Interreg CENTRAL EUROPE

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TeBiCE

# D.3.1.3 Strategy for a "without- barriers" market of by-products and waste from agri-food sectors in CE

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# 1. INTRODUCTION AND SCOPE OF THE DOCUMENT

Deliverable D3.1.3 aim to support the project objective of reducing regulatory and procedural barriers that affect the valorisation and circulation of agro-food residual streams across the partner countries. Building on the analytical work carried out in D3.1.2, which focused on market barriers and action priorities, this deliverable addresses the legal and administrative dimension of market uptake, with specific attention to the pathways for by-product classification and End-of-Waste (EoW) status.

In practice, the feasibility of valorisation pathways is often influenced not only by technical readiness or market demand, but also by the regulatory qualification of the material stream. The same residual flow may be treated differently depending on national legal transposition, competent authority practice, evidentiary requirements, and procedural expectations. This may generate uncertainty for operators, increase transaction costs, delay investments, and limit the replicability of solutions across countries. For this reason, a comparative regulatory analysis is a necessary complement to the market-oriented assessment already developed in D3.1.2.

The purpose of D3.1.3 is therefore twofold. First, it provides a structured comparison of how the partner countries interpret and operationalise the EU Waste Framework concepts of by-product (Article 5) and End-of-Waste (Article 6). Second, it translates this comparison into a practical support output, namely operational guidelines that can assist project partners and stakeholders in:

- the preliminary classification of a residual stream (with particular reference to by-product vs waste logic), and
- the preparation of by-product guide-line in compliance with all the different countries' legislations.

The document covers the partner countries involved in the project — Italy, Slovenia, Germany, Poland, Austria and Slovakia — and starts from the European regulatory baseline as the common frame of reference for the comparison. The analysis is not limited to a formal description of legal texts; rather, it is developed with an implementation-oriented perspective, considering how the EU framework is translated into national provisions, guidance, competent authority arrangements and practical evidentiary expectations. This is particularly important in the project context, where the objective is not only to understand the legal landscape, but also to support concrete decision-making for pilot development and future replication. In line with the approach adopted in D3.1.2, this deliverable is designed as an operational document rather than a purely doctrinal legal analysis. Its added value lies in combining comparability (through a common analytical structure across countries), practical relevance (through partner-based country information and procedural focus), and usability (through the development of guidance-oriented tools). The final output is intended to help reduce regulatory uncertainty, improve preparedness of operators, and support a more consistent and transparent approach to by-product pathways in the project area. This deliverable should therefore be read as a comparative and action-oriented support instrument for WP3: it bridges the gap between regulatory heterogeneity and operational needs, and contributes to the

broader project objective of enabling less fragmented and more scalable valorisation pathways for agro-food residual streams across the participating Member States.

## 1.1. METHODOLOGY

To develop this document, a hybrid methodology was adopted, combining regulatory research (EU and national frameworks) and structured inputs from project partners, with the aim of comparing how the by-product concept (Article 5, Waste Framework Directive) is transposed and applied in the project countries, identifying common requirements and recurring evidence patterns, and translating them into shared operational guidelines for the preliminary classification of pilot residual streams as by-products.

In addition, the methodology also includes a targeted review of the End-of-Waste (EoW) framework (Article 6, Waste Framework Directive) and of the main national approaches in the project countries. This EoW mapping is used to frame the regulatory landscape and to clarify why the deliverable does not develop standardised EoW guidelines applicable across all partner countries and pilot value chains.:

- Desk research of EU and national frameworks (By-product – Article 5; End-of-Waste – Article 6) to better understand the market for by-products and/or waste, seeking to identify the main critical issues hindering their commercialization;
- Partner survey (Country Pack + Pilot Pack) with evidence requests. Each project partner was asked to complete a questionnaire to collect key information relating to agricultural waste framework directive of their countries.

The scope of the document covers the project countries and the pilot agricultural wastes, detailed in Table 1:

- Countries: Italy, Slovenia, Germany, Poland, Austria, Slovakia.
- By-products: Wine (pomace/lees/stems), Radicchio (leaves/roots), Apple (pomace → pectin), Corn (cobs/husks), Hemp (shives/fibres/dust), Insect frass, Biogas/digestate, Pumpkin-seed press cake.

| Partner (PP) | Country | Pilot Focus | By-product(s) | National Waste framework |
|---|---|---|---|---|
| LP1 - AVISP | Italy | Wine | Pomace, lees, stems, tartaric residues | D.Lgs. 3 aprile 2006, n. 152<br>• Art. 184-bis - by-product;<br>• Art. 184-ter - End of waste. |
| LP1 - AVISP | Italy | Radicchio | Outer and trimming leaves, roots | |
| PP3 - FHI | Italy | Apple | Peels, pomace, seeds | |

| | | | | |
|---|---|---|---|---|
| PP2 - NIC | Slovenia | Apple | Apple pomace | Uredba o odpadkih<br>• Art. 7 - by-product;<br>• Art. 8 - End of waste. |
| PP2 - NIC | Slovenia | Corn | Corn cobs and husks | |
| | | | | |
| PP4 - CCB | Germany | Hemp | Hemp residues | Kreislaufwirtschaftsgesetz (KrWG)<br>• Section 4 - By-products;<br>• Section 5 - End of waste. |
| PP5 - UWM | Poland | Insect farming | Frass (insect manure) | Ustawa z dnia 14 grudnia 2012 r. o odpadach<br>• Art. 10 - by-products;<br>• Art. 14 - End of waste. |
| PP6 - KPV | Poland | Biogas | Food waste, corn residues | |
| PP8 - CUAS | Austria | Pumpkin seeds | Press cake | Abfallwirtschaftsgesetz 2002 (AWG 2002)<br>• Art. 2 Abs. 3a - by-product;<br>• Art. 5 - End of waste |
| PP9 - SUA | Slovakia | Hemp | Shives, fibres, dust | Act No. 79/2015 Coll. on Waste<br>• Art. 2(4) - by-product;<br>• Art. 2(5) - End of waste. |

## 1.2. OUTPUT

The output of Deliverable 3.1.3 is an operational guidance tool that supports project partners, companies and public authorities in the preliminary classification of agricultural residual streams as by-products, in a way that is consistent with the EU baseline (Waste Framework Directive, Article 5) and aligned with the national implementation approaches in the TeBiCE partner countries.

The tool developed in this document is a By-product Classification Manual / Guideline, designed to transform the regulatory requirements for by-product status into a practical decision-support framework. Its purpose is to help shift the discussion from “can we treat this stream as a by-product?” to “what evidence do we need to demonstrate compliance, how do we document it, and what are the minimum conditions we must be able to prove across the project countries?”

In practical terms, the guideline is structured to provide a common classification pathway, supported by harmonised checklists and evidence templates, enabling users to assess whether a stream can plausibly meet the by-product conditions and to identify the documentation gaps that may prevent a robust classification. While it does not replace national competent authority decisions, it supports

regulatory preparedness and reduces uncertainty by making requirements transparent, comparable, and actionable.

In short, the By-product Classification Manual is a structured and transferable guidance output that makes classification pathways comparable and executable: it clarifies what to check, what to document, by whom, and with what minimum evidence, and it allows users to update their assessment as pilot streams evolve and additional data become available during project implementation.

## 2. EUROPEAN REGULATORY FRAMEWORK

Directive 2008/98/EC (Waste Framework Directive – WFD) establishes the core EU legal framework for waste management and for the key legal distinctions that are central to TeBiCE pilots: waste, by-products, and end-of-waste status. The Directive defines common principles (including the waste hierarchy, the duty of care and key definitions) and sets harmonised conditions for when a substance or object may be treated as a by-product (Article 5) or when a waste may cease to be waste after recovery (Article 6). As an EU directive, the WFD is binding as to the result to be achieved, while leaving Member States discretion regarding the form and methods of implementation. In other words, Member States must transpose the WFD into national law and ensure that the legal outcomes required by the Directive are met, but the national legislative and administrative systems may differ in how they operationalise procedures, competent authorities' roles, guidance instruments and evidentiary expectations. This is a critical point for cross-country valorisation of agricultural residual streams: even where the EU legal conditions are the same, national transposition and practice can lead to different levels of clarity, documentation burden and predictability. For this reason, the EU baseline is used in this deliverable as a common reference logic to structure the national comparison and to derive an output that remains compliant across all project countries. The following sections report the core legal provisions of Article 5 and Article 6 and interpret them through an implementation lens, focusing on the key conditions and on what they imply in terms of evidence and documentation for operators.

### 2.1. ARTICLE 5 - BY-PRODUCT CRITERIA (BP)

The Directive sets the general rule that a production residue can be considered a by-product (and not waste) only if specific conditions are met. Article 5(1) states:

> *"1. Member States shall take appropriate measures to ensure that a substance or object resulting from a production process the primary aim of which is not the production of that substance or object is considered not to be waste, but to be a by-product if the following conditions are met:*
>
> *a) further use of the substance or object is certain;*
>
> *b) the substance or object can be used directly without any further processing other than normal industrial practice;*
>
> *c) the substance or object is produced as an integral part of a production process; and*

*d) further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.*

*2. The Commission may adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down in paragraph 1 to specific substances or objects.*

*Those detailed criteria shall ensure a high level of protection of the environment and human health and facilitate the prudent and rational utilisation of natural resources.*

*Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 39(2). When adopting those implementing acts, the Commission shall take as a starting point the most stringent and environmentally protective of any criteria adopted by Member States in accordance with paragraph 3 of this Article and shall prioritise replicable practices of industrial symbiosis in the development of the detailed criteria.*

*3. Where criteria have not been set at Union level under paragraph 2, Member States may establish detailed criteria on the application of the conditions laid down in paragraph 1 to specific substances or objects.*

*Member States shall notify the Commission of those detailed criteria in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council ( 4 ) where so required by that Directive."*

The first important point of this article is the clarification that the substance or object considered a by-product derives from a process whose primary objective is not the production of that substance or object. (*...a substance or object resulting from a production process* ***the primary aim of which is not the production of that substance or object****...)* This means that I can only classify a by-product as something "superfluous" or something in excess of a production process—not, for example, a leftover finished product derived from the process, or defective parts or inventory leftovers of products/objects used in the production process. This clarification alone makes it clear that a by-product is generated in a production process, not upstream or downstream. After this specification, four conditions are listed that must be met. All four simultaneously, without excluding any of them. In practice, Article 5 is less a "label" and more an evidence-based qualification: it requires a coherent narrative of origin, intended use, technical suitability and compliance. These four criteria can therefore be interpreted by different European countries for their implementation, which makes it difficult to find common classifications for all.

Below is an implementation-oriented reading of each condition and the typical evidence logic it implies.

### a) further use of the substance or object is certain;

The Directive requires that the substance or object be used by someone. This means that there must be a buyer who will use that substance or object. This means that if I have a process discard and I don't know who can use it "as is" (condition b), it must be classified as waste. It is therefore clear how important it is to combine market and barrier analysis (D3.1.2) in order to apply Article 5. Without a

clear market for these wastes, the first condition is already not met. Operationally, this is typically demonstrated through:

- stable and identified downstream user(s) and use(s);
- commercial/contractual arrangements or documented internal use;
- realistic logistics and storage conditions consistent with the intended use;
- absence of disposal intent.

For agro-food streams, this condition often becomes the "weakest link" when flows are seasonal, variable in quality, or when the market outlet is not secured. The guideline output in this deliverable will therefore translate "certainty" into concrete evidence options.

### b) the substance or object can be used directly without any further processing other than normal industrial practice

The Directive requires that the substance/object "can be used directly without any further processing other than normal industrial practice." The second condition requires that each substance or object be used as is, without any treatment that substantially alters its characteristics. This point is also important to clarify because it can be confused with a waste treatment phase (Article 6). It can also be misinterpreted as meaning that no type of treatment can be performed on the discarded substance or object. Minimal treatments, such as storage, volumetric reduction, or moisture loss, can be performed to allow for better transportation or use in a subsequent process phase. The true meaning of this point of the directive is that the chemical/physical conditions of the substance or object cannot be treated/modified/altered in their entirety in order to be used in another production process. The key implementation challenge is distinguishing:

- allowed handling/conditioning steps (e.g., sorting, dewatering, stabilization, size reduction) if they are standard in the relevant industry, and
- steps that indicate the material is being "recovered from waste".

For pilots, the implication is that the by-product pathway is most robust when the required conditioning is minimal, standardized and clearly framed as a normal industrial practice for the intended downstream sector.

### c) the substance or object is produced as an integral part of a production process

The third condition further specifies the introductory part of this article. The discarded substances or objects must be derived from a production process, and therefore clearly derived from a production process and not a finished product leftover, warehouse surplus, or something that has been produced but no longer has any function or use. Operationally, this condition anchors the by-product concept to residues that arise unavoidably or routinely from a legitimate production process (e.g., food processing, farming, fermentation, etc.), rather than materials intentionally produced for disposal. Evidence typically includes:

- process description and mass balance logic;
- traceability to a defined production stage;
- clear distinction between production residue and discarded/contaminated material.

d) **further use is lawful, i.e. the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts**

The final condition concerns environmental safety and human health. It seems logical and intuitive that a substance or object used "as is" in a new production process should not cause further harm to the environment or human health. The directive specifies this in detail to emphasize the concept. This is the compliance-and-risk condition and often requires:

- conformity with applicable product/sector rules (e.g., animal feed, fertilizer, chemical, product safety);
- contaminant control and quality specifications;
- QA/QC and traceability measures proportional to the risk and use.

For agro-food residual streams, this is where analytical evidence (e.g., contaminants, microbiology where relevant), specification sheets, and a control plan can become essential, especially when the intended use is sensitive (feed/fertiliser) or when cross-border movements raise additional scrutiny.

Paragraph 2 of Article 5 empowers the Commission to directly define specific regulatory acts that define the conditions for classifying waste as a by-product: *"implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down in paragraph 1."*

While the European Commission does not define specific by-product flows, it leaves the power to define specific classification criteria to its member countries (paragraph 3 of Article 5). This is why we analyze the different interpretations and applications of Article 5, seeking a common factor that simplifies the classification as a by-product as much as possible.

## 2.2. ARTICLE 6 - END OF WASTE CRITERIA (EOW)

Article 6(1) establishes that certain specified waste may cease to be waste after recovery, if conditions are met. The Directive states:

> *"1. Member States shall take appropriate measures to ensure that waste which has undergone a recycling or other recovery operation is considered to have ceased to be waste if it complies with the following conditions:*
>
> *a) the substance or object is to be used for specific purposes;*
>
> *b) a market or demand exists for such a substance or object;*
>
> *c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and*

d) *the use of the substance or object will not lead to overall adverse environmental or human health impacts.*

*2. The Commission shall monitor the development of national end-of-waste criteria in Member States, and assess the need to develop Union-wide criteria on this basis. To that end, and where appropriate, the Commission shall adopt implementing acts in order to establish detailed criteria on the uniform application of the conditions laid down in paragraph 1 to certain types of waste.*

*Those detailed criteria shall ensure a high level of protection of the environment and human health and facilitate the prudent and rational utilisation of natural resources. They shall include*

a) *permissible waste input material for the recovery operation;*

b) *allowed treatment processes and techniques;*

c) *quality criteria for end-of-waste materials resulting from the recovery operation in line with the applicable product standards, including limit values for pollutants where necessary;*

d) *requirements for management systems to demonstrate compliance with the end-of-waste criteria, including for quality control and self-monitoring, and accreditation, where appropriate; and*

e) *a requirement for a statement of conformity.*

*Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 39(2).*

*When adopting those implementing acts, the Commission shall take account of the relevant criteria established by Member States in accordance with paragraph 3 and shall take as a starting point the most stringent and environmentally protective of those criteria.*

*3. Where criteria have not been set at Union level under paragraph 2, Member States may establish detailed criteria on the application of the conditions laid down in paragraph 1 to certain types of waste. Those detailed criteria shall take into account any possible adverse environmental and human health impacts of the substance or object and shall satisfy the requirements laid down in points (a) to (e) of paragraph 2.*

*Member States shall notify the Commission of those criteria in accordance with Directive (EU) 2015/1535 where so required by that Directive.*

*4. Where criteria have not been set at either Union or national level under paragraph 2 or 3, respectively, a Member State may decide on a case-by-case basis, or take appropriate measures to verify, that certain waste has ceased to be waste on the basis of the conditions laid down in paragraph 1 and, where necessary, reflecting the requirements laid down in points (a) to (e) of paragraph 2, and taking into account limit values for pollutants and any possible adverse environmental and human health impacts. Such case-by-case decisions are not required to be notified to the Commission in accordance with Directive (EU) 2015/1535.*

*Member States may make information about case-by-case decisions and about the results of verification by competent authorities publicly available by electronic means.*

*5. The natural or legal person who:*

*a) uses, for the first time, a material that has ceased to be waste and that has not been placed on the market; or*

*b) places a material on the market for the first time after it has ceased to be waste,*

*shall ensure that the material meets relevant requirements under the applicable chemical and product related legislation. The conditions laid down in paragraph 1 have to be met before the legislation on chemicals and products applies to the material that has ceased to be waste."*

The first consideration regarding Article 6, which differentiates it from Article 5, is that the subject in question is waste. I have no way of interpreting whether waste is a by-product or something else. In this article, we're already talking about waste, and all the rules and criteria specified subsequently concern the operations and conditions applicable to waste. These conditions, if fully met, without exception, allow me to consider waste no longer as waste but as a secondary raw material comparable to a virgin raw material. Another important aspect that characterizes Article 6 is that waste must undergo a recycling process, this means that I cannot achieve an End of Waste if I do not carry out a waste treatment activity: *"…that waste which has undergone a recycling or other recovery operation…".* Another difference from Article 5 is that, in addition to meeting four specific conditions (similar to those for by-products), four specific criteria must also be met to ensure the quality of the treatment, the avoidance of harm to the environment and human health, and the quality of the end-of-waste obtained. These quality conditions must be comparable, if not better, than virgin raw materials available on the market. Let's analyze below the meaning of the four conditions for the End of Waste and the four criteria to be respected:

a) the substance or object is to be used for specific purposes;

As with the by-product, the first condition to meet is that the substance/material obtained from the recycling process must have a specific use; there must be another production process that utilizes it. Connected to point b), there must be a market that "absorbs" it. It means that the recovered output must be commonly used for identified purposes—i.e., it has a recognised function and is not an exceptional or purely hypothetical use. The producer of an EoW must show a clear, standard use scenario (sector/application) and that the material fits that use in practice.

b) a market or demand exists for such a substance or object;

The second condition is connected to the first: not only must there be a specific technical use, or use in a production process, but there must be a market that ensures its purchase and exchange, that indicates it can circulate as a product/material rather than remain a "treated waste". The evidence to be produced typically includes off-take arrangements, comparable transactions, price lists/market references, letters of intent, or other proof of real demand.

c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products;

The third condition specify that the output must meet the technical requirements for its intended use and comply with product legislation and standards applicable to that use. This is usually demonstrated through technical specifications, quality parameters, contaminant limits, test results, and a QA/QC system, plus proof of compliance with the relevant downstream regulatory framework (depending on use). It is the criterion that allows the end of waste to be compared with a finished product or a virgin raw material according to the physical/chemical/technical/performance conditions etc. of use.

d) the use of the substance or object will not lead to overall adverse environmental or human health impacts.

As with Article 5, the final condition concerns the need to avoid causing harm to the environment and human health when using End of Waste. This is the risk-based condition: beyond formal compliance, it requires showing that risks in the intended use scenario are controlled (e.g., contaminant monitoring, traceability, restrictions of use where relevant).

In addition to the four conditions that must be met simultaneously, an End of Waste site must also meet five specific criteria to be considered as such. These criteria depend largely on the treatment process the waste undergoes to lose its waste classification. The five criteria are:

a) permissible waste input material for the recovery operation;

EoW criteria must clearly define which waste streams are eligible as input for the recovery operation. This includes the type and origin of the waste, any relevant classifications, and exclusions (e.g., contaminated or unsuitable fractions), so that only inputs consistent with the intended output quality are accepted.

b) allowed treatment processes and techniques;

EoW criteria should describe which recovery processes, treatment steps, and techniques are permitted to produce the end-of-waste material. This ensures that EoW status is linked to a defined and repeatable processing route, rather than to an undefined range of treatments with variable outcomes.

c) quality criteria for end-of-waste materials resulting from the recovery operation in line with the applicable product standards, including limit values for pollutants where necessary;

EoW criteria must set measurable quality requirements for the recovered material, aligned with the intended use and with applicable product standards. Where relevant, they should include limit values for pollutants and other critical parameters to ensure the material is suitable, safe, and consistent for its specific applications.

d) requirements for management systems to demonstrate compliance with the end-of-waste criteria, including for quality control and self-monitoring, and accreditation, where appropriate; and

EoW criteria should require an appropriate management and control system to demonstrate ongoing compliance, typically including quality assurance and quality control procedures, self-monitoring, sampling and testing plans, record-keeping and traceability, and—where appropriate—accreditation of testing activities or laboratories.

e) a requirement for a statement of conformity.

EoW criteria should include an obligation to issue a statement of conformity for the material placed on the market as end-of-waste. This statement documents that the relevant criteria have been met for the specific batch or delivery, providing transparency and enabling verification along the supply chain and by competent authorities.

Article 6 is intrinsically use- and stream-specific. While Article 5 sets a general test for production residues, Article 6 is designed for materials that are already classified as waste and are transformed into a product-like output through recovery. The practical consequences are:

1. Recovery process centrality: EoW depends on the existence of a defined recovery process and output specification, often requiring process control and quality assurance.
2. Market and compliance demonstration: EoW requires showing not only technical suitability but also that the output meets applicable legal standards and does not create adverse impacts.
3. Criteria setting complexity: EU-wide criteria exist only for certain streams; where not available, Member States may implement national criteria or case-by-case decisions, leading to fragmentation.

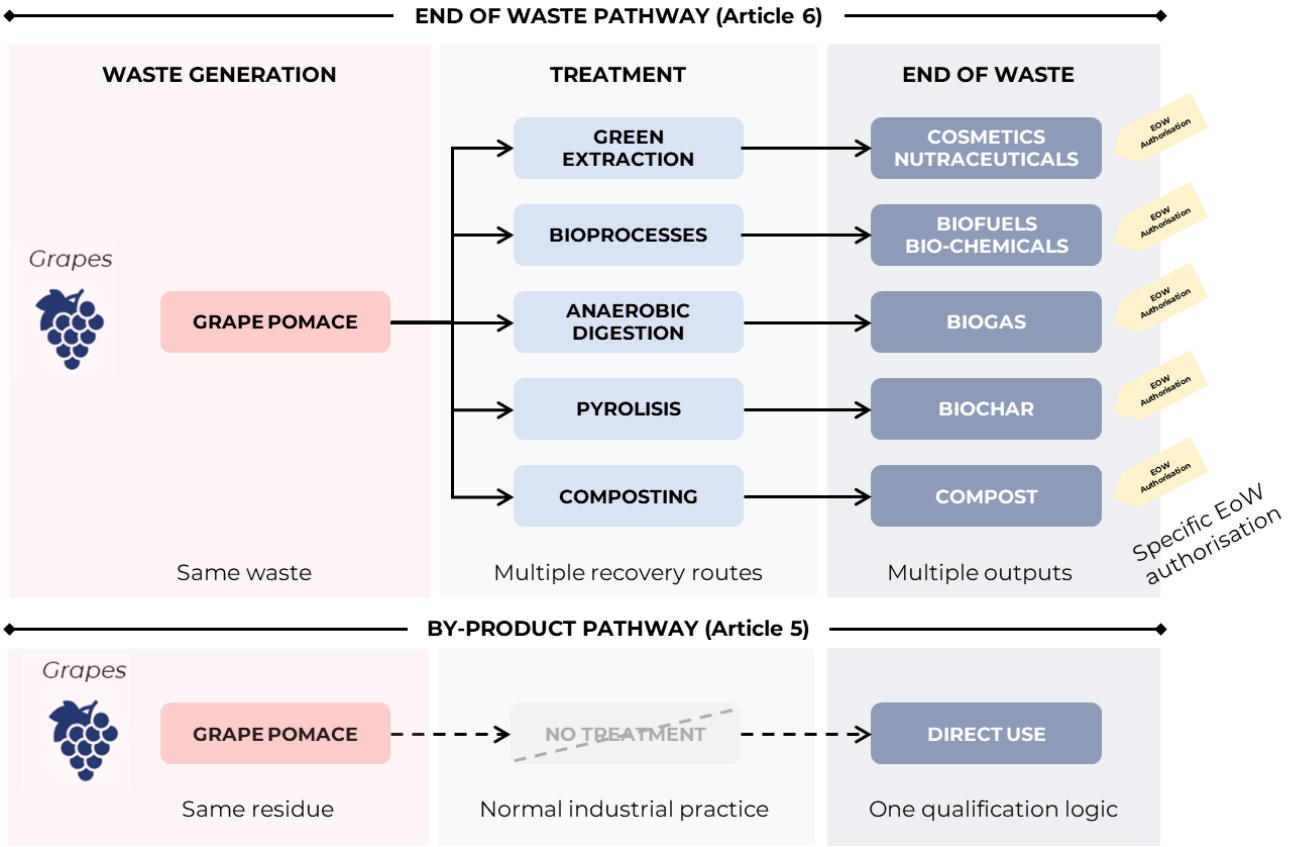
## 2.3. FINAL CONSIDERATION

As seen from the analysis of the two legislative articles relating to by-products and End of Waste, the differences between the two approaches are substantial. First of all, to be classified as by-product, it must meet four conditions that are slightly less stringent than those of End of Waste and do not require additional verification criteria. Another substantial difference is that the definition of End of Waste depends not only on the type of waste that you want to treat (criteria (a), paragraph 2 of Article 6 – "*permissible waste input material for the recovery operation*;"), but also on the treatment/recycling process it undergoes and the use characteristics it must meet in order to be marketed as a virgin material (criteria (b) and (c), paragraph 2 of Article 6). This significant difference highlights how for each agricultural waste, even if similar, and in each EU country, different End of Waste regulations can be developed based on the different treatment technologies or end uses. For this reason, EoWs are defined on a case-by-case basis in each country and in each industrial supply chain, to ensure the best possible recovery of that specific waste.

Let's take an example:

An agricultural waste like grape pomace, once considered waste, must undergo specific treatments to transform it into a new secondary raw material ready for a specific use in a new production process.

Its transformation from waste is process-dependent: green extraction routes yield polyphenol-rich extracts for cosmetics/nutraceuticals; bioprocesses convert it into biofuels and bio-based chemicals; anaerobic digestion produces biogas/biomethane, while pyrolysis generates biochar for soil amendment or adsorption applications; composting (including of exhausted biomass) closes the loop in agriculture.




This means that for each different recycling operation, a specific End-of-Waste procedure is required, which must be authorized by the competent authorities.

This essential consideration highlights the real difference with by-product classification, where the classification is more linear and does not depend on the treatment the waste must undergo. Remember that in the by-product classification criteria, "the substance or object" must not undergo treatment but must be used essentially as is.

From this consideration, it is clear how the by-product classification is more easily comparable and standardized than that of an End of Waste. No matter what type of agricultural waste I'm considering or what type of treatment it should undergo, the procedure for classifying waste as a by-product can be the same across different pilot projects and EU countries. The following chapters therefore analyze

only the regulatory articles relating to by-products, culminating in the output of deliverable D.3.1.3, which provides standard guidelines for classifying agricultural waste as a by-product.

# 3. COUNTRY ANALYSIS

To analyse how regulatory conditions shape the feasibility of valorisation pathways, this chapter provides a country-by-country assessment of the legal provisions governing by-product status in the TeBiCE partner countries (Italy, Slovenia, Germany, Poland, Austria, Slovakia). The purpose is not only to list the relevant national articles, but to understand how far national transposition and implementation may diverge from the common EU baseline and, most importantly, how these rules are applied in practice by operators and competent authorities.

Across the project area, a recurring common factor behind regulatory barriers is interpretability: even when EU concepts are shared, differences in national wording, guidance, procedural expectations and evidentiary thresholds can make the same material flow legally "clear" in one country and legally "uncertain" in another. When legal status is uncertain, the stream does not become a reliable resource and its valorisation remains exposed to administrative risk.

A second cross-cutting factor is demonstrability. By-product frameworks are built around conditions that must be proven, not assumed. In practice, this means that operators need a consistent evidence package (intended use, technical specifications, quality controls, traceability, compliance checks) and must be able to align it with what national provisions and authorities expect. Where rules are interpreted case-by-case, the burden shifts from "knowing the article" to "knowing how to document compliance".

Finally, the chapter highlights applicability: the regulatory text alone does not determine outcomes unless it can be operationalized through workable procedures, clear roles, and predictable decision pathways. For this reason, each country section links the legal articles to their practical implications—who is responsible, what is typically required to support the classification, and where the most frequent bottlenecks and grey areas emerge. The resulting mapping provides the necessary basis for the comparative analysis and for the development of the shared guidance output in Chapter 4.

**N.B: In all comparison tables of EU and member state legislation, an English translation is made from the original official text using online translation software. Therefore, please note that the translation from the original language into English may contain some vocabulary errors, which, however, do not affect the interpretation of the legislative article.**

## 3.1. ITALY (LP - PP3)

Italy transposes the EU Waste Framework Directive through Legislative Decree 152/2006 (Environmental Code). By-product status is regulated under Article 184-bis. The national structure is closely aligned with the EU baseline, but **practical implementation is strongly influenced by evidence quality, intended use clarity, and the degree of standardisation available for the output material and its downstream application**.

Competent authority

In Italy, the regulatory governance relevant to by-product is typically multi-level. Strategic and regulatory guidance is national, while authorisations and operational controls are managed through regional and local competent authorities depending on the specific case and territorial arrangements (e.g., environmental agencies and local permitting bodies). Partner inputs highlight that, in Italy, the success of a by-product classification largely depends on the **ability to document a stable and lawful use and to demonstrate that the material can be used directly (or with only normal industrial practice) with a predictable quality profile**. Where quality is variable, markets are fragmented, or the intended use is not sufficiently defined, operators tend to experience higher uncertainty and may be pushed towards waste management pathways even for streams that are conceptually eligible for by-product status.

### 3.1.1. BY-PRODUCT

By-product status is regulated under Art. 184-bis of D.Lgs. 152/2006, which mirrors the EU Article 5 approach by requiring that all conditions are met and demonstrable through appropriate evidence.

| EU WFD Art. 5(1) – conditions (a–d) | Italy – D.Lgs. 152/2006, Art. 184-bis(1) (working translation) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(a) Further use is certain.<br>(b) Direct use without further processing other than normal industrial practice.<br>(c) Produced as integral part of a production process.<br>(d) Lawful use + no overall adverse impacts. | A substance or object is a by-product (and not waste) if all of the following are met:<br>(a) it originates from a production process of which it is an integral part and the primary aim is not the production of that substance/object;<br>(b) it is certain that the substance/object will be used, in the course of the same or a subsequent production or use process;<br>(c) it can be used directly without any further processing other than normal industrial practice;<br>(d) further use is lawful, i.e., it meets all relevant requirements for products and for environmental and health protection for the specific use and will not lead to overall | Lexicon: "by-product / sottoprodotto" and explicit link to "same or subsequent production/use process" (practical emphasis on the use pathway). Substance: substantively very close to EU; differences mainly in phrasing and in how "certainty of use" is framed. |

| | | |
|---|---|---|
| | adverse environmental or human health impacts. | |

In practical terms, the Italian framework treats by-product status as an evidence-based qualification. The legal test is EU-consistent, but the operational focus is placed on

(i) the certainty and stability of the intended use,

(ii) the technical framing of any handling/treatment steps as normal industrial practice, and

(iii) the demonstration that the by-product use is lawful and safe, including compliance with any applicable sector/product requirements relevant to the intended downstream application.

### 3.1.2. BP PROCEDURE PATHWAY

Italy does not provide a single universal "application form" for by-product recognition applicable to all streams; by-product status is generally treated as an evidence-based legal qualification under Art. 184-bis of Legislative Decree 152/2006, supported by a structured documentation package demonstrating the four statutory conditions. A key national reference that operationalises the interpretation of Art. 184-bis is Ministerial Decree 13 October 2016, No. 264, which introduces indicative criteria specifically aimed at facilitating the demonstration of by-product requirements (i.e., how to build evidence in practice). The official text is published in the Italian Official Gazette and is also available via Normattiva and the Ministry portal. In addition, institutional guidance is often sectoral (e.g., SNPA/ARPA guidance on specific materials) and can be used as practical support for how evidence, controls, and documentation are typically structured; ARPA Veneto provides a clear institutional summary of the regulatory context and the role of DM 264/2016. FAQ-style institutional clarifications referencing Art. 184-bis are also available through the national chamber-of-commerce environmental portal (Ecocamere).

## 3.2. SLOVENIA (PP2)

Slovenia addresses the Waste Framework Directive concepts through the Decree on Waste (Uredba o odpadkih). By-product status is covered under Article 7 (stranski proizvod). The structure **follows the EU baseline closely,** while implementation is largely driven by evidence strength, documentation quality, and—especially for EoW—the degree to which criteria exist or are assessed case-by-case.

#### Competent authority

Governance is typically organised at national level through the relevant ministry and environmental institutions, with implementation involving permitting/control functions and inspections at the appropriate administrative level. Partner inputs highlight **that by-product classification becomes robust when the intended use is clearly defined** and supported by predictable specifications and basic quality control evidence. Where use scenarios remain generic (or quality is highly variable), authorities and operators tend to apply a more cautious approach.

### 3.2.1. BY-PRODUCT

By-product is regulated under Art. 7 of the Decree on Waste, reflecting the EU Article 5 four-condition logic.

| EU WFD Art. 5(1) – conditions (a–d) | Slovenia – Uredba o odpadkih 77/22, Art. 7(1) (working translation) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(a) Further use is certain.<br>(b) Direct use without further processing other than normal industrial practice.<br>(c) Produced as integral part of a production process.<br>(d) Lawful use + no overall adverse impacts. | A substance or object arising from a production process whose main purpose is not the production of that substance/object ("production residue") is a by-product and not waste if:<br>1) further use of the production residue is ensured, not merely possible;<br>2) it can be used directly without any further processing except normal industrial procedures;<br>3) it is produced as a constituent part of the production process; and<br>4) it meets requirements for its use under product/chemicals/environment/human health legislation, and its further use will not have harmful effects on the environment and human health. | Lexicon: uses "production residue / ostanek proizvodnje" and stresses "ensured, not merely possible". Substance: EU-equivalent conditions, but wording is slightly stricter on certainty (ensured vs certain) and explicitly embeds product/chemicals compliance in the condition. |

In practice, Slovenia treats by-product status as a demonstrable qualification requiring a credible use pathway and clear separation from waste recovery logic. The decisive elements are typically

(i) certainty of further use;

(ii) technical framing of any handling steps as normal practice for the receiving sector, and

(iii) lawful/safe use supported by minimum quality evidence.

### 3.2.2. BP PROCEDURE PATHWAY

In Slovenia, no single universal "notification form" was identified as a mandatory pathway for recognising by-product status at national level. By-product status is framed primarily as a legal qualification under Article 7 (stranski proizvod) of the Decree on Waste (Uredba o odpadkih 77/22), and is supported by an evidence dossier demonstrating compliance with the statutory conditions (certainty/ensured further use, direct use without processing beyond normal industrial practice, integral part of production, lawful and safe use). The most robust institutional references for operators are therefore the official legal texts, accessible through the Slovenian official legal portal (PISRS) and the Official Gazette publication of the regulation.

## 3.3. GERMANY (PP4)

Germany implements the WFD through the Circular Economy Act (Kreislaufwirtschaftsgesetz – KrWG). By-products are regulated under Section 4. The framework **is strongly EU-aligned, with implementation shaped by a structured administrative system** and, in practice, a high importance given to technical documentation and legal certainty.

### Competent authority

Competences are typically exercised at regional (Länder) level, with permitting, control and enforcement responsibilities distributed within the federal structure. Partner inputs suggest that the decisive factor is **the demonstrability of compliance: clear specifications, stable use scenario, and defensible framing of processing steps.**

### 3.3.1. BY-PRODUCT

By-product is regulated under KrWG Section 4, mirroring the EU Article 5 logic.

| EU WFD Art. 5(1) – conditions (a–d) | Germany – KrWG Section 4(1) (official EN text) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(a) Further use is certain.<br>(b) Direct use without further processing other than normal industrial practice.<br>(c) Produced as integral part of a production process.<br>(d) Lawful use + no overall adverse impacts. | A substance or object resulting from a production process whose primary aim is not the production of that substance/object is a by-product (not waste) if:<br>1) further use is safeguarded;<br>2) no pre-treatment beyond normal industrial practice is necessary;<br>3) it is produced as an integral part of a production process; and<br>4) further use is lawful (meeting product/environment/health requirements and not leading to overall detrimental impacts). | Lexicon: “safeguarded” / “no pre-treatment beyond normal industrial practice”. Substance: aligned with EU; emphasis on “pre-treatment” wording and the “lawful use” clause explicitly includes the “no overall detrimental impacts” element. |

In practice, the by-product pathway is viable when the stream is clearly tied to a production process, has a credible downstream use and can be handled with standard industrial steps. Robustness increases when operators define specifications and controls that make quality predictable.

### 3.3.2. BP PROCEDURE PATHWAY

Germany does not operate a single nationwide by-product “application form” as a default. By-product status is typically handled as an evidence-based legal qualification under §4 KrWG (Nebenprodukte). In practice, implementation is supported by enforcement/implementation guidance (Vollzugshilfen/Handlungshilfen) that may be issued at Länder level to promote consistent

authority assessment. A strong example is the North Rhine–Westphalia (NRW) "Handlungshilfe" on the authority review of by-product status, which explicitly supports a structured verification approach and clarifies critical boundary issues (e.g., the distinction between waste and by-product). Therefore, Germany combines a clear statutory basis with additional institutional implementation guidance, even if guidance is not issued as one single federal template.

## 3.4. POLAND (PP5 - PP6)

Poland transposes WFD principles through the Act of 14 December 2012 on Waste. By-product is regulated under Article 10. **The legal framework is aligned with EU concepts**, but practical implementation depends on evidence strength and the extent to which procedures are formalised in guidance and administrative practice.

### Competent authority

Responsibilities are typically distributed across national and sub-national administration, with permitting and control functions handled at the competent administrative level. Partner inputs suggest that the "make-or-break" factor is the **ability to present a coherent, verifiable documentation package.**

### 3.4.1. BY-PRODUCT

By-product is regulated under Art. 10 of the 2012 Act, reflecting EU Article 5 conditions.

| EU WFD Art. 5(1) – conditions (a–d) | Poland – Act of 14 Dec 2012 on Waste, Art. 10 (working translation) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(a) Further use is certain.<br>(b) Direct use without further processing other than normal industrial practice.<br>(c) Produced as integral part of a production process.<br>(d) Lawful use + no overall adverse impacts. | An object/substance arising from a production process whose primary purpose is not its production is a by-product (not waste) if jointly:<br>(1) its further use is certain;<br>(2) it can be used directly without further processing other than normal industrial practice;<br>(3) it is produced as an integral part of the production process;<br>(4) it meets all relevant requirements (including legal requirements) concerning the product, environmental protection, and protection of human life and health for the specific use, and such use will not cause overall adverse effects;<br>(5) it meets detailed conditions for recognition as a by-product if such conditions are laid | Substance: Poland adds an explicit 5th condition about "additional detailed conditions" where defined (EU law or national implementing rules). Lexicon: "recognition as by-product" and explicit reference to detailed conditions beyond the basic test. |

| | | |
|---|---|---|
| | down in EU law or in national implementing provisions. | |

The Polish approach is evidence-driven: by-product status is supported when the operator can demonstrate certainty of use, standard handling steps, and lawful use backed by quality parameters. In practice, formal documentation quality is critical to reduce requalification risks.

### 3.4.2. BP PROCEDURE PATHWAY

Poland is one of the few partner countries with a clearly recognisable formal administrative pathway based on notification ("zgłoszenie") for recognising a substance/object as a by-product. This pathway is anchored in the by-product provisions of the Waste Act and is operationalised through a notification submitted to the competent regional authority. In practice, Polish institutional BIP (Public Information Bulletin) pages published by regional administrations describe the service and list required documentation, and they commonly provide an official notification form. For example, the Pomorskie BIP publishes a form ("Zgłoszenie uznania … za produkt uboczny") that also lists the required content and documents (applicant identification, place of generation, description of the substance/object and quantities, description of the production process where it arises and the process in which it will be used, etc.). This makes the Polish by-product pathway comparatively more standardised and "procedure-like" than in most other partner countries.

## 3.5. AUSTRIA (PP8)

Austria implements WFD principles through the Waste Management Act 2002 (AWG 2002). By-product is regulated under §2(3a) (Nebenprodukt. **The framework is EU-consistent, while the operational pathway depends on how clearly the stream's use and quality can be framed**.

**Competent authority**

Austria applies waste governance through a combination of federal and regional responsibilities. Competent authority functions (permitting, controls, enforcement) typically operate at the relevant administrative level, meaning that implementation may reflect both national legal framing and regional practice. Partner inputs confirm that by-product classification is supported when a stream has a stable use case, clear quality parameters, and simple, standard handling steps.

### 3.5.1. BY-PRODUCT

By-product is regulated under AWG 2002 §2(3a), reflecting the EU Article 5 four-condition test.

| EU WFD Art. 5(1) – conditions (a–d) | Austria – AWG 2002 §2(3a) (working translation) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(a) Further use is certain. | A substance or object that is the result of a manufacturing process whose main objective is | Lexicon: "manufacturing process", "protected interests" and explicit "harmless/fit" framing. |

| | | |
|---|---|---|
| (b) Direct use without further processing other than normal industrial practice.<br>(c) Produced as integral part of a production process.<br>(d) Lawful use + no overall adverse impacts. | not the manufacture of that substance/object can be considered a by-product and not waste only if:<br>(1) it is certain that the substance/object will continue to be used;<br>(2) it can be used directly without further processing that goes beyond normal industrial processes;<br>(3) it is produced as an integral part of a manufacturing process; and<br>(4) further use is lawful, in particular it is harmless/fit for the intended beneficial purpose, protected interests are not impaired, and all relevant legal provisions are complied with. | Substance: EU-equivalent; lawful use clause is worded more as a compliance + safeguards requirement. |

The Austrian approach tends to favour clear definition of the use pathway, with attention to whether any treatment steps remain within normal industrial practice for the receiving sector. Quality consistency and lawful use framing are central to maintaining a defensible by-product status.

### 3.5.2. BP PROCEDURE PATHWAY

In Austria, no single universal by-product notification form was identified as mandatory at federal level. By-product status is primarily framed through the legal test in AWG 2002, §2(3a) (Nebenprodukt), and implementation tends to be documentation-based and handled through competent authority practice. The RIS legal database provides the up-to-date statutory text and is the most reliable institutional reference for the by-product conditions. While Austria does not appear to provide a single federal "required documents list" as a universal template for by-products, the framework allows for authority clarification mechanisms in borderline cases within the broader waste-status determination system; therefore, operators typically rely on a structured evidence dossier aligned with the statutory conditions.

## 3.6. SLOVAKIA (PP9)

Slovakia implements WFD principles through Act No. 79/2015 Coll. on Waste. By-product is addressed under §2(4). **The legal framing is closely aligned with EU concepts**, while practical application depends on evidence packages and administrative interpretation for the intended use scenario.

#### Competent authority

Waste governance is typically managed through national environmental administration with implementation functions (authorisations, controls, inspections) carried out at the competent administrative level. Partner inputs highlight that by-product classification is strongest when it is supported by a clear use scenario and minimum quality controls.

### 3.6.1. BY-PRODUCT

By-product is addressed under Act 79/2015 §2(4), reflecting the EU Article 5 four-condition logic.

| EU WFD Art. 5(1) – conditions (a–d) | Slovakia – Act No. 79/2015 Coll. on Waste, §2(4) (official EN text) | Main lexical / substantive differences |
|---|---|---|
| EU WFD Art. 5(1) – conditions (a–d)<br>(e) Further use is certain.<br>(f) Direct use without further processing other than normal industrial practice.<br>(g) Produced as integral part of a production process.<br>(h) Lawful use + no overall adverse impacts. | By-product is a substance or object which meets the conditions below:<br>(a) it is a result of a production process, the primary aim of which is not the production of that item;<br>(b) its further use is certain;<br>(c) it can be used directly without any further processing other than normal industrial practice;<br>(d) it is produced as an integral part of a production process;<br>(e) its further use complies with product/environment/health requirements and will not cause overall adverse impacts;<br>(f) it meets specific criteria, if determined under specific regulations;<br>(g) a permit has been granted. | Substance: Slovakia goes beyond EU Art. 5 by adding extra conditions: (f) "specific criteria if set" and (g) an explicit permit requirement. This is a major divergence in implementation burden. |

In practice, Slovakia's by-product pathway requires a clear link to production, certainty of further use, limited processing framed as normal practice, and lawful/safe use supported by basic quality evidence and traceability.

### 3.6.2. BP PROCEDURE PATHWAY

Slovakia is a special case among partner countries because the legal definition of by-product in the Waste Act includes additional requirements beyond the EU four conditions, including a clause indicating that consent/approval has been granted if required under §97(1)(o). This means that by-product recognition may involve an authorisation/consent step in certain situations, not only self-classification based on evidence. The official English version of Act No. 79/2015 Coll. on Waste is available from the Ministry, while the legally authentic consolidated Slovak text can be accessed via Slov-Lex; both references support a cautious approach in practice, encouraging early confirmation of the competent authority pathway where the consent requirement may apply.

# 4. COMPARATIVE ANALYSIS

This chapter is the core comparative component of Deliverable 3.1.3. Building on the EU baseline (WFD Article 5) and the country analysis in Chapter 3, it compares how the TeBiCE partner countries operationalise the by-product concept in law and in practice. The aim is not to re-state legal definitions, but to make implementation differences visible and comparable, with a focus on what matters for operators and policy makers: clarity, documentation burden, procedural standardisation, predictability of outcomes, and the overall transferability of the by-product pathway across borders.

The by-product concept is formally harmonised at EU level, yet the country mapping shows that Member States can diverge in three main ways:

(i) lexical and evidentiary emphasis (e.g., “use is safeguarded/ensured”);

(ii) procedural framing (self-assessment vs notification/permit expectations);

(iii) additional national conditions that go beyond the four EU requirements (notably in Slovakia, and partly in Poland).

These differences directly affect legal certainty and transaction costs, particularly for SMEs managing seasonal and heterogeneous agricultural streams.

The comparative matrix below translates national approaches into a common set of indicators, which are:

- Regulatory clarity

Degree to which the national legal provision on by-products is clearly formulated and easy to interpret in operational terms, including how explicitly it reflects the EU Article 5 conditions and how many grey areas remain (e.g., “certainty of use”, “normal industrial practice”).

- Standardisation of BP procedure

Extent to which the by-product pathway is supported by a consistent and repeatable procedure (e.g., clear steps, recognised documentation packages, predictable authority interaction), as opposed to being handled mainly through ad hoc or highly case-by-case interpretations.

- Official guidance availability

Availability and practical usefulness of public guidance supporting implementation (e.g., ministerial/agency guidance notes, official FAQs, interpretative documents, templates), including how accessible and sector-relevant these materials are for operators.

- Predictability of outcome

How reliably an operator can anticipate the classification outcome when providing a complete and coherent evidence package, considering consistency of interpretation, stability of administrative practice, and the presence of clear acceptance criteria.

– SME-friendliness

Practical accessibility of the by-product pathway for SMEs, considering administrative complexity, documentation burden, costs of evidence generation, availability of templates/support, and the extent to which the system tolerates limited internal regulatory capacity.

– Transnational transferability

Extent to which a by-product classification approach (evidence package, documentation logic, and procedural expectations) can be replicated across project countries with minimal rework—i.e., how far a "common guideline" remains valid and usable across borders despite national differences.

The scale is qualitative (High/Medium/Low) to remain robust across different administrative systems and to avoid false precision. Where relevant, short notes explain the key drivers behind each score.

Legend

- 1 - High = generally clear/standardised/predictable/accessible in most contexts
- 2 - Medium = workable but dependent on case features, evidence strength, or local practice
- 3 - Low = fragmented, unclear, or strongly dependent on discretionary/case-by-case interpretation

| Country | Regulatory clarity | Standardisation | Official guidance availability | Predictability of outcome | SME-friendliness | Transnational transferability |
|---|---|---|---|---|---|---|
| Italy | 2 | 2 | 2 | 2 | 2 | 2 |
| Slovenia | 2 | 2 | 2 | 2 | 2 | 2 |
| Germany | 1 | 1 | 1-2 | 1-2 | 2 | 1-2 |
| Poland | 2 | 2 | 2 | 2 | 2-3 | 2 |
| Austria | 1 | 1-2 | 2 | 1-2 | 2 | 1-2 |
| Slovakia | 2 | 2-3 | 2 | 2-3 | 3 | 2-3 |

The comparative analysis supports a clear conclusion: a harmonised and transferable output is feasible for by-product classification, because the EU baseline is stable and because the national differences can be addressed through a common evidence logic rather than through country-specific procedural replication.

## 4.1. CROSS-COUNTRY "COMMON FACTORS"

Across the six partner countries, the comparative analysis highlights a set of recurring common factors that determine whether an agricultural stream can credibly be treated as a by-product. These are the "practical translation" of Article 5 into operational reality.

- Legal certainty is driven by use certainty, not by stream origin alone

All countries start from the same logic: a residue from production may be a by-product. In practice, however, the decisive factor is almost always whether the **further use is demonstrably certain**. This shifts the key operational effort from "describing the production process" to "locking the use pathway" through identified users, recurring demand signals, and contractual or organisational arrangements.

- The boundary between "normal industrial practice" and "recovery" is the main grey area

The most frequent interpretive bottleneck is the treatment/conditioning step. Across countries, classification becomes fragile when the stream requires processing that looks like a waste recovery operation rather than normal handling in the receiving industry. The practical implication is that a by-product pathway is most defensible when conditioning steps are minimal, standardised, and can be clearly framed as normal industrial practice for that downstream sector.

- "Lawful use" translates into a compliance narrative and minimum QA/QC

Even when the stream has a clear use, by-product status remains weak if operators cannot show that the use is lawful and safe. Across countries, this almost always requires at least a minimum evidence set: a specification sheet, basic contaminant/quality parameters relevant to the use, and a proportionate QA/QC and traceability approach. The "lawful use" condition is therefore a bridge to product and sector rules, and it forces operators to think like product suppliers rather than waste holders.

- Divergence is concentrated in procedural framing and additional national conditions

The main cross-country differences are not the four EU conditions themselves, but:

(i) how much of the burden is placed on formal documentation and standardisation,

(ii) whether authorities require notification/permit-like steps, and

(iii) whether national law adds conditions (notably Slovakia; partially Poland). These divergences directly impact SMEs, which often lack resources for extensive documentation, repeated testing, and administrative engagement.

Thanks to the analysis of the various by-product reception methods and the common factors that emerged, common guidelines are developed that allow waste to be classified as a by-product.

## 4.2. BY-PRODUCT TOOL

The output of Deliverable D.3.1.3 is a **standardised, evidence-based tool** to support the preliminary classification of agricultural residual streams as **by-products** across the TeBiCE partner countries (Italy, Slovenia, Germany, Poland, Austria, Slovakia). The tool operationalises the common EU baseline (WFD Article 5) and integrates the "best practice" implementation features identified in the country analysis, with the explicit aim of improving legal certainty, comparability and replicability.

Although the by-product concept is harmonised at EU level, national frameworks show differences in how the Article 5 conditions are phrased, how strongly they emphasise use certainty, and how far they translate legal requirements into procedural expectations. The TeBiCE By-product Tool therefore follows a two-layer structure:

1. Core EU-aligned pathway: one harmonised decision logic and minimum evidence package, valid across all partner countries and pilot streams.
2. Country sensitivity flags: a short set of country-specific checks that do not alter the core method but prevent false expectations in jurisdictions where additional procedural or evidentiary elements may apply.

This design makes the tool transferable (single method for all pilots) while remaining robust (explicitly reflecting practical divergences observed across partner countries).

By-product classification is not a label: it is an evidence-based qualification. A residue can be treated as a by-product only when the operator can demonstrate compliance with the applicable conditions and keep compliance demonstrable over time, through appropriate management, controls and documentation.

Golden rule (cross-country): by-product status is robust only when:

(i) further use is ensured

(ii) no processing beyond normal industrial practice is required.

If either element is weak, the stream tends to remain legally uncertain and is more likely to be managed under waste rules.

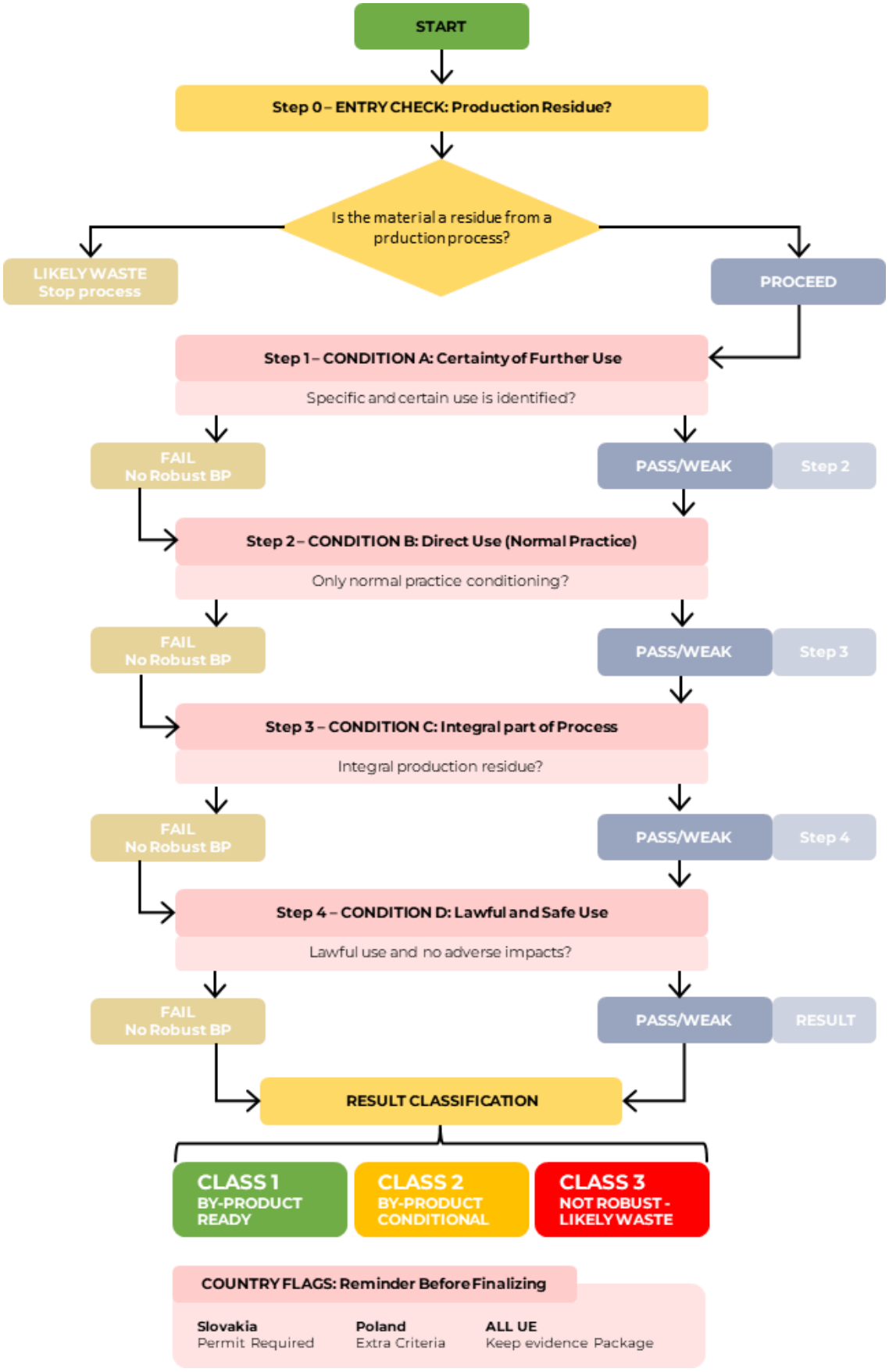
The By-product Tool is composed of three integrated components:

- (A) Decision pathway: a harmonised step-by-step logic aligned with the EU Article 5 conditions, producing a classification outcome.
- (B) Minimum Evidence Package (MEP): a standard dossier structure that enables operators to demonstrate each condition through verifiable documents and data.
- (C) Readiness levels: a simple output classification that supports decision-making and prioritisation (ready / conditional / not robust).

The tool produces one of the following outcomes:

- Class 1 – By-product Ready: all conditions are met and the evidence package is complete.
- Class 2 – By-product Conditional: no condition fails, but one or more conditions are weak; corrective actions are required before the by-product pathway can be considered robust.
- Class 3 – Not robust as by-product (likely waste): at least one condition fails, or the evidence package is insufficient to support a defensible qualification.

### 4.2.1. DECISION PATHWAY



The diagram represents the logical classification flow to follow for each production waste item that one would like to classify as a by-product. All the different steps are specified below:

- Step 0 – Entry check: production residue and segregation

Confirm that the material is a production residue arising from a production process and is managed as a segregated stream. A by-product pathway is viable only if the material is clearly linked to a production process and is kept separate from waste and contamination sources.

Minimum evidence (Step 0):

- process description and point of generation (where the stream arises)
- typical quantities and seasonality profile
- segregation rule (how the stream is kept separate from waste/contamination)
- basic storage conditions to preserve intended use

If the stream cannot be clearly identified as a production residue and properly segregated, the by-product route becomes structurally weak.

- STEP 1 – Condition A: further use is ensured (certainty of use)

Demonstrate that the further use is not merely possible, but specific and ensured. In practice, certainty of use is the primary driver of legal robustness across all partner countries. In order to pass to the next step and accomplished the STEP 1, a specific intended use is defined and supported by credible evidence of real uptake.

Examples of acceptable evidence options:

- off-take contract or framework agreement;
- letter of intent supported by delivery plan (volumes, frequency, logistics) and receiver acceptance;
- documented internal use plan (process plan + expected consumption);
- historical evidence of regular uptake (transactions or recurring use);

Decision logic:

- PASS if use is specific, identified and evidenced;
- WEAK if use is plausible but not yet secured (requires strengthening);
- FAIL if use is generic (“it could be used for…”) or not evidenced;

- STEP 2 – Condition B: direct use with no processing beyond normal industrial practice

Demonstrate that the stream can be used directly or after only those handling steps that qualify as normal industrial practice for the receiving sector. This condition is the most frequent “grey area” in practice: it is essential to distinguish normal handling/conditioning from operations that resemble waste recovery.

Minimum evidence:

- list of handling/conditioning steps from generation to use;
- justification that each step is normal practice in the relevant industry (benchmark, receiver requirements, standard practice references);
- explicit statement that no recovery-like transformation is required to make the stream usable;

Decision logic:

- PASS if steps are limited, standardised and defensibly normal practice;
- AT RISK/WEAK if steps are more intensive or not clearly standardized;
- FAIL if the required processing resembles waste recovery or substantial transformation beyond normal practice.

- STEP 3 – Condition C: produced as an integral part of a production process

Show that the stream is generated as an integral part of the production process and that the primary aim of the process is not the production of this stream.

Minimum evidence:

- clear description of the production process and the stage where the stream is generated;
- simple mass-balance logic (primary product + residue) where relevant;
- traceability of origin (site/process line) and segregation measures.

Decision logic:

- PASS if the stream is a routine/structural residue of a production process;
- FAIL if origin is unclear, mixed with waste, or intentionally discarded.

- STEP 4 – Condition D: lawful use and no overall adverse environmental or human health impacts

Demonstrate that the intended use is lawful and safe and will not cause overall adverse impacts. This condition requires a compliance narrative supported by basic quality and risk controls.

The tool standardises this condition through three mandatory building blocks:

1. Compliance mapping: identify the downstream regulatory framework relevant to the intended use (product/environment/health rules).
2. Specification sheet: define key quality parameters and acceptance limits fit for the intended use, including critical contaminants where relevant.
3. QA/QC and traceability plan: demonstrate how compliance is maintained over time (sampling, testing, records, non-conformity handling).

Decision logic:

- PASS if compliance mapping + specification + controls are in place

- WEAK if one building block is incomplete (requires completion)
- FAIL if the intended use is not legally compatible or risks cannot be controlled

- RESULT CLASSIFICATION

The By-product Tool is designed to be used iteratively. Classification is not necessarily a one-off decision: a stream may move from Conditional to Ready as the intended use is secured, specifications are stabilized, and monitoring and traceability measures are implemented.

- Class 1 – By-product Ready: This outcome applies when all Article 5 conditions are met and the Minimum Evidence Package (MEP) is complete and auditable, including completion of any relevant country sensitivity checks. In this case, the by-product pathway can be considered robust for operational use and scaling, and the next step is typically to proceed with replication/scale-up and contractual standardization.
- Class 2 – By-product Conditional: This outcome applies when no condition fails, but one or more conditions are weak or at risk, and the MEP is incomplete in specific areas. The stream may still be eligible as a by-product, but the classification is not yet sufficiently robust for replication or large-scale marketing. After corrective actions are implemented, the tool should be re-applied to confirm whether the stream reaches Class 1.
- Class 3 – Not robust as by-product (likely waste): This outcome applies when at least one Article 5 condition fails, or when the pathway relies on processing that goes beyond normal industrial practice (i.e., recovery-like transformation) and therefore cannot be defended under the by-product concept. In this case, the stream should be managed under waste rules.

### 4.2.2. MINIMUM EVIDENCE PACKAGE (MEP) - DOCUMENT SET

To ensure comparability and transferability across the TeBiCE partner countries, the tool adopts a harmonised Minimum Evidence Package (MEP) structured as a set of standard documents. This approach reflects the strongest operational practices identified in the country analysis:

(i) formal completeness and structured content (Poland-style);

(ii) evidence continuity and record retention (Italy DM logic);

(iii) authority-ready documentation with clear boundary management and traceability (Germany practice).

The table below constitute the minimum dossier required to demonstrate the by-product conditions in a consistent, auditable and replicable way.

| DOCUMENT TO PRODUCE | WHAT IS | EXAMPLE OF MINIMUM CONTENT |
|---|---|---|
| Stream Identity & Origin | A one-page technical identification record that defines the stream and demonstrates it is a production residue with a clear origin and controlled segregation. | – stream name and description (local + English);<br>– source process and point of generation;<br>– quantities, seasonality, variability;<br>– segregation and contamination prevention measures;<br>– storage conditions and maximum storage time; |
| Intended Use Declaration | A formal statement demonstrating that further use is specific and ensured, supported by evidence of uptake (external receiver or internal use). | – intended use (specific purpose) and receiving sector/application;<br>– identified receiver/user (or internal unit);<br>– evidence of certainty (contract/internal plan/historical uptake);<br>– logistics plan; |
| Normal Industrial Practice | A short technical note proving that any handling/conditioning steps qualify as normal industrial practice and do not amount to recovery-like transformation. | – list of handling steps and rationale as normal industrial practice;<br>– receiving sector practice benchmark or receiver requirements;<br>– exclusion of recovery-like transformation; |
| Lawful Use & Risk Management | A combined compliance dossier linking the intended use to the applicable downstream legal framework and defining product-like quality requirements and risk controls. | – compliance mapping to downstream legal framework<br>– key parameters and limits<br>– pollutant/contaminant checks where relevant to use<br>– environmental/health protection reasoning linked to evidence |
| Quality and Traceability Control Plan | An operational self-monitoring and traceability plan proving that compliance is maintained over time and can be audited. | – sampling/testing frequency;<br>– traceability system (lot/batch definition; chain of custody)<br>– non-conformity procedure |

# 5. CONCLUSIONS

This deliverable (D3.1.3) supports WP3 by addressing a practical barrier that affects the scalability of TeBiCE pilots: the same agro-food residual stream may face different legal interpretations across countries, mainly due to differences in implementation practice and evidence expectations. Starting from the EU Waste Framework Directive baseline (Articles 5 and 6), the document compared the partner-country frameworks and translated the results into an operational output.

The main conclusion is that by-product classification (Article 5) can be meaningfully compared and standardised across the project countries, because it relies on a stable four-condition test and, in most cases, an evidence-based approach. The real "make-or-break" points across countries are: (i) proving that further use is certain/ensured, (ii) keeping any handling steps within normal industrial practice (and clearly documenting this boundary), and (iii) supporting lawful use with a minimum level of specification, QA/QC and traceability.

End-of-Waste (Article 6) was analysed to frame the regulatory context, but it is not turned into a standard tool in this deliverable because it is inherently process- and end-use dependent and tends to require stream-specific criteria and authority assessment. For this reason, the operational output focuses on by-products.

The core output of D3.1.3 is therefore the TeBiCE By-product Tool: a harmonised decision pathway with three readiness levels (Ready / Conditional / Not robust) and a Minimum Evidence Package structured as standard documents. This tool is designed to help partners and operators move from "can this be a by-product?" to "what do we need to prove it, with which documents, and what should we fix if it is not robust yet?". It also supports replication across countries through a common evidence logic, while highlighting country sensitivity flags (e.g., notification or consent/permit expectations where applicable).