validating and standardising the sampling and test methods themselves therefore matters as much as recognising the certification bodies that use them.

4. Provide clearer guidance on deviation management

Living Lab stakeholders who tested BIN2BEAN's decision-tree tool found it useful for identifying CCPs and CPs, but asked for more concrete guidance on what to do once a deviation is detected, minimum corrective actions and practical examples for different scenarios, together with a concluding summary of identified CCP/CP candidates (Chapter 2). Regulatory guidance on CCP implementation should build this in directly, rather than leaving deviation management to be worked out case by case.

5. Allow flexibility for different starting points.

Amsterdam, Egaleo and Hamburg are, on BIN2BEAN's own evidence, at different stages of bio-waste treatment and quality-management maturity, and the CCP framework was designed to be adapted to each context accordingly. Regulatory frameworks that reference CCPs should preserve this flexibility and, in line with Chapter 6 (Recommendation 4), should be drafted with emerging collection and treatment technologies in mind, so that operators using new methods are not held to control measures designed for a different process.

6. Tie CCP verification to funding and capacity-building instruments

Public funding for regulatory assessment from the start of a project and for training and capacity-building should explicitly cover the resources needed to set up and operate a CCP-based system, monitoring equipment, staff time, record-keeping, rather than treating CCP implementation as a cost operators are expected to absorb once the product is already on the market.

The same logic applies to embedding CCPs in regulatory practice. Before finalising guidance or legislation that references CCPs, it is worth checking:

Checklist item

☐	Does collection-stage guidance point explicitly to CCP1 as the mechanism for verifying quality, rather than leaving "acceptable quality" undefined?
☐	Is a CCP-based system formally recognised as an accepted route to demonstrating FPR compliance, alongside other quality-assurance approaches?
☐	Are the analytical and sampling methods used to verify critical limits comparable across the Member States or regions involved?
☐	Does the guidance explain what to do once a deviation is detected, not only how to identify the CCP itself?
☐	Does the framework leave room for operators and regions at different stages of maturity (see Table 4) to apply it differently, rather than imposing one uniform model?
☐	Does funding for regulatory assessment or capacity-building explicitly cover the cost of setting up and running CCP monitoring, not only the cost of developing the product?

8. Conclusions

The evidence brought together in this Policy Roadmap shows that the main challenge for bio-waste valorisation in Europe is not the absence of policy objectives, but the difficulty of translating them into effective implementation across the whole value chain. Separate collection, recycling, nutrient recovery, circularity and soil health are already supported by EU legislation and policy, yet the relevant rules are distributed across different sectors and governance levels and do not always interact consistently in practice.

The experience of the three BIN2BEAN Living Labs makes clear that these challenges take different forms depending on local conditions and system maturity. Hamburg illustrates the benefits of a well-established system in which collection, treatment, charging, quality management and marketing have developed together. Amsterdam highlights the difficulty of adapting conventional collection approaches to dense urban areas and of introducing alternative technologies that do not fit easily within existing regulatory definitions. Egaleo shows that the presence of formal legal responsibilities and financing mechanisms does not necessarily guarantee implementation when institutional coordination, administrative capacity and political support are still developing.

A second central finding concerns the quality of collected bio-waste. Increasing separate collection remains essential, but higher quantities do not automatically lead to better outcomes if contamination makes treatment more difficult or compromises the quality of the resulting soil improvers. This reinforces the need for policies that consider feedstock quality alongside collection volumes and for quality-management approaches that can identify and control problems early in the value chain.

Quality management alone, however, cannot address the wider regulatory barriers identified in the analysis. Problems also arise where end-of-waste status differs between Member States, where requirements developed for established processes do not accommodate emerging collection or treatment technologies, and where waste, fertiliser, agricultural, soil and climate policies create conflicting incentives. The relationship between the objective of returning organic matter and nutrients to soils and the rules governing nutrient application is one example, while the relative treatment of biological recycling, landfilling and incineration provides another. Addressing these issues requires better alignment between policy areas and governance levels rather than isolated changes to individual rules.

Longer-term opportunities, including more harmonised end-of-waste criteria, improved cross-border recognition of quality-assurance systems and the possible certification of carbon removals delivered through soil improvers, will require further methodological development and coordinated action at EU level.

For this reason, the recommendations in this roadmap are deliberately differentiated by governance level and time horizon. They should not be interpreted as a uniform package, but as a set of options that can be adapted to the maturity of each bio-waste system and to the specific barriers being addressed.

Effective bio-waste valorisation ultimately depends on the different parts of the chain working together. Poor feedstock quality can undermine treatment, effective treatment without clear product status can restrict market access, and technically sound soil improvers will have limited impact if end users lack sufficient confidence or incentive to adopt them. The central contribution of this Policy Roadmap is therefore to connect these dimensions and identify where policy intervention can support them at local, national and European level, helping to move from broad ambitions for circularity and soil health towards a more practical and adaptable framework for bio-waste valorisation and regenerative soil management.

About BIN2BEAN

[Bin2Bean](#) is a research-action project, co-funded by the European Commission under the Mission Soil, which aims to optimize the performance of bio-waste collection and transformation into soil improvers. It started in September 2023 and will last 3 years.



Bin2Bean collaborates with 3 City-Region Living Labs (Amsterdam, Egaleo, Hamburg), which have different states of progress and levels of experience on the topic, to implement a series of activities:

1. **Map local contexts**, in terms of state-of-progress, existing initiatives, needs, material and monetary flows.
2. **Design a tailored evaluation framework** to demonstrate the safety, environmental and socio-economic performance of bio-waste collection systems and soil improvers.
3. **Develop a scoring system**, fed by data from the evaluation framework, to help cities select the most effective and market-ready solutions adapted to their context.
4. **Develop tailored and viable business and/or community models** for the highest scored solutions, according to stakeholders' willingness-to-adopt.
5. **Draft local, national and EU policy roadmaps**, including waste charging policies and citizen awareness campaigns. All this will feed into a PDCA (Plan, Do, Check, Act) toolbox, enabling any city-region to create a continuous improvement loop towards effective bio-waste recycling and regenerative soil systems.

Disclaimer: AI-assisted tools were used to support language editing, translation, and the integration of material, while all content was reviewed and validated by the authors.

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