

TURNING WASTE INTO VALUE

Industrial symbiosis as
a driver for
competitiveness and
EU alignment in the
Western Balkans

POLICY PAPER

→ December 2025

Turning waste into value

Industrial symbiosis as a driver for competitiveness and EU alignment in the Western Balkans

December 2025, 2nd edition

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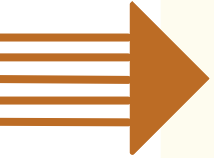


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Executive Summary

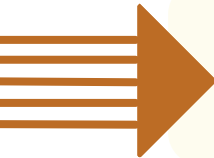
Key Observations

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- The WB6 economies are at different stages of waste management development: while Serbia and partly Montenegro have defined end-of-waste and by-product frameworks, Albania, Bosnia and Herzegovina, Kosovo and North Macedonia remain at early stages. This uneven capacity highlights the need for harmonised approaches and knowledge sharing across the region.
 - Any IS policy must meet environmental, social, and economic feasibility criteria, ensuring that solutions deliver ecological benefits, are financially viable, and generate fair social outcomes.
 - Low hanging fruits synergies should serve as entry points, using readily available waste streams (slag, fly ash, wood waste, plastics, sludge, etc.) to initiate early projects and build confidence among stakeholders.


Long-term Focus

- 
- Reducing transactional costs is vital, particularly through co-located industrial symbiosis that minimises logistics barriers.
 - The ultimate vision is the creation of Eco-Industrial Parks (s), aligned with the international UNIDO/World Bank/GIZ framework,¹ enabling clustered companies to exchange materials, energy, and knowledge efficiently.

Role of the Common Regional Market (CRM)

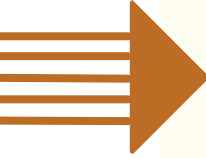


The CRM is a crucial vehicle for scaling IS by harmonising definitions of waste, by-products, and secondary raw materials, streamlining customs procedures, and supporting education, skills, and financing mechanisms.



¹ UNIDO, World Bank Group, GIZ, An International Framework for Eco-Industrial Parks, Version 2.0 (2021).

Development Recommendations



Key actors:

- Ministries of environment and economy (policy alignment, regulation, incentives)
- Chambers of commerce (aggregation, governance, outreach)
- Customs authorities (cross-border facilitation)
- Industrial zone and park coordinators (local implementation)
- Industry leaders (practical deployment of exchanges)

Employment and skills:

- IS must create quality employment across all pay ranges, not just low-wage positions. Skilled engineers, technicians, managers and IT specialists are equally essential.
- The region must internalise knowledge through expertise development, structured training, and continuous exchange of best practices.

Digitalisation:

A regional digital platform should serve as the backbone for IS, integrating:


- Material exchange tools
- Education and training
- Collaboration and matchmaking
- AI-supported symbiosis estimation and mapping

Local facilitation:

Micro-regional technical agents and local promoters are needed to animate companies, map flows, prepare business cases and accelerate project initiation at the ground level.

Roadmap

A phased implementation of the integrated regional IS system is recommended to allow the leveling of differences, careful alignment with EU regulations and piloting policies to generate feedback loops, based on which further planning may be possible. The following section outlines the roadmap for this development.



Conclusion

All regional stakeholders, businesses and local facilitators need to actively participate in shaping and advancing this integrated IS platform. Their engagement is vital to ensuring its success, fostering innovation, and accelerating the transition towards a sustainable and collaborative regional economy. Only through a collaborative, hands-on approach, it is possible to build the future of industrial symbiosis. In essence, this Policy system is gauged to enable:

1. A predictable regional regulatory environment
2. Organised access to funding
3. Enhancing skills
4. Open trade for resilient sustainable supply chains

WB6 Integrated Industrial Symbiosis System Development Roadmap

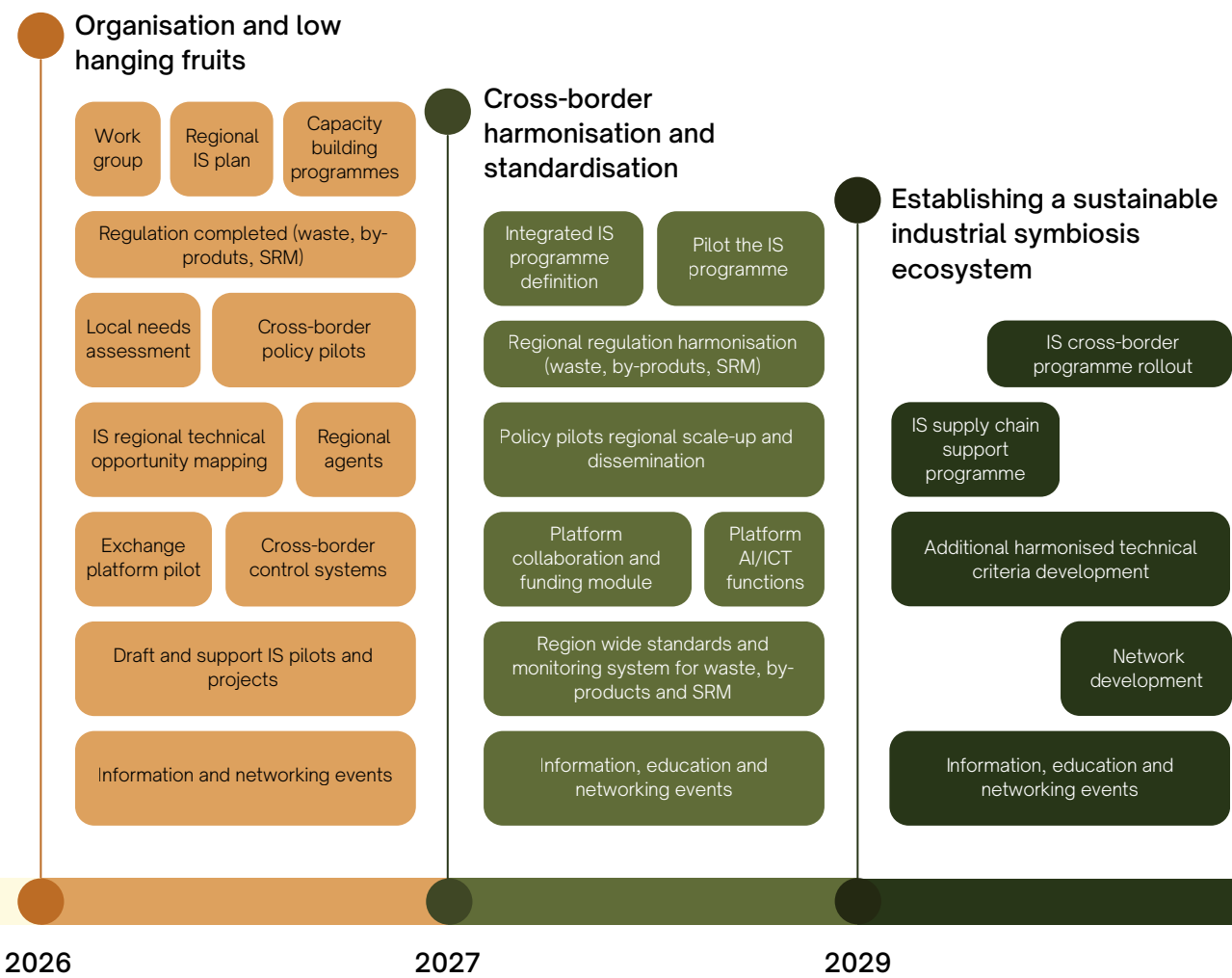


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LIST OF ABBREVIATIONS

| | |
|-----------------|---|
| AI | Artificial Intelligence |
| AFD | Agence Française de Développement |
| AHK | German Chambers Abroad (Aulandshandelskammer) |
| B2B | Business to Business |
| BSI | British Standards Institution |
| BiH | Bosnia and Herzegovina |
| CBAM | Carbon Border Adjustment Mechanism |
| CE | Circular Economy |
| CEFTA | Central European Free Trade Agreement |
| CEN | European Committee for Standardization |
| CENELEC | European Committee for Electrotechnical Standardization |
| CMUR | Circular Materials Use Rate |
| CO ₂ | Carbon Dioxide |
| CRM | Common Regional Market |
| CWA | CEN Workshop Agreement |
| EBRD | European Bank for Reconstruction and Development |
| EIB | European Investment Bank |
| EIP | Eco-Industrial Park |
| EN | European Norm |
| EOL | End-of-Life |
| EoW | End-of-Waste |
| EPOS | Enhanced energy and resource Efficiency and Performance in process industry Operations via onsite and cross-sectorial Symbiosis |
| EPR | Extended Producer Responsibility |
| ESG | Environment Social Governance |
| EU | European Union |
| FISS | Finnish Industrial Symbiosis System |
| GEF | Global Environment Facility |
| GET | Green Economy Transition |
| GHG | Green House Gas |
| GIS | Geographic Information System |
| GIZ | Gesellschaft für Internationale Zusammenarbeit |
| ICT | Information and Communication Technology |
| IFC | International Finance Corporation |

| | |
|-------|---|
| IMPEL | European Union Network for the Implementation and Enforcement of Environmental Law |
| IPA | Instrument for Pre-Accession Assistance |
| IS | Industrial Symbiosis |
| KPI | Key Performance Indicator |
| LCA | Life Cycle Assessment |
| LCSA | Life Cycle Social Analysis |
| LoW | List of Waste Codes |
| MFA | Material Flow Analysis |
| MRV | Monitoring, Reporting and Verification |
| MSME | Micro, Small and Medium Enterprises |
| NISP | National Industrial Symbiosis Programme |
| OVAM | Openbare Vlaamse Afvalstoffenmaatschappij, engl.: Public Waste Agency in the region of Flanders (Belgium) |
| PAS | Publicly Available Specifications |
| PET | Polyethylene Terephthalate |
| POP | Persistent Organic Pollutants |
| PRO | Producer Responsibility Operators |
| RCC | Regional Cooperation Council |
| RDF | Refuse-derived Fuel |
| R&D | Research and Development |
| SIDA | Swedish International Development Cooperation Agency |
| SITRA | The Finnish Innovation Fund Sitra |
| SLCA | Life Cycle Sustainability Assessment |
| SME | Small and medium-sized enterprises |
| SRM | Secondary Raw Materials |
| SWAN | A digital Solid Waste reuse plAtform for BalkaN |
| TRIS | Technical Regulation Information System |
| UNDP | United Nations Development Programme |
| UNIDO | United Nations Industrial Development Organization |
| WB | World Bank |
| WB6 | Western Balkans Six |
| WBIF | Western Balkans Investment Framework |
| WBS | Waste, By-product and Secondary raw materials |
| WFD | Waste Framework Directive (Directive 2008/98/EC on waste) |
| WSR | Waste Shipment Regulation |

What is Industrial Symbiosis?

The European Committee for Standardization (CEN) defines industrial symbiosis (IS) as follows:²



“Industrial symbiosis is the use by one company or sector of underutilised resources broadly defined (including waste, by-products, residues, energy, water, logistics, capacity, expertise, equipment and materials) from another, with the result of keeping resources in productive use for longer.”

This definition is usually used as a working text to describe major aspects of this institution. Therefore, the industrial symbiosis is widely used in major European Union (EU) regulatory and policy documents to promote resource efficiency, sustainable use of resources, circular economy and waste management goals.

In that light, myriads of actors should or could be involved in the industrial symbiosis system development, about which we will write more in this Policy Brief. **In short, national, subnational, local and industrial bodies should contribute with their respected obligations, resources and capacities, to achieve a functioning industrial symbiosis.**

Moreover, in the context of the Western Balkans Six (WB6), policy harmonisation, direct collaboration and mutual resource investment are suggested to become pillars of industrial symbiosis, focusing on key resource circulation such as:

- Waste
- By-products
- Secondary raw materials.

Finally, the processes of

- Regional programme formation
- Monitoring and reporting structures
- Collaboration avenues
- Financial frameworks

are suggested to be the key pillars of the building the regional industrial symbiosis of the future. This will be the focus of the Policy Brief below.

² CEN Workshop Agreement CWA 17354:2018, “Industrial Symbiosis: Core Elements and Implementation Approaches,” Section 1 (Scope), CEN/CENELEC, December 2018.

Industrial Symbiosis in Real Life

Currently, almost a hundred formats of success are reported as success cases, yet this document will focus on the two most prominent that may introduce working models for the regional development in the Western Balkans.

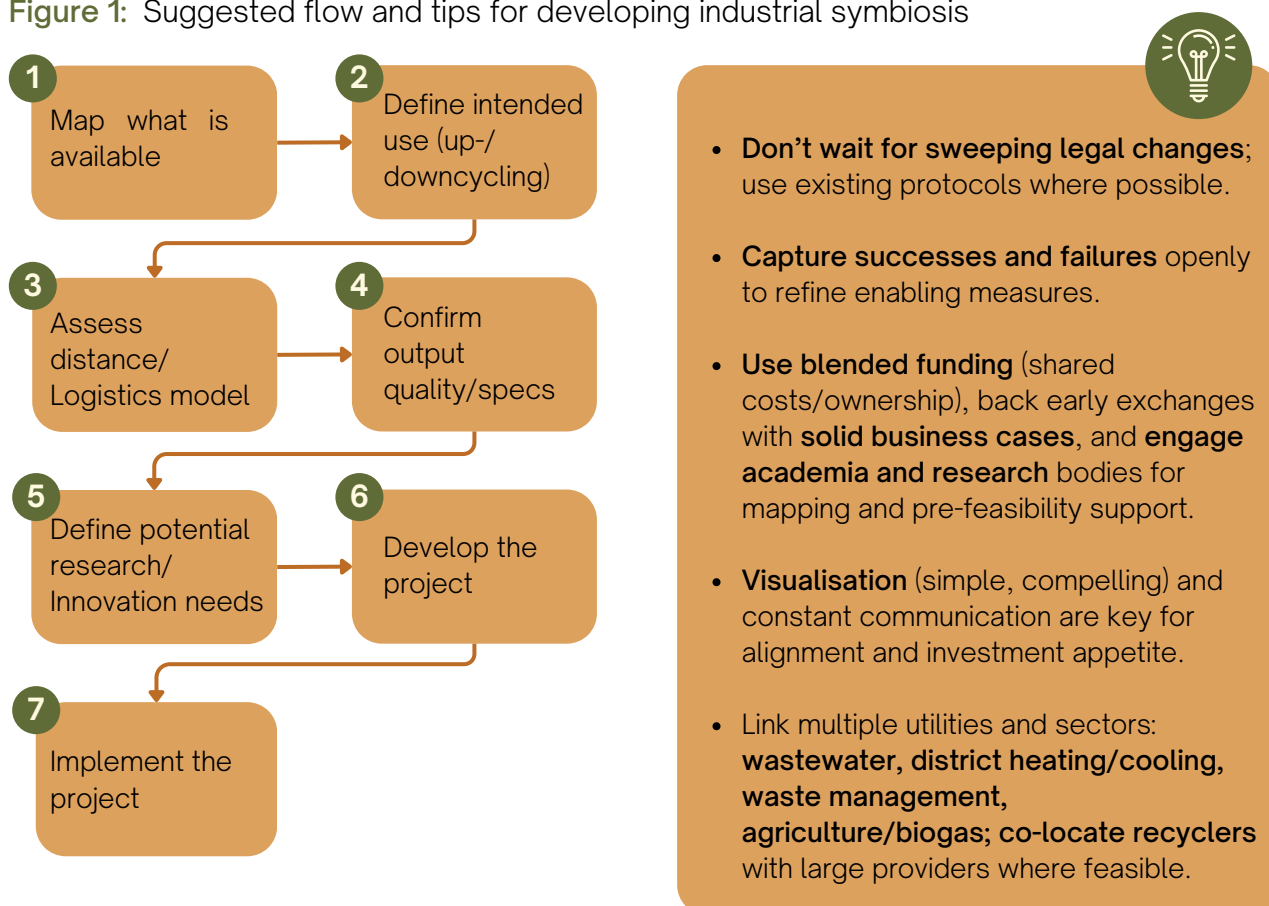
Kalundborg Symbiosis

✦ The Kalundborg Symbiosis is factually a thriving partnership-based collaboration between the local Danish municipality of Kalundborg and industrial actors, where numerous symbiotic flows (34 flows currently) are developed to achieve environmental, social and economic goals. Some key characteristics are:

- Municipality involvement primarily in addressing energy flows and waste flows.
- Relative proximity of exchanging partners, where flows are distributed almost directly between partnering actors.
- The governing body of the Kalundborg Symbiosis is gauged to provide the necessary support in connecting interested parties. It acts as a facilitator of the symbiosis, more than a regulator of the flows.
- Local growth of industrial symbiosis enabled rapid advancement, using the “low hanging fruits” approach to develop the system and attract more interested parties.

One of the major conclusions from the interview with a representative of the Kalundborg Symbiosis is the logical sequence of development of early symbiotic flows (Figure 1).

Figure 1: Suggested flow and tips for developing industrial symbiosis



The Finnish Industrial Symbiosis System (FISS)

The development of industrial symbiosis in Finland had the national approach through connecting regions. Currently it strives to promote and develop a “beyond borders” model to support cross-border facilitation of circular flows.

✦ Its governing body, [Motiva](#), acts as an enabling, facilitating and monitoring actor that promotes, supports and provides tools for material exchange throughout Finland. It is supported by regional facilitators that promote, investigate and drive project-based outcomes which, in turn, increase the reuse of materials.

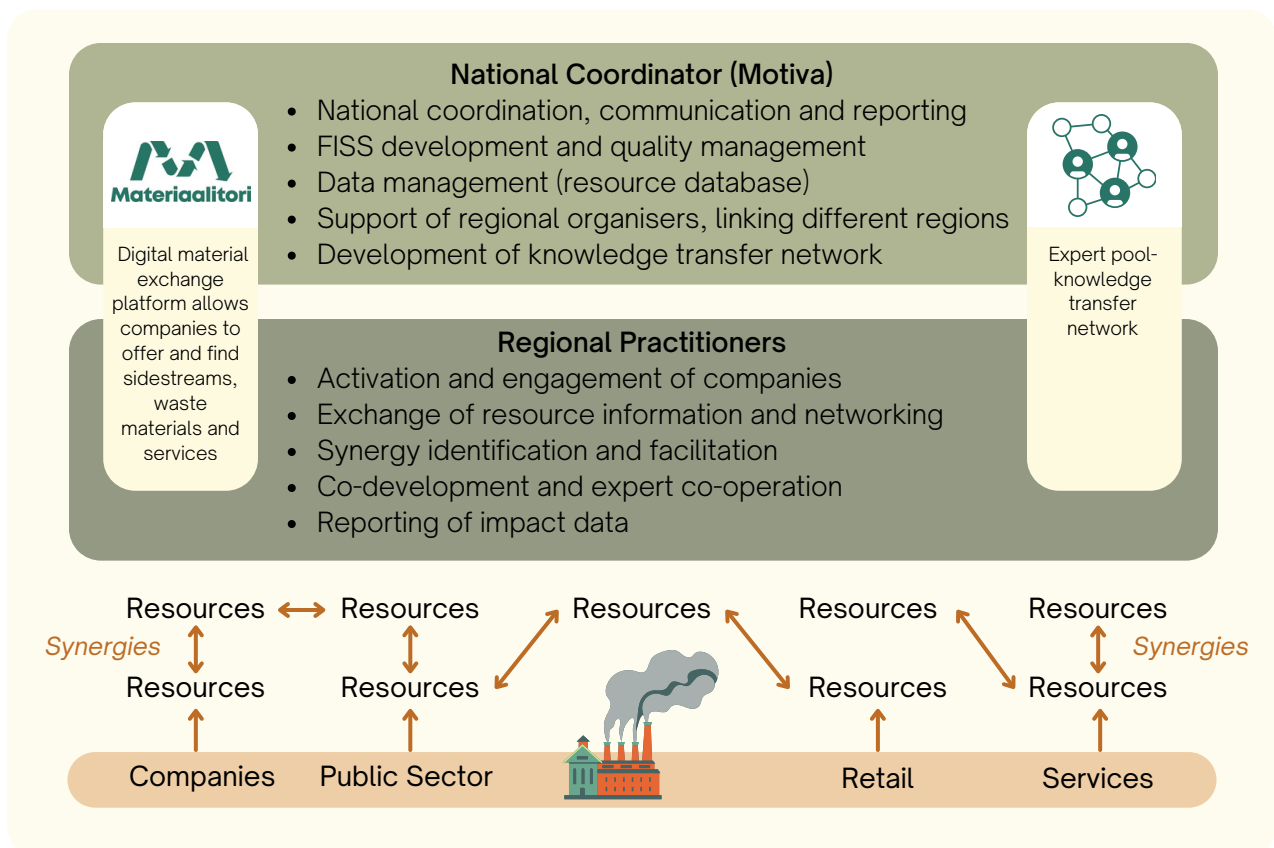
The Finnish Industrial Symbiosis System (FISS) has developed a “Material Finding” platform, [Materiaalitori](#), that acts as a binding element for actors involved in exchanges. It is not a material marketplace, yet it acts as a market creation and coordination tool. It regulates flows in view of providing the process for legal proof-of-market and conditionally allows local public utility companies to engage in materials exchange. It is also used as a tool for companies that require waste management services.

Practitioners – Facilitators drive outcomes

Regional facilitators (often from development agencies/universities) onboard firms, run workshops and convert matches to projects. Trust and continuity matter more than software features.

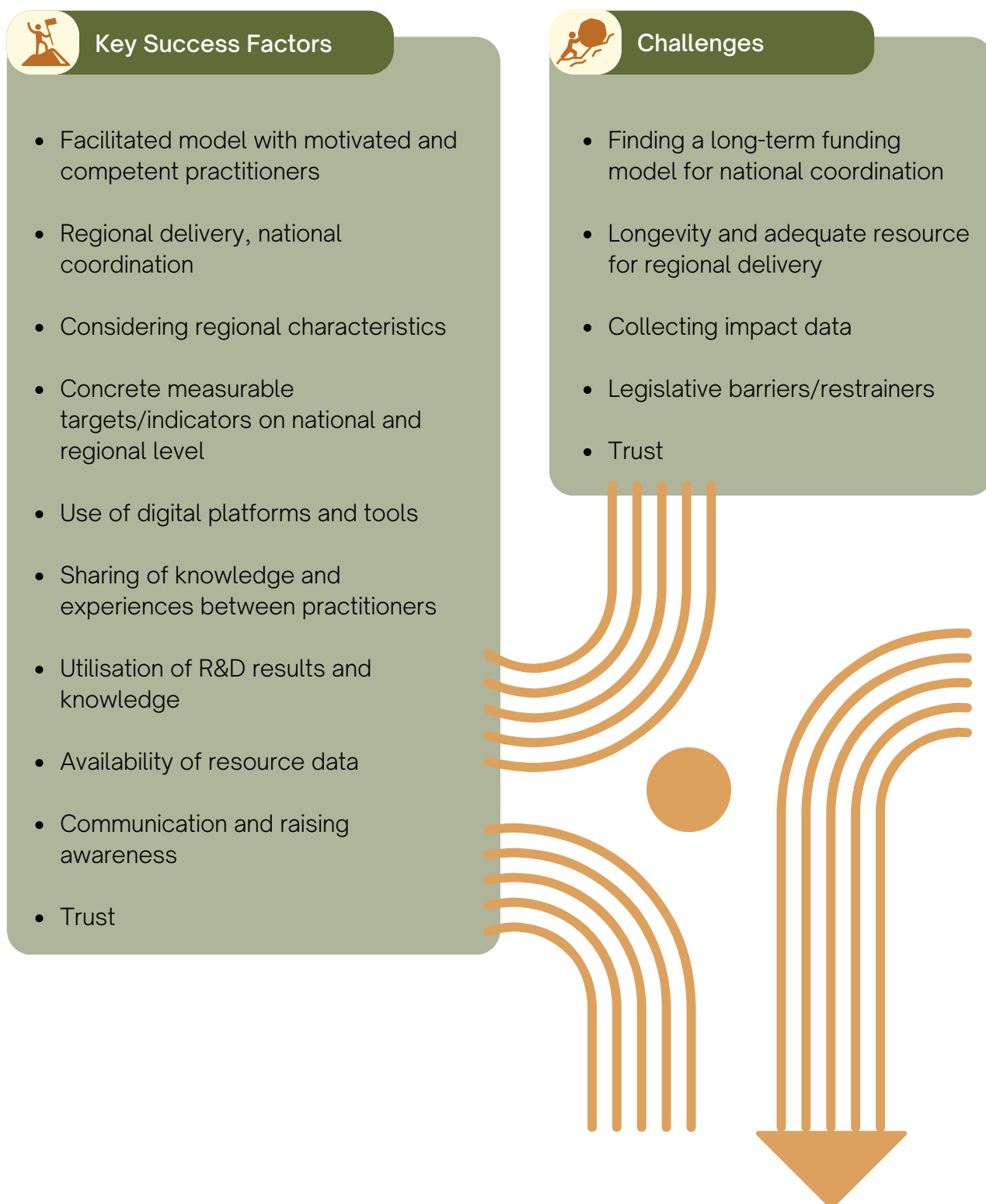


Figure 2: Overview of the FISS system



The system is run based on the current policy and regulatory framework, where it does not influence policy development, but is anchored to make use of resources dedicated to circular economy and resource efficiency programmes. Hence, its early development was driven by a programme supported by [Sitra](#), the Finnish Innovation Fund, to establish and pilot early exchanges.

Some key characteristics describing the FISS system are:



Policy Alignment

Policy plays an important role in enabling the movement of end-of-life (EOL) materials within and across countries. Furthermore, harmonisation with major export markets for WB6 economies, such as the EU, would facilitate not only development, but also the growth and integration of future symbiotic systems.

It is globally recognised that unstable reverse material flows, higher and volatile prices of virgin and secondary raw materials, combined with the diminishing security of long supply chain dependencies may hamper production and value creation.

The **Common Regional Market (CRM)** is recognised as a key lever for unlocking **environmental, economic, and social benefits in the WB6**. Fragmented national markets — Albania (2.7 million inhabitants),³ Bosnia and Herzegovina (3.5 million inhabitants),⁴ Kosovo (1.7 million inhabitants),³ Montenegro (0.7 million inhabitants),³ North Macedonia (1.8 million inhabitants)³ and Serbia (6.6 million inhabitants)³— each with modest but growing economic capacities, face additional barriers in developing viable circular material systems, especially for low-value, dispersed flows (e.g. plastics, waste textiles) and low-volume, high-cost streams (e.g. metal sludge).

Therefore, harmonisation of regulation, policies and other subordinate legislation will play an important role in the industrial symbiosis development.

EU Regulation

✦ The EU positions its **Circular Economy Action Plan**, the **European Green Deal**, and the EU waste legislation as pillars for resource efficiency. The recent development of the Critical Raw Materials Act, the extended producer responsibility (EPR) system for mechanisms in textile, and the forthcoming Circular Economy Act will further increase resource efficiency within the EU, while boosting the economic case for materials circulation.

✦ Amendments to the **EU Waste Framework Directive (WFD)** add additional aspects to the WFD while maintaining the focus on waste prevention. It now sets out the definitions of by-products (WFD, Article 5), and end-of-waste status (WFD, Article 6) as new regulatory terms. These serve as precursors for the reuse of resources. Responsibility for defining these institutions in detail is largely delegated to Member States, which do so through national regulatory frameworks. One of the initiatives planned within the **EU Strategy for Sustainable and Circular Textiles** was an increase in the recycled content. This laid the ground for the recently adopted EU rules to reduce textile (and food) waste, with a mandate for all Member States to define EPR schemes within a 30-month period. ✦

³ Eurostat, [Population in enlargement countries](#) (last updated 18 July 2024). [Accessed: 23 September 2025].

⁴ Statista, [Bosnia & Herzegovina: Total population from 2010 to 2025 \(in millions\)](#), 2025. [Accessed: 23 September 2025].

⁵ European Commission, [Proposal for a Directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste \(COM\(2023\) 420 final\)](#), Brussels, 5 July 2023. [Accessed: 23 September 2025].

- ✦ Furthermore, the [Ecodesign for Sustainable Products Regulation](#) will focus, among others, on recycled content of final products, raising the demand for high-quality recyclates. The
- ✦ [Carbon Border Adjustment Mechanism \(CBAM\)](#) already places a price on embedded CO₂ emissions in imported products. With its expected scope extension (potentially covering the chemical industry, polymers, fossil-derived products, textiles, and more), it will both create opportunities for decarbonisation and increase the overall cost of materials and products exported from the WB6 economies to the EU.
- ✦ The [EU Critical Raw Materials Act](#) may raise barriers for non-recycled materials while boosting the use of recycled (secondary) raw materials. It could also create opportunities for large-scale investments in recycling plants focused on exporting to the EU.
- ✦ The [Green Deal Industrial Plan](#) further facilitates clean production and circularity and raises the need for resource-efficient and energy-efficient manufacturing. Industrial symbiosis (including energy symbiosis) may play a significant role in achieving this plan.
- ✦ The forthcoming [Circular Economy Act](#) will possibly further increase both the pressure and the opportunities to join the EU market with high-quality products and materials derived from end-of-life market.
- ✦ Finally, the [Economic and Investment Plan for the Western Balkans 2021–2027](#) may be a significant lever for reaching the state of successful circulation of materials.

The message is clear:

The future near-shore market is pulling and will reward clean production, recycled content, resource and energy efficiency.


Some regulations regarding waste and by-product flows are displayed in the Annex 1 . The EU has defined regulations for some material streams, such as:

- Scrap metal: Regulation (EU) No 333/2011
- Scrap copper: Regulation (EU) No 715/2013
- Glass cullet: Regulation (EU) No 1179/2012
- Fertilisers: Regulation (EU) No 2019/1009

WB6 Policy Context – prerequisites for success of the future of industrial symbiosis

Regulation and policy alignment with the EU regarding topics on material reuse, resource efficiency, and particularly waste management have begun within the WB6 region, yet following a different pace. **The direct reference to enabling circulation of resources between countries lays especially in four aspects of regulatory acts, being:**

- Waste collection and treatment
- The end-of-waste clause
- By-product clause
- Strategic dedication to waste reduction and reuse

Serbia has defined the end-of-waste status, and the by-product status, while the Serbian Chamber of Commerce and Industry has made one step further in providing the place to promote the registered by-products and secondary raw materials, via the **Circular Economy Platform**. The new draft amendments to the Law on Waste (September 2025) aim to further simplify procedures for granting end-of-waste and by-products status. These amendments may increase the scope of operational EPRs. In this regard, it seems that Serbia can provide valuable lessons to regional material circulation. 

Montenegro has implemented the end-of-waste status, which enables close cooperation in the domain of registered secondary raw materials.

North Macedonia is currently undergoing the redefinition of its waste management system. Within the policy and regulatory documents, the end-of-waste status is recommended as one of the enabling functions for better waste and resource management, providing the basis for the official recognition of secondary raw materials (SRM) that may re-enter the market. **The Economic Chamber of North Macedonia is in the process of developing a platform for a register of secondary raw materials, which will primarily map raw materials at the national level.** Quantities should be measured within a clear time period from when the waste is generated. The measurement should also include the legal status of the waste (how it must be handled or disposed of), as well as data on its composition, origin and producer, together with key material characteristics.

Albania's amended Law on Waste, with a draft adopted in late 2024, still offers a window of opportunity to refine and expand the legal definitions governing resource reuse. Currently, metal scrap is the only material permitted for reuse.

The barriers to be addressed are multidimensional and were identified through interviews conducted by the authors of this Policy Brief with key stakeholders involved in practical aspects of material exchange. These stakeholders include chambers of commerce, industry representatives, and supporting agencies such as GIZ and the Western Balkans Six Chamber Investment Forum. The main barriers are summarised in the table below.

Table 1:

Barriers to integrated industrial symbiosis implementation and recommended actions

| | Barriers | Recommended levers |
|---|--|--|
| Non-harmonised regulations | <p>Different legal definitions or definition gaps create practical barriers to cross-border material exchange, particularly in how countries define:</p> <ul style="list-style-type: none"> • Materials • By-products • Secondary raw materials with end-of-waste status • Waste. | <ul style="list-style-type: none"> • Harmonise the legal structure across the Western Balkans, including relevant definitions and by-laws, enabling waste exports in the region and EU. • Use the Common Regional Market framework as an existing instrument to facilitate legal alignment. • Alternatively, prioritise national-level IS development models (such as the Kalundborg or FISS) to accelerate progress within individual countries. • Define the end-of-waste status in Albania, North Macedonia, Kosovo and Bosnia and Herzegovina. • Define the by-product status institution in Albania, Bosnia and Herzegovina, Kosovo, Montenegro and North Macedonia. |
| Cross-border waste shipment difficulties | <ul style="list-style-type: none"> • Some waste streams face export difficulties due to strict customs procedures, limited capacity, or weak market and political incentives. • Strong monitoring remains essential to prevent hazardous or potentially hazardous waste from entering markets unnoticed. | <ul style="list-style-type: none"> • Develop a common regional cross-border waste regulation aligned with EU Regulation 2024/1157 on waste shipments, the still-applicable Regulation (EC) 1013/2006, and the Basel Convention. • Strengthen customs rules, capacity building, and guidelines in line with the Commission's 2015 guidance for implementing the WSR/1013/2006,⁶ and prepare for updated guidelines under Regulation 2024/1157. |

⁶ European Commission, [Commission notice on the application of certain provisions of Regulation \(EC\) No 1013/2006 of the European Parliament and of the Council on shipments of waste](#), Official Journal of the European Union C 153, 12 May 2015, p. 1–10. [Accessed: 29 September 2025].

| Barriers | Recommended levers |
|---|--|
| <p>Lack of testing and inspection laboratories</p> | <p>No common system exists for validating the technical (physical, biological, and chemical) characteristics of waste, by-products, and secondary raw materials.</p> <p>This slows down status approval and increases costs when validation must be performed outside the region.</p> |
| <p>Lack of the common Monitoring, Reporting and Verification framework</p> | <ul style="list-style-type: none"> • Several WB6 economies still use different versions of the List of Waste (LoW): Albania, BiH, and Kosovo follow the older EU 2000/532/EC list, while Serbia, North Macedonia and Montenegro apply the updated EU 2014/955/EU version (including subsequent POPs entries). • The absence of a common Monitoring, Reporting and Verification (MRV) framework creates challenges for coordinated regional planning of waste flows, industrial symbiosis opportunities, statistical reporting, and sample testing. |

| Barriers | | Recommended levers |
|---|---|--|
| EPR schemes underdeveloped | <p>EPR schemes in the region operate sub-optimally or are not yet established, limiting effective waste collection and sorting.</p> <p>This reduces the potential for investment in waste treatment facilities and constrains the production of secondary raw materials (SRMs).</p> | <ul style="list-style-type: none"> • All WB6 economies could benefit from operational or hybrid EPR schemes, implemented through Producer Responsibility Organisations (PROs), to ensure that waste is properly collected, sorted, and treated (recycled). • Regionally coordinated EPR schemes could function effectively if supported by the necessary framework conditions, enabling the establishment of selected treatment centers while avoiding underutilisation and maintaining fair economic competition. • Economic incentives can create a stable environment for resource operators—such as collectors, recyclers, and PROs. Following EU practice, incentives may initially be volume-based and later linked to the quality and market value of collected, sorted, and recycled waste streams. |
| Lack of a regional systemic, strategic vision for resource efficiency and industrial symbiosis | <p>Different aspects, goals and aspirations in economic and environmental terms may hinder the common approach of WB6 to reach a well-functioning, cross border SRM market, or industrial symbiosis.</p> | <ul style="list-style-type: none"> • Develop a common strategic document that commits countries to reuse waste, by-products and materials, contributing to measurable circular economy and decarbonisation progress, and supporting the creation of a unified SRM market. • This strategy should integrate economic, environmental, and social aspects of the industrial symbiosis collaboration platform. It should focus on: <ul style="list-style-type: none"> ◦ Reuse of resources, water, and energy ◦ Decarbonisation ◦ Provision of additional social benefits, such as raised income profiles of engaged workforce, improved general working conditions and enhanced employability and gender equality across all levels of education. • Otherwise, the social effects may remain limited to low-wage segments, limiting innovation, development capacity and development independence. |

Operational Alignment

Following the established cases of Kalundborg and FISS, as well as the interviews conducted with experts from the WB6 Chambers of Commerce, the way forward to the development of industrial symbiosis is to foster local-based synergies that are:

- Economically viable
- Environmentally sound

Industrial Zones and Material Flows

The WB6 region possesses a number of industrial zones, however, many industrial zones are using old technologies, fossil fuels and traditionally treated waste.

The key industries of importance for IS are:

- metallurgy
- energy
- chemistry
- food processing
- building materials
- new waste management sector



Preliminary material flows that could have cross-border use value through symbiosis have been identified. Many industrial zones or large industrial plants share similar waste:

1. **Thermal power plants** (Serbia, Montenegro, Bosnia and Herzegovina, North Macedonia) produce fly ash, bottom ash and slag;
2. **Steel mills** and foundries generate slag;
3. **Ore processing plants** and cement plants produce various mineral wastes;
4. The **food industry** provides biomaterials (organic residues);
5. **Wood industry** waste sawdust and wood residue.



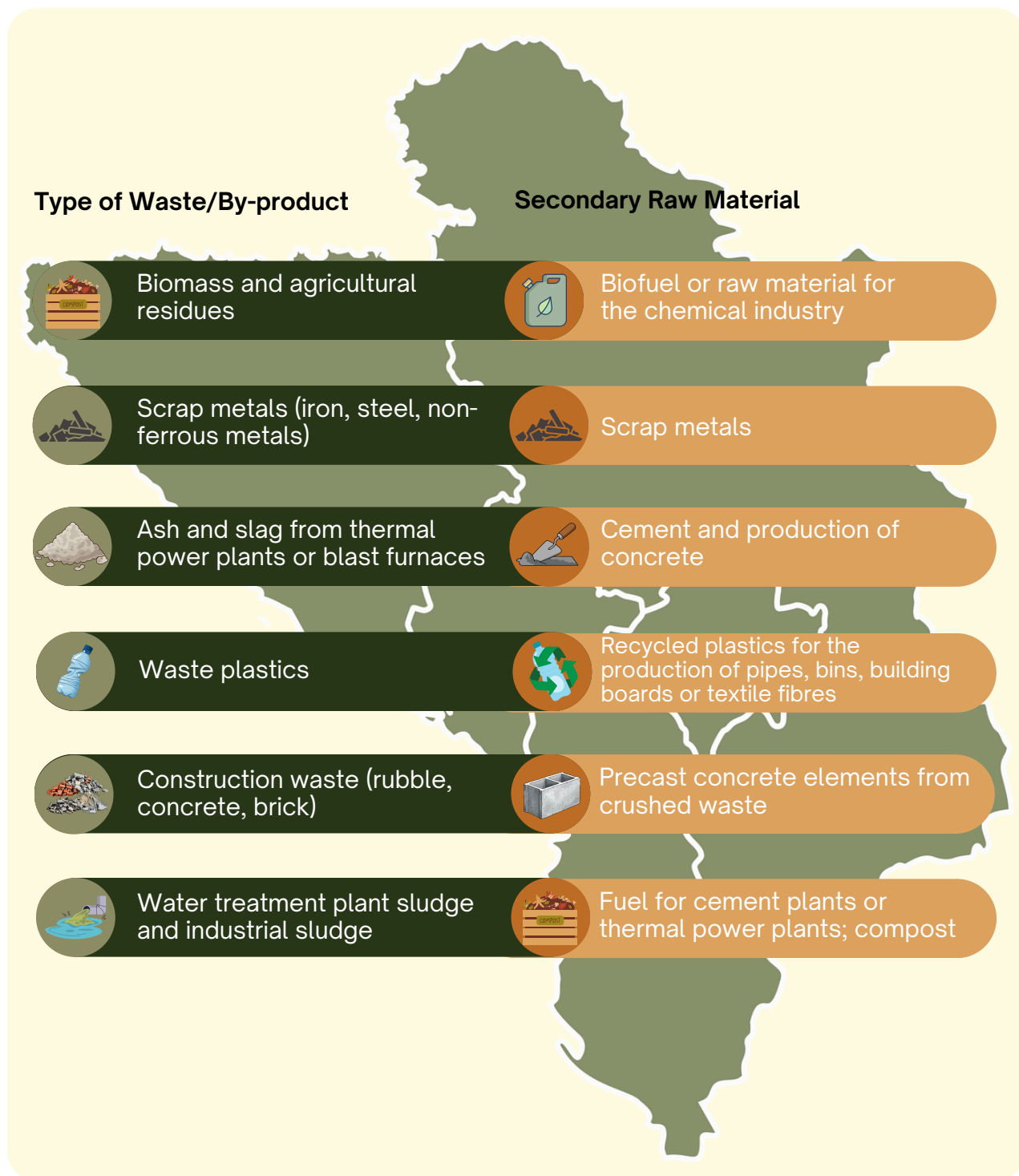
Meanwhile, large urban areas generate construction rubble, sludge from wastewater treatment plants, waste plastics, and these can be treated as industrial-urban symbiosis, as exemplified by the Kalundborg Symbiosis.

In six interviews, the need for detailed mapping of such industrial zones and their waste streams was highlighted as a basis for identifying synergies. Such a project would typically require 6 to 12 months of work with specific identified industrial parks.

In other words, it is necessary to geographically match the supply and demand for secondary resources – e.g. locate where certain waste is generated and where it could replace the primary raw materials in the neighbouring economy. Currently, this information is fragmented. Therefore, regional mapping must be worked on to make potential "loops" of material visible and achievable to place within the industrial symbiosis framework.

To make these preliminary flows easier to understand, the illustration below groups the identified waste and by-product streams together with the industries that could potentially reuse them. This simplified ‘reuse map’ does not show locations, but it highlights clear matches between available materials and possible industrial applications, helping to visualise where the first symbiosis opportunities may lie.⁷

Figure 3: Simplified ‘Reuse Map’ of potential waste and by-product streams in the WB6



⁷ For more details on material flows, please consult Annex 2 of this document.

Operational Development Areas

Based on these first success case developments, the completed research and interview-based information, the motivation to develop an integrated IS system should sprout in a planned manner. To achieve planned, synchronised outputs, several categories of development have to be addressed. The table below shows that list.

Table 2:

Development areas and recommended actions for an integrated regional industrial symbiosis

| Development areas | Recommended levers |
|--|---|
| <p>Information, knowledge, expertise and technology availability</p> <ul style="list-style-type: none"> • Expertise gap: The expertise necessary for the IS recognition, planning and implementation is not readily available. • Fragmented expert pool: Experts needed to map and implement IS are scattered across both public and private sectors. • Information gaps: Companies lack timely access to information, regulatory updates, financing, resources (excess and secondary raw materials, waste and by-products), and expert support opportunities, resulting in higher transaction costs. • Limited knowledge and technology overview: Companies lack access to best available technologies, good or best practice, successful case studies, hindering investments. | <ul style="list-style-type: none"> • Capacity-building for liaison experts: Establish a FISS-based training programme to equip regional experts to identify underutilised resource flows, assess industrial symbiosis opportunities, and support early pilot projects. • Incentivised expert pool: Create a regional expert pool by subsidising technical assistance for industrial symbiosis project development, strengthening SME capacity to engage. Required expertise includes sustainable industrial engineering and design, cleaner production, energy efficiency and renewables, environmental assessment and LCA, carbon footprinting, circularity analysis, and business/financial modelling. • Information platform: Develop a regional information platform to share data, guidance, and successful case studies. This would strengthen tacit knowledge exchange and centralise access for stakeholders; the RCC's Green Agenda Observatory could host or support this function. |

| Development area | Recommended levers |
|---------------------------------------|---|
| <p>Potential flows mapping</p> | <p>No real IS mapping: WB6 still doesn't have a proper industrial symbiosis mapping. With limited information and skills, local actors struggle to spot and develop IS opportunities.</p> <p>Only scattered data and information received from interviews and a few projects are available, so the current picture of material flow potential remains incomplete.</p> <p>Possible outgoing flows:</p> <ul style="list-style-type: none"> • Slag and metal waste • Bottom and fly ash • Wood waste • Plastic waste • Construction waste • Industrial sludge (WWTP) • Textile waste • Manure and plant-based waste <p>Possible receiving industries:</p> <ul style="list-style-type: none"> • Glass • Construction • Cement • Chemical • Agriculture • Automotive • Wood and furniture • Textile • Packaging <p><i>More details are provided in Annex 2 – Potential materials for industrial symbiosis.</i></p> |

- Conduct a comprehensive mapping of industrial symbiosis potential across the WB6, covering material volumes, economic value, environmental impact and social effects. The mapping should highlight clear opportunities while ensuring no unintended harm to people or nature.
- Build an AI/ICT-based tool—building on earlier attempts like the SWAN project—to continuously scan technical requirements, available technologies and proven case studies.
- Turn this tool into a core module of a regional digital platform that supports ongoing identification and development of industrial symbiosis projects.

| Development area | Closer description | Recommended levers |
|---|--|--|
| <p>Data demand and standardisation</p> | <p>Current data requirements discourage private stakeholders from engaging in industrial symbiosis, while bilateral agreements often work better. There is a need to simplify and focus data demands so that they support, rather than hinder, cooperation.</p> <p>Businesses need incentives to share useful data, similar to the approach used in the FISS system, where data sharing directly supports brokerage and increases the chances of successful partnerships. The region also needs aligned and reliable data on materials, by-products and waste classifications, measurement systems, cross-border trade rules, and local resource availability.</p> | <ul style="list-style-type: none"> • Align material, by-product, and waste classifications, cross-border trade requirements, and national/local resource data so businesses have a clear basis for investing in reuse, recycled content and new infrastructure. • CEFTA, together with WB6 ministries, should lead the development of common data standards and provide capacity-building for both public and private actors. • Establish or expand the expert pool (mentioned earlier) to assist companies in collecting environmental and material-flow data, helping them to enter and benefit from industrial symbiosis networks. |
| <p>Trust</p> | <p>Business trust is crucial for the IS development. It has been voiced that trust is especially important to be established in the following areas:</p> <ul style="list-style-type: none"> • Finance • Waste flows – quantities • Waste – treatment systems • End-to-end business deals | <ul style="list-style-type: none"> • IS system provider/coordinator must ensure both the availability of data and the protection of data privacy. That is why IS system coordinator is advised not to produce business deals directly, nor to act as a data-demand authority, but to serve as a facilitator of knowledge, expertise, regional level information, and 1-to-1 business opportunity finder. • Coupled with the brokerage system, the ministerial-level controlling system is advised to connect its controlling system in order to produce law-abiding processes and material flows. • The Kalundborg Symbiosis, FISS, and NISP systems may serve as successful examples of that approach. The Chamber Investment Forum, or a rotating chambers governance system, could act as the operating structure for such a coordinator role. |

| Development area | | Recommended levers |
|------------------------|--|---|
| Digitalisation and ICT | <p>Fragmented legal, strategic, volumetric, administrative, business and impact data almost inevitably hinder the development of a regional IS.</p> | <ul style="list-style-type: none"> • Deploy a regional digital platform that will encompass at a minimum the following modules: <ul style="list-style-type: none"> ◦ Capacity building ◦ Promotion of success cases with lessons learned ◦ Regulation alignment ◦ Financial incentive rules ◦ Financial opportunities ◦ Resource flows mapping ◦ Brokerage system • The platform should be developed as an underlying backbone for the IS development. SWAN, EPOS or Serbian Chamber of Commerce Circular Economy (CCIS) platform may serve as a starting point with distinctive roles and strengths (as an education, information, and mapping hub; EPOS provides tools and methods, while SWAN may produce the ICT IS opportunity mapping tool). |
| Operational capacity | <p>Sustainable resource availability is scarce due to several reasons:</p> <ul style="list-style-type: none"> • Municipal systems vary and are often too weak to support regional business cases (e.g. glass, textiles). • Transport capacity is not optimal, nor assessed for its economic and environmental impacts. Therefore, it may create bottlenecks or unintended consequences. • Lack of basic measurement systems undermines sustainable resource exchange. • Testing, monitoring and inspection bodies lack staff, skills and resources. | <ul style="list-style-type: none"> • Local municipalities, regional authorities, and national bodies should be actively included in the final industrial symbiosis system to help secure and manage resource availability for market actors. • Strengthen staffing, skills and integrity systems so that public institutions can meet legal requirements and effectively support industrial symbiosis on the ground. |

| Development area | Recommended levers |
|---|--|
| <p data-bbox="169 248 357 309">Sustainable business case</p> <p data-bbox="416 248 863 488">Companies prioritise the economic side of industrial symbiosis, but growing environmental and due-diligence pressures mean they also need simple, clear information on environmental and social costs and benefits.</p> <p data-bbox="416 533 895 703">Weak enforcement of waste laws and low penalties make landfilling or dumping the easiest option for many MSMEs, reducing interest in IS solutions.</p> <p data-bbox="416 748 895 987">Then, the perceived high transactional costs (time investment for partner mapping, technology, financing, regulation alignment), with unclear financial and/or environmental benefits steer away from the IS currently.</p> <p data-bbox="416 1032 879 1240">Budget lines for early movers, infrastructure, transport and other support are largely absent or rely on international aid, creating ad-hoc development instead of steady, long-term incentives for IS investment.</p> | <ul data-bbox="946 248 1426 920" style="list-style-type: none"> • Support early opportunities: The IS coordinating body should create conditions for capturing low-hanging fruits by helping existing actors and emerging technologies form the first real symbiotic partnerships. • Provide steady technical and financial support: The IS system should offer stable regional assistance so local actors have the capacity and resources to undertake IS projects. • Develop a long-term regional programme: A 5–10-year support programme, with aligned sub-regional action plans, should be created to deliver clear economic, environmental and social results. |

Integrated Industrial Symbiosis Policy System for the WB6 Region

In order to establish a functional cross-border industrial symbiosis in the WB6, a phased approach with a clearly defined sequence of activities is proposed.

Short-term (0–2 years) – Organisation and Low hanging fruits

1

- **Identify several pilot cases of industrial symbiosis** that are commercially viable and have policy support.
- **Launch 3–5 pilot projects** with minimal investment, focusing on different types of synergy (material and energy).
- **Address obstacles** in delivery quality, administrative processes, technological requirements, risk detection, and compliance with EU regulations.
- **Raise awareness** through campaigns, open calls, technical networking events, and workshops where companies gain practical IS-related value.

Key Actors: chambers of commerce (aggregation), ministries of environmental protection (providing approvals and/or inspection for pilot cases)

Suggested KPIs:

- Number of pilot project proposals
- Number of pilot projects in implementation
- Number of industrial and SME participants in networking and information events

2

- **Establish an IS Mapping Technical Task Force** to conduct technical mapping of symbiotic relationships using GIS, MFA, and industrial metabolism approaches across the region.
- **Integrate high-level environmental and climate impact estimates.**
- **Ensure gender equality** and competence-based decision-making.

Key Actors: expert pool, Green Transition Task Force at the chambers of commerce, Regional Cooperation Council (RCC)

Suggested KPIs:

- Number of multidisciplinary skills acquired by members of Mapping Technical Task Force team. Suggested skills: MFA analysis, industrial engineering, LCA, environmental impact assessment, legal expertise, waste management, industrial ecology, chemical engineering
- Gender equality index

Aligned Policy Pilots: In parallel with harmonisation and pilot projects, governments and chambers should initiate aligned policy pilots. These can begin as bilateral agreements and gradually expand to the CRM framework. As IS is an organic, business-driven process, strict top-down enforcement is not advisable. **Instead, the focus should be on enabling bottom-up engagement through the following actions:**

- **Facilitate learning and knowledge exchange** among companies.
- **Increase awareness and attractiveness** of participating in IS for companies.
- **Establish supportive market rules** with environmental and social safeguards, including technical assistance for mapping, developing business cases, and conducting impact assessments such as Life Cycle Social Analysis (LCSA), Life Cycle Sustainability Assessment (SLCA), or carbon footprint analyses.
- **Promote equitable regional economic development by creating a shared or rotating governance system.** Major functions for the system governance are:
 - Capacity building (knowledge, technology, infrastructure)
 - Policy and regulation alignment
 - Sustainable financing and funding
 - Outreach (mapping opportunities, promoting the concept and networking)
 - Technical assistance
 - Orchestration (management)
- **Harmonise regulations and standards** for selected end-of-waste materials, by-products, or waste.
- **Define circular input criteria** (e.g. recycled content) within supporting policy or industrial regulation (like the Eco-design Sustainable Product Regulation, or EU Critical Materials Act).
- **Conduct needs assessments** and **establish a shared framework** for laboratory, monitoring, and control.

Aligning these pilots ensures that bilateral insights directly shape CRM implementation, promoting regional coherence and stakeholder trust.

Key Actors: ministries of environment, environmental agencies, chambers of commerce (governance system), ministries of economy, institutes with laboratory and testing capabilities, UNDP, EBRD, GIZ and other support agencies (SIDA, AFD) or chamber networks such as AHK and similar

Suggested KPIs:

- Number of proposed pilot projects
- Number of supporting technical assistance engagements (tasks)
- CO₂ abatement levels
- Life-cycle impact % reduction
- Number of policies aligned through the region
- Direct communication reach (via face-to-face events and meetings)
- Digital communication reach
- Lead conversion rate
- Number of circular input criteria implemented through open calls and through technical assistance programmes
- Total value of infrastructure, monitoring, and control facilities and institutions
- Resource productivity

- **Exchange Platform:** Develop or scale an existing digital platform for IS, enabling B2B exchanges of by-products and waste.
- Address key risks such as trust in waste quality and mismatches between supply and demand.
- Include databases of operators and build on examples like [FISS's Materiaalitori](#). Promote uptake through chambers, outreach and networking events and evolve the platform from a “waste transfer” tool into a full “by-product market platform.”
- Activate sales agents to increase the volume of registered materials, by-products and secondary raw materials.



Key Actors: chambers of commerce, subnational chamber networks, development agencies, industrial zone operators (including local municipalities), industry actors.

Suggested KPIs:

- Number of material, energy, and water symbiotic exchanges completed
- Total value of material, energy and water symbiotic exchanges completed
- Total volume of material, energy and water symbiotic exchanges completed
- Number of platform active members (six months activity threshold)

Programmatic Financing and Planning: Establish continuous multi-stakeholder networking and roundtables involving chambers, ministries, funders and industry. These should result in a strategic regional IS development plan with clear objectives, roles and budgets, providing funders with clarity on what parts of the IS system they can support and how. The plan can draw on models such as FISS or the Materials Marketplace, providing structured stages and defined financial needs. Early funder engagement in programme design will help mobilise resources more effectively.

The plan should also cover Eco-Industrial Park (EIP) development and IS integration among nearby companies through identifying priority industrial zones, linking waste and resource flows between proximate firms, and designing the necessary infrastructure and regulations to enable exchanges. Aligning EIP development with the WB/UNIDO/GIZ International Framework for EIP highlights long-term investment opportunities, while proximity-based symbiosis facilitates faster implementation, easier oversight, and lower transaction costs.

This plan should also be integrated into national policy management systems, as a strategy, a programme, a policy, or another suitable form of binding document.

Key Actors: ministries of environment, economy and chambers of commerce, funders, mapped key industrial representatives

Suggested KPIs:

- Number of unique key stakeholder participants
- Number of knowledge-transfer activities conducted with international IS facilitators
- Number of industrial park/zone operators engaged in EIP development
- Number of industrial park/zone tenants involved in assessments and planning
- Number of local self-government Memorandum of Understanding signatories
- Volume of funds mobilised with international financing organisations
- Financial leverage ratio

Medium-term (2–4 years) – cross-border harmonisation and standardisation

1 **Regulatory Harmonisation:** Coordinate WB6 governments on harmonising key definitions in waste management, including common acceptance of by-product and end-of-waste criteria, as well as procedures for cross-border movements of secondary raw materials. This harmonisation is suggested to be based on the Policy Pilots done previously in the short-term period.

It is necessary to acknowledge differences in infrastructure and business development among the economies. For example, Montenegro currently cannot hand over high-quality secondary raw materials despite generating waste, while Serbia has the capacity to process several types of waste (such as rubber, steel scrap, plastics, paper, etc.). Currently, none of the economies tackles textile end-of-life material. A system with clearly defined rules (for by-products and end-of-waste) would benefit Albania, Kosovo, Montenegro and North Macedonia by removing burdensome waste, while generating value in BiH and Serbia, where treatment facilities exist. In parallel, additional infrastructure may be built for textiles, biogenic materials, or other recognised potential industrial symbiosis flows across the region.

Administrative barriers to waste exchanges must be removed and pilot shipments facilitated, while new regulations are fully aligned with the latest Waste Framework Directive and its end-of-waste and by-product rules. National frameworks should also transpose the Critical Raw Materials Act, CBAM and the Ecodesign for Sustainable Products Regulation to encourage greater use of secondary raw materials. Alignment with the EU Regulations and conformities would bring the WB6 countries a step further to EU and avoid competitive disadvantages for supply chains.

However, transposition should be preceded by thorough ex-ante analysis for economic, material, social and environmental aspects, since unintended consequences may occur with this novel policy formats. Adapted EU policies should realistically answer to the regional capacity existence, planned capacity building, technological feasibility and economic necessity. These criteria should guide the scope and goals of such policies.

Proposed policy directions for enhancing circularity and the uptake of secondary materials in the Western Balkans:

Albania:

- Establish collection and treatment systems.
- Define legal bases for EoW and by-products (textiles, metals).
- Develop centres for secondary raw materials.
- Enable import of non-hazardous industrial waste, by-products and secondary raw materials.
- Develop economy regulations and supporting policies to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.



Bosnia and Herzegovina:

- Finalise the EPR system.
- Establish legal bases for EoW and by-products.
- Create inter-entity and cross-cantonal controls.
- Establish transparent placement systems for secondary raw materials and by-products.
- Develop economy regulations and supporting policies to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.



Kosovo:

- Establish collection and treatment systems.
- Define legal bases for EoW and by-products where economically viable (metals).
- Set up centres for secondary raw material production.
- Develop economy regulation and supporting policy to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.

Montenegro:

- Improve EPR capacity.
- Streamline cross-border waste movements.
- Draft by-laws for EoW and by-products. However, contributions are expected to remain modest due to a service-based economy.
- Develop economy regulations and supporting policies to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.

North Macedonia:

- Improve EPR capacity.
- Streamline cross-border waste movements.
- Define by-laws for EoW and constitute the legal framework for by-products.
- Establish collection and treatment systems.
- Consider shared recycling infrastructure with neighbouring countries, for materials already developed (e.g. plastics in Serbia, E-Waste in Serbia).
- Consider including EPR for textiles, following the demand from the industry.
- Develop economy regulations and supporting policies to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.

Serbia:

- Further develop criteria for EoW and by-product status.
- Advise other Western Balkan economies.
- Pilot national and cross-border exchanges.
- Develop economy regulations and supporting policies to increase the uptake of secondary raw materials, and by-products into production processes.
- Prioritise reuse over recovery or landfilling by requiring recycled or recyclable content in product technical criteria.
- Include recyclability and reuse criteria in green public procurement rules and related public procurement regulations.

Key Actors: ministries responsible for environmental protection and ministries responsible for economic development.

Suggested KPIs:

- CO₂ abatement
- Life-cycle effects improvement ratio:

$$\text{LCA Improvement (\%)} = \frac{LCA_{\text{baseline}} - LCA_{\text{project}}}{LCA_{\text{baseline}}} * 100$$

- Recycled input %
- Circular Materials Use Rate (CMUR)
- Resource productivity

Collaboration Platform: Develop additional modules for a regional collaboration platform bringing together research institutions, companies, chambers, and public authorities. The platform should foster joint research and innovation, facilitate material exchanges, and create funding opportunities. Its primary goal in its second term is to generate bankable IS projects for defined funders (EBRD, EIB, IFC, WBIF etc.). By aligning research with industry needs and fostering cross-border partnerships, the platform will translate ideas into projects ready for financing and implementation.

Key Actors: chambers of commerce, pool of experts, financing and funding institutions, ministries of economy and environmental protection

Suggested KPIs:

- Number of collaborative projects submitted
- Collaboration index, or:
 - Average monthly interactions between users (minimum Level 2 users)
 - Average monthly exchanges between users (minimum Level 2 users)

Development of a Control System:

- **Establish a harmonised WB6-wide system for verifying the quality of secondary raw materials**, using accredited laboratories recognised by the EU.
- **Improve intergovernmental exchange** of permits, documentation, and technical requirements for by-products and EoW.
- **Develop criteria ensuring quality and safety**, with environmental, social, and economic safeguards.
- **Develop customs frameworks, protocols, information exchange portal** and guidelines through the Common Regional Market mechanism for waste, by-product and secondary raw material cross border shipments, in the following areas:
 - Approval of new waste, by-product and SRM (jointly WBS) streams in the WB6, with status permits (to differentiate between end-of-waste, by-product or waste streams)
 - Inspection and allowance protocols and documentation such as permits, category codes, and other required information via the customs institution
 - WBS movement administration (loading point, transport routes, offload destination, offload receipt, volumes, codes, etc.)
 - WBS treatment system documentation (intended end process output, waste streams, further by-product streams)
 - Other supporting activities and documentation as required

Key Actors: ministries of environmental protection, ministries of economic development, chambers of commerce, RCC, customs departments, CEFTA, Common Regional Market governing body

Suggested KPIs:

- Number of certificates/declarations issued by laboratories
- Total volume of materials covered by issued laboratories' declarations or test results accepted by customs offices and administrations
- Total value of materials addressed by issued laboratories' certificates or test results accepted by customs offices and administrations
- Number of by-products registered
- Number of end-of-waste status items registered

Long-term (4+ years) – establishing a sustainable IS ecosystem

1 Integrate industrial symbiosis into industrial and environmental development strategies in each WB6 economy.

- Introduce technical and financial incentives for SME supply chain companies
- Maintain and expand the digital platform
- Connect to EU networks (e.g. CircLean). Make IS a standard business model across the region

Key Actors: ministries of environmental protection, ministries of economic development, chambers of commerce, RCC, customs departments, CEFTA, Common Regional Market governing body, industrial actors, research and innovation institutions.

Suggested KPIs:

- Number of programmes, policies dedicated to industrial symbiosis
- Total volume of funds dedicated or attracted to industrial symbiosis through policies
- Total volume (by weight) of international end-of-waste items traded within the WB6 economies
- Total value (by value) of international end-of-waste items traded within the WB6 economies
- Total value (by weight) of international end-of-waste items exported beyond the WB6 economies
- Total volume (by value) of international end-of-waste items exported beyond the WB6 economies
- Number and value of international collaborative projects with international IS operators

2 Develop an efficient EIP network system based on IS. This includes creating a regional network to exchange bulk materials, waste, and by-products, and to share knowledge, technical assistance, and support. Such a network forms both an expert pool and a support system that accelerates economic transition. Over time, individual parks may reduce reliance on support systems, leading to lower costs and reduced resource needs from funders and governments.

Key Actors: ministries of environmental protection, ministries of economic development, chambers of commerce, RCC, customs departments, CEFTA, Common Regional Market governing body, industrial actors, industrial zones and industrial park coordinators (including local municipalities), research and innovation institutions

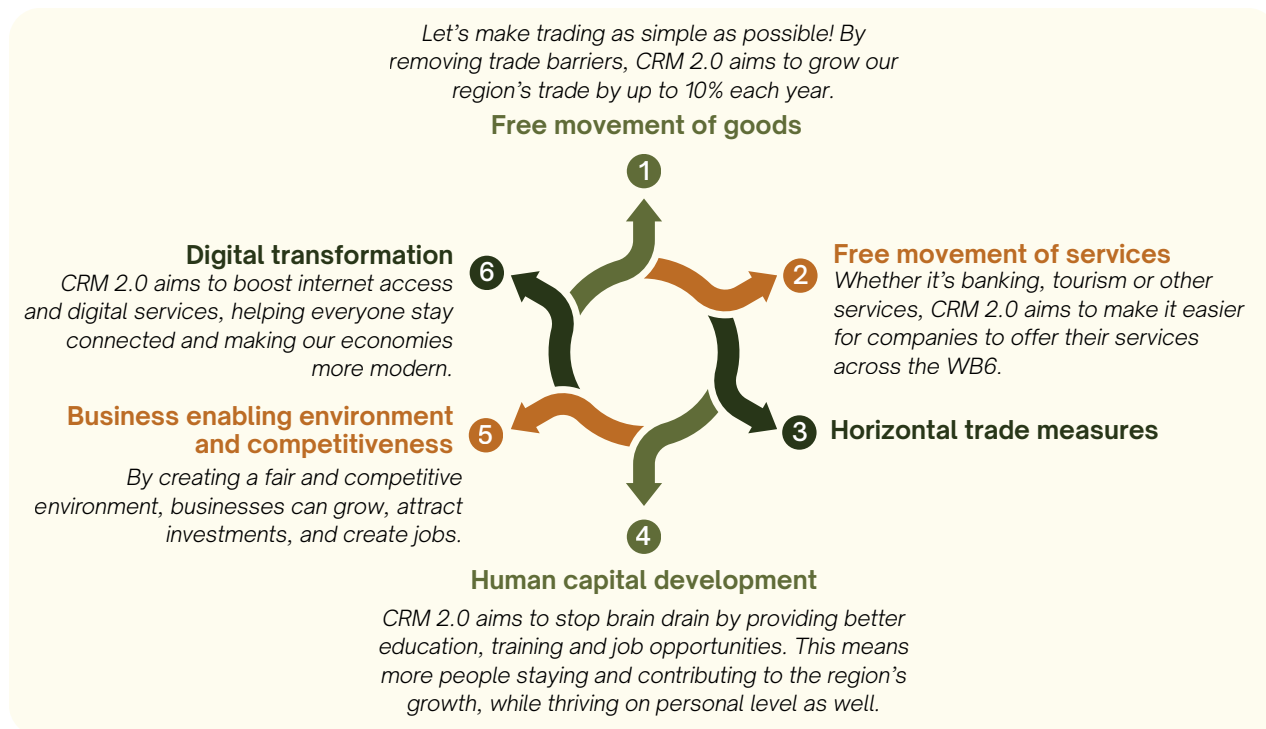
Suggested KPIs:

- Total value of IS exchanged materials
- Total volume of IS exchanged materials
- CO₂ abatement
- LCA impact decrease
- Resource productivity

The Role of the Common Regional Market 2.0

The Common Regional Market of the Western Balkans Six is a regionally owned framework built on EU rules and standards, designed to boost competitiveness and remove remaining trade barriers. It serves as a catalyst for deeper economic integration within the region and as a stepping stone toward closer alignment with the EU Single Market.

The new CRM Action Plan 2.0, covering the period 2025–2028, structures its regional initiatives across six key areas, which can be used for advancing a regional industrial symbiosis system:



- 1 2 Facilitate cross-border Industrial Symbiosis**
 - Streamline customs procedures and border mechanisms.
 - Establish safeguards and harmonised protocols for pilot projects of shipments and cross-border waste exchanges.
- 4 Strengthen skills and technical capacities**
 - Develop targeted education and capacity-building programmes on IS.
 - Create and maintain a regional expert pool to support IS project drafting and access to financing.
- 5 Enhance investment readiness and business uptake**
 - Provide advisory services and technical support to help companies design IS projects.
 - Promote financial instruments that incentivise the use of secondary raw materials.
- 6 Digitalise IS cooperation through a regional platform**
 - Introduce and scale an industrial symbiosis digital platform.
 - Integrate AI and ICT tools to match materials, identify synergies, and streamline reporting.

Funding and Resource Mobilisation

Funding should be channelled through structured programmes offered by international financial institutions and EU instruments. Potential avenues include:

- **EBRD** – [Green Economy Transition \(GET\) initiative](#), resource efficiency credit lines, small and medium-sized enterprises (SME) sustainability programmes.
- **EIB** – [InnovFin](#) and [InvestEU](#) programmes for environment and climate, funding for circular economy infrastructure and digitalisation of exchanges.
- **IFC** – Eco-Industrial Park frameworks and advisory financing for IS-linked projects (see [link 1](#), [link 2](#)).
- **WBIF** – blending facility for regional infrastructure and technical assistance with a green transition focus.
- **IPA III** (EU Instrument for Pre-Accession Assistance) – funding for regional cooperation, environmental alignment, and green transition measures.
- **Horizon Europe** & **LIFE** – research, innovation, and demonstration projects linked to IS and s

Additional Opportunities:

- **GEF** (Global Environment Facility) – supports projects reducing green house gas (GHG) emissions, enhancing resource efficiency, and promoting circular economy practices.
- **European Commission** instruments for the Western Balkans – under the [Economic and Investment Plan](#), as well as targeted energy and environmental measures.
- **Other EU programmes** – [Interreg](#) (cross-border cooperation), [Western Balkans Enterprise Development & Innovation Facility \(WB EDIF\)](#), and Green Agenda dedicated funds.

By combining these instruments, WB6 economies can diversify their financing base and ensure that IS initiatives and networks are embedded in both regional cooperation and EU transition pathways.

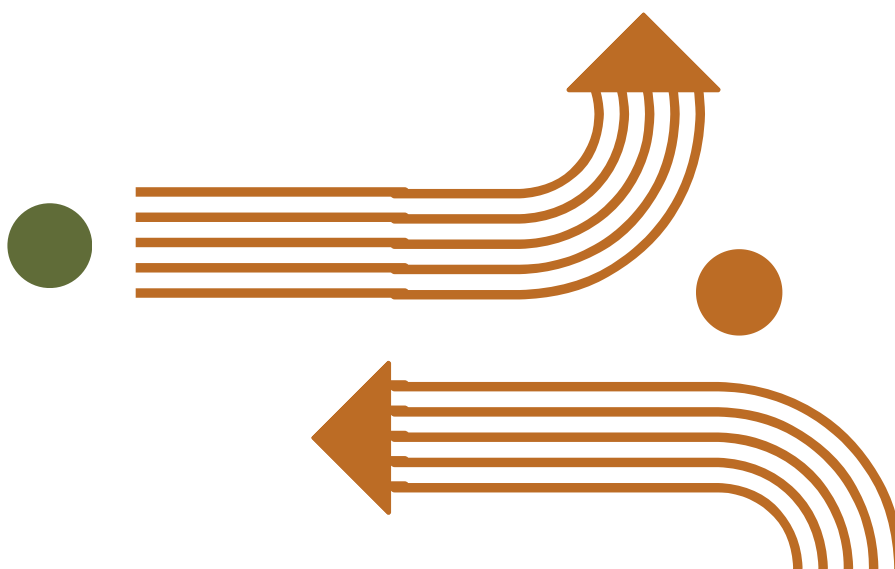
Potential Lock-ins to Be Avoided

Building a cross-border IS system requires careful attention to potential lock-ins that could undermine progress:



- **Overreliance on incineration** – undermines circularity, reduces long-term efficiency, and risks stranded infrastructure.
- **Complex data requirements** – discourage SMEs; reporting must remain balanced, transparent, and user-friendly.
- **Dependence on municipal waste streams** – slows IS diffusion and risks competition with public waste utilities. Systems such as FISS can help manage collaboration.
- **Regulatory and operational barriers** – unresolved differences can block synergies; harmonisation and phased approaches are essential.
- **Narrow focus on resource flows** – ignoring environmental and social safeguards creates legal and reputational risks. Monitoring of all impacts is required.
- **Short-termism** – pilots without long-term planning risk becoming isolated; IS must be embedded within strategies and funding frameworks.
- **Insufficient capacity building** – lack of expertise prevents uptake; investment in skills and awareness is necessary.
- **Over-centralisation** – concentrating control in a single hub reduces inclusivity and resilience; distributed networks of s and experts help balance benefits.

By addressing these risks proactively, the WB6 can build a resilient, inclusive, and scalable IS network, ensuring that IS becomes a driver of sustainable development rather than an isolated experiment.

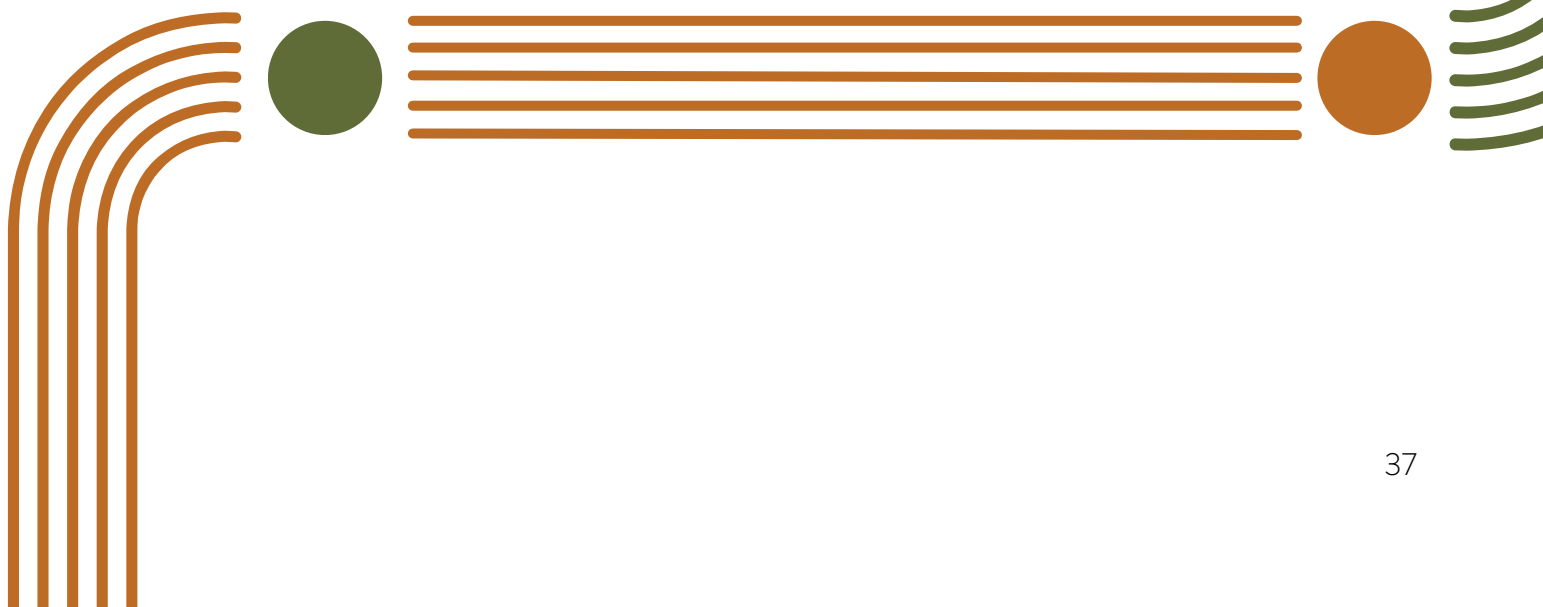


Roadmap

This roadmap operationalises the proposals described in the short-, medium-, and long-term sections, providing a clear pathway for implementation. Each action corresponds to earlier measures.

Low hanging fruits (0-1 year)

- 1 **Establish a joint working group** (chambers and ministries) with quarterly roundtables.
- 2 **Define the regional IS development plan**, including the Eco-Industrial Park as a vehicle for future IS infusion (following the International Framework).
- 3 **Launch IS technical opportunity mapping** through MFA analysis.
- 4 **Launch networking** and information campaigns and events.
- 5 **Form a local promotional wide agent team** to animate local companies and a narrow technical expert team to map potential, draft business cases and propose IS projects for funding or deployment.
- 6 **Assess local self-government needs** and capacities (industrial, expertise, financial, ESG).
- 7 Identify and act on low hanging fruits opportunities from industry.
- 8 Create a value proposition for the regional IS platform.



Short-term (1–2 years)

- 1 **Develop and deploy education programmes**, based on the needs assessment.
- 2 **Implement cross-border policy pilots** for fast movers particularly based on waste, by-products and end-of-waste materials.
- 3 **Scale or further develop the IS exchange platform**.
- 4 **Develop monitoring and cross-border control systems** (aligned with ESG principles).
- 5 **Finalise regulation development** for end-of-waste and by-product with sub-legal acts across the region.
- 6 Develop the regional platform.

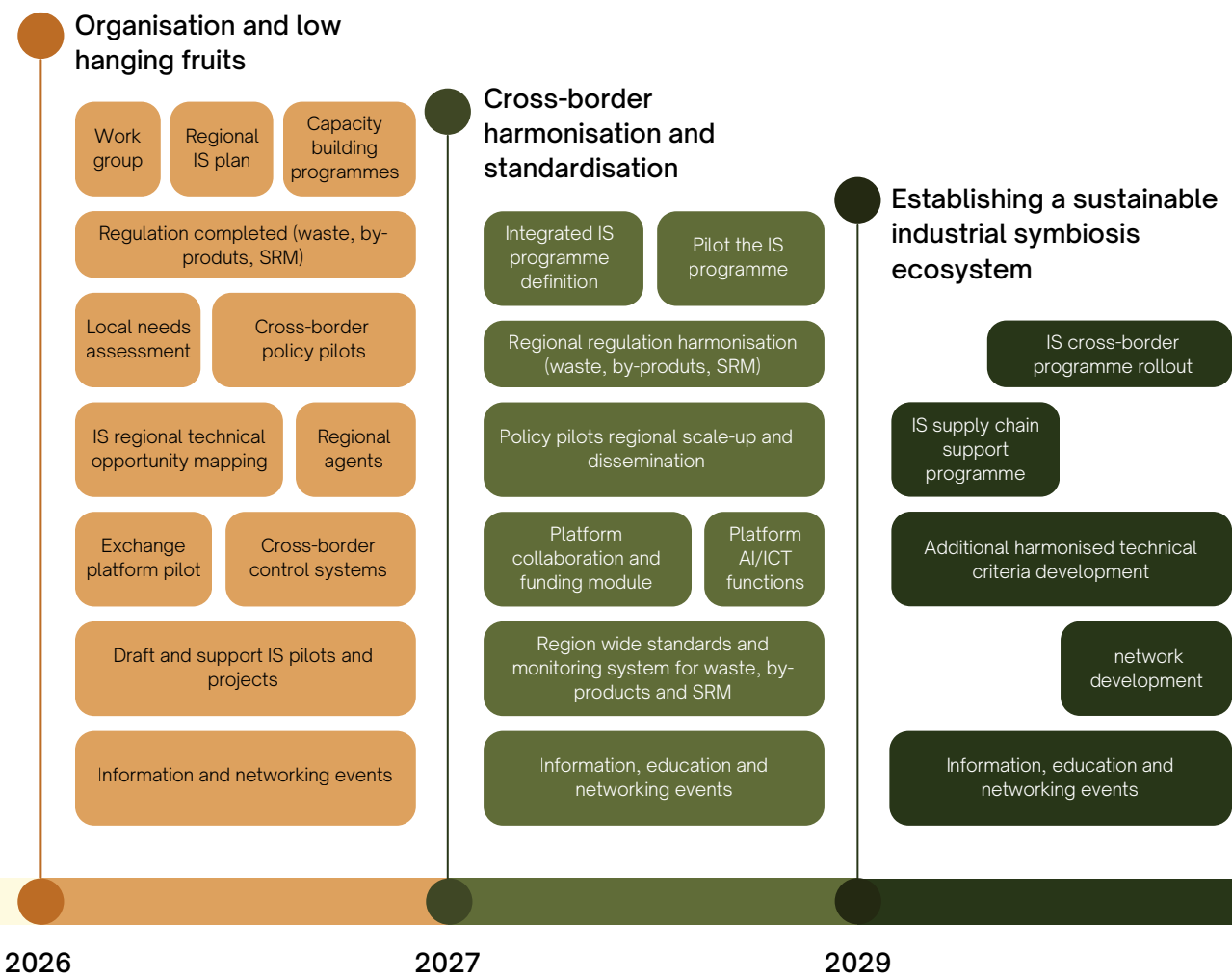
Medium-term (2–4 years)

- 1 **Finalise regulation harmonisation** for end-of-waste and by-product with sub-legal acts across the region.
- 2 **Include project/funding collaboration** sections in the platform.
- 3 Define and pilot an integrated IS/ Programme (FISS model).
- 4 **Include potential AI/ICT functions of the platform** for automatic mapping of benefits, intended and potential use of waste, by-products, and SRC to future potential clients.
- 5 **Scale up successful pilot policy projects**, pivot the unsuccessful but necessary ones, abandon the non-priority unsuccessful initiatives.
- 6 Start with the IS implementation plan.

Long-term (4+ years)

- 1 Roll out the cross-border IS/(FISS) programme.

WB6 Integrated Industrial Symbiosis System Development Roadmap



Annex 1: End-of-Waste and By-Product Regulation

An overview of EU Member States state of play

This annex complements the main document "Policy paper: Turning Waste into Value – Industrial Symbiosis as a Driver of Competitiveness and EU Alignment in the Western Balkans" by outlining the regulatory framework for by-products and end-of-waste criteria across EU Member States, highlighting national approaches, harmonisation efforts, and lessons for the Western Balkans to support circular economy practices.

Introduction: Industrial symbiosis – when waste or a side stream of one process becomes a raw material for another – depends on a clear legal framework. Through the Waste Management Directive 2008/98/EC (amended 2018/851), the EU introduced the concepts of by-products (material that is produced as part of production, but meets the conditions to be non-waste) and end-of-waste (EoW). These mechanisms remove regulatory barriers so that high-quality recycled materials can be freely used and traded as products, rather than being treated as waste. For industrial symbiosis to work, it is crucial that regulations clearly define when a material is not waste – thus fostering a circular economy, while preserving (metal, municipal, construction, organic, sludge, ash, plastic, etc.), the conditions and permitted uses of the material.

Note: All EU Member States have transposed the basic provisions of Directive 2008/98/EC into their waste laws. The conditions for a by-product are generally the same:¹

- the material is produced as an integral part of production
- there is some further use without prior treatment
- it meets all technical and health standards for that use
- its further use does not harm the environment or health

Similarly, waste ceases to be waste when, after a prescribed recovery process, it meets specific quality criteria and there is a market for that purpose. The table below ([page 41](#)) lists the key national regulations and criteria by country. The EU has adopted common criteria for some streams (e.g. iron, steel and aluminum scrap metal; glass fracture; copper scrap metal; as well as recycled fertilisers) that apply directly in all Member States. Below is an overview of the national regulations of all EU Member States governing the definition of by-products and end-of-waste criteria, including the types of waste covered.

¹ French Ministry for Ecological Transition, [Different Categories of Waste](#).

All EU Member States have introduced uniform EU principles into their legislation – which ensures basic similarity: the definition of by-products and the conditions for end-of-waste status are largely identical, common EU regulations for certain materials (metal scrap, glass, copper, as well as the new Fertilisers Regulation 2019/1009) apply everywhere, creating a minimum level of harmonisation.

However, there are differences between countries in their approach to detail:

- **France, Italy, Estonia, Portugal** have proactively developed national criteria for multiple waste streams, covering specific materials (compost, waste-to-waste fuels, construction aggregates, waste tires, waste paper, etc.).
- Others are slower – they rely on general provisions and a case-by-case approach (**Scandinavia, Malta, Lithuania**, etc., often without formal criteria).

There are also different types of applications:

- **Austria** and **Germany** focused on construction waste and compost,
- **France** on various industrial streams (oils, chemicals, fabrics),
- **Italy** and **Spain** on major recyclates (fuels, rubber, paper),
- while smaller countries waited for EU guidelines.

Technical requirements (quality standards, test methods) may be stricter in some countries (e.g. the Dutch leaching limits are very rigorous), while others have taken over existing EU or industry standards (BSI PAS, CEN, ISO) without further tightening.

These experiences of the EU suggest that the WB6 region can learn: all the economies of the region have already begun to align their regulations with the EU acquis. The next step is to operationalise the concept of by-products and end-of-waste status.

It is recommended to adopt clear guidelines or regulations in WB6, modelled on successful EU examples, like:

- **standards for quality compost** as in Slovenia (which would facilitate the use of bio-waste as fertiliser),
- **criteria for recycled building aggregate** as in Austria/Germany (for use in infrastructure projects), or for waste tyres and plastics as in France, Italy or Portugal – in order to safely use secondary raw materials in industry and construction.

It is advised to coordinate these criteria regionally (preferably to adopt the strictest EU practices) to allow materials to circulate freely among the countries of the Western Balkans without waste status, thus encouraging a wider industrial symbiosis in the region.

With the implementation of existing EU quality standards and certification, the Western Balkans can facilitate investment in recycling infrastructure and the development of secondary raw materials markets, while protecting the environment – which will accelerate the transition to a circular economy and move closer to EU goals.

Table 1: Non-exhaustive list of waste status policies and regulations in EU Member States

| Country | Waste/By-product flow | Use | Stage | Notification | Revision |
|---------|-----------------------------------|--|----------|--------------|----------|
| Germany | Substitutional building materials | BTP | Project | 2017 | |
| Austria | Solid and liquid waste | Fuel | | 2009 | |
| Austria | Recycled wood | Wood industry | | 2011 | |
| Austria | Recycled building materials | BTP | Final | 2015 | |
| Belgium | Papers, inert waste aggregates | Recycling | Project | 2017 | |
| Belgium | Animal by-products | Soil amendment | Project | 2018 | |
| Spain | Paperboard | Recycling | Final | 2020 | |
| Spain | Rubber and Rubber powder | Sports fields, games, rubber articles, bituminous blends | Project | 2021 | |
| Estonia | Biodegradable waste – composting | Soil amendment | Final | 2012 | |
| Estonia | Urban STEP sludge | STEP sludge product, based on STEP sludge and biodegradable waste (compost, digestate, or other by product such as biocoal, dry residues, ash) | Final | 2017 | |
| Estonia | Tyre chips | Shale oil | Final | 2018 | |
| Estonia | Waste containing hydrocarbons | Fuel component | Project | 2018 | |
| Estonia | Construction and demolition waste | BTP | Project | | |
| Estonia | Digestats of methanisation | Soil amendment | Project | 2020 | |
| Greece | Elastomers | Recycling | Final | 2019 | |
| Ireland | Recycled gypsum | Plaster | Final | 2010 | |
| Ireland | Used tyres | Ballots for surface installations | Rejected | | |

| Country | Waste/by-product flow | Use | Stage | Notification | Revision |
|-------------|--|---|---------|--------------|----------|
| Italy | Solid Recovery Fuels (CSR) | Fuel | | 2012 | |
| Italy | Bituminous concrete | BTP | Project | 2018 | |
| Italy | Rubber from used tyres | Rubber articles, lower layers of playgrounds and sports areas, filling of sports surfaces, construction, chemical industry, foaming agents for the steel industry | Project | 2018 | |
| Italy | Absorbent products for the person | Secondary raw materials: cellulose, super absorbent polymers, plastics | Project | 2019 | |
| Italy | Paperboard | Recycling | Project | 2020 | |
| Italy | Scanning residues of roads | Inert component | Project | 2020 | |
| Latvia | End-of-life tyres | Rubber | Final | 2018 | |
| Netherlands | Recycled aggregates | BTP | Project | 2014 | |
| Netherlands | Granulates | BTP | Final | 2014 | |
| Netherlands | Compost and slurry | Fertiliser | Project | 2016 | |
| Poland | Asphalt | Road technology | Project | 2021 | |
| Portugal | Biodegradable waste – composting and anaerobic digestion; Soil amendment | | Final | 2014 | |
| Portugal | Plastic recovered | Plastic not intended for combustion, fuel transformation, pyrolysis (and similar technologies), disposal, or discontinuation | Final | 2016 | |
| Portugal | Rubber from used tyres | Rubber not intended for combustion, pyrolysis (and similar technologies), disposal, or abandonment | Final | 2017 | |

| Country | Waste/by-product flow | Use | Stage | Notification | Revision |
|----------------|--|--|---------|--------------|----------|
| Portugal | Organic waste | Soil Amendment | Project | 2019 | |
| Czech Republic | Bituminous mixture | BTP | Project | 2019 | |
| United Kingdom | Granulates of inert waste | BTP | Final | 2005 | 2013 |
| United Kingdom | Biodegradable waste – composting | Soil Amendment | Final | 2008 | 2012 |
| United Kingdom | Rubber from used tyres | Construction, automobile, construction, high consumption | Final | 2009 | 2014 |
| United Kingdom | Biodegradable waste – anaerobic digestion | Soil amendment | Final | 2009 | 2013 |
| United Kingdom | Flying ash and ash under the fireplace | BTP | Final | 2010 | |
| United Kingdom | Lubricating oils | Fuel | Final | 2011 | 2014 |
| United Kingdom | Ashes of poultry, feather and straw litter | Soil amendment | Final | 2012 | |
| United Kingdom | Biomethane | Gas | Final | 2014 | |
| United Kingdom | Recycled gypsum | Plaster, amendment, cement | Final | 2014 | |
| United Kingdom | Plastics not from packaging | Secondary raw material (chips or pellets) for plastics | Final | 2014 | |
| United Kingdom | Flat glass | Glass Calcines | Final | 2014 | |
| United Kingdom | Steel slag | BTP | Final | 2015 | |
| Slovakia | Waste | Fuels | Final | 2015 | |
| Slovenia | Biodegradable waste – composting and anaerobic digestion | Soil amendment | Final | 2013 | |

Recommended further reading

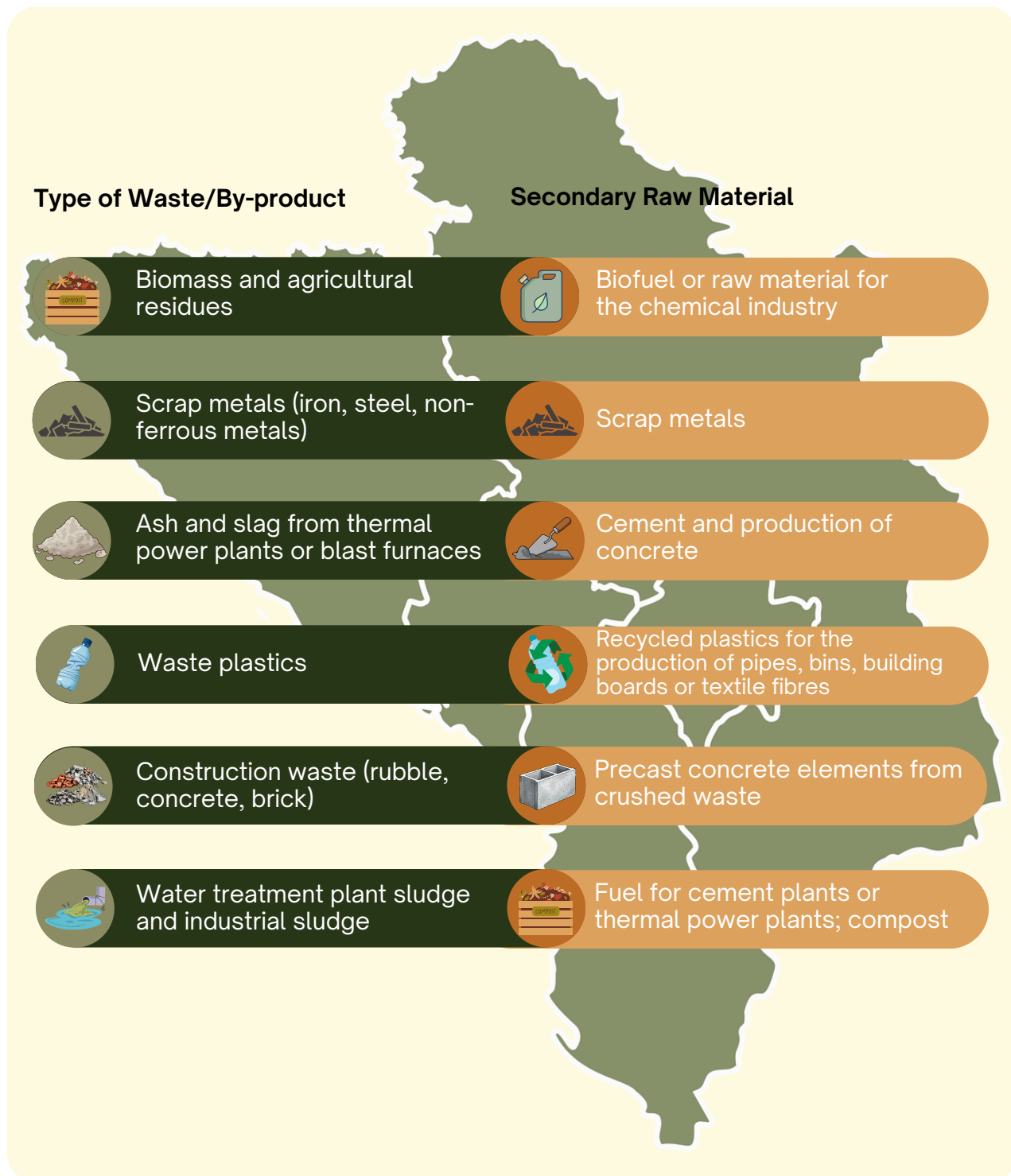
For a comprehensive understanding of how end-of-waste (EoW) and by-product criteria are currently implemented across EU Member States, readers are strongly encouraged to consult the IMPEL/OVAM overview of national EoW legislation and procedures. This resource provides up-to-date country profiles, summaries of stream-specific criteria, and insights into national conformity assessment systems. It also includes direct links to national legal texts, procedural guidance, and relevant TRIS notifications. The overview is available in two formats:

- IMPEL/OVAM Overview – April 2025 edition, available at this [link](#)
- IMPEL/OVAM Overview – September 2025 (OVAM) edition, available at this [link](#)

Together, these documents offer the most complete publicly available mapping of EoW and by-product practices in the EU. Readers looking for deeper technical details, national comparison, or case-by-case procedures will find these reports an essential reference point.

Annex 2: Potential Materials for Industrial Symbiosis

Certain types of waste and by-products stand out as the most promising for inclusion in industrial symbiosis in the WB6, given their quantities and possibilities of use in other processes. Key candidates include:



- **Scrap metals (iron, steel, non-ferrous metals):** Scrap metal and shavings are of high value and are already being collected extensively for recycling. In regional symbiosis, steel mills and foundries can use **steel scrap** collected from multiple countries as a secondary raw material. Similarly, **aluminum and copper scrap** can be melted down and reprocessed. Through better coordination, WB6 countries can reduce raw waste exports and make more use of it within the region. (For example, the steel industry in Serbia and North Macedonia can employ waste generated in Bosnia and Herzegovina, instead of that waste ending up on the foreign market.)



However, there is a high-level of probability that the metal sector in each country is ready to absorb most of the scrap metal from the market and that this recycling system is already in place, but it is necessary to address waste from the metallurgical industry (slag, sawdust, ash, etc.).

- **Ash and slag from thermal power plants, slag from blast furnaces:** These mineral wastes are generated in large quantities (e.g. ash from coal-fired power plants in Obrenovac, Tuzla, Ugljevik; slag in the Zenica or Smederevo steelworks) and can be used. The most common application for **fly ash and slag** is in the production of building materials – cement industry and in the production of concrete. Ash with appropriate characteristics can replace some of the clinker in cement or be an additive for concrete mixes, while granulated blast furnace slag is used as an eco-friendly cement additive. There are several cement plants in the WB6 (e.g. in Albania, Bosnia and Herzegovina, Kosovo and Serbia) that could absorb ash/slag from regional thermal power plants, representing a classic example of the symbiosis of the energy-construction sector.
- **Construction waste (rubble, concrete, brick):** The construction sector in WB6 generates significant amounts of demolition and construction waste. Most of this material currently ends up in landfills, but there is a possibility of recycling it into aggregate for civil engineering or as a raw material for secondary products (e.g. precast concrete elements from crushed waste). **The use of crushed concrete and asphalt for the construction of roads or embankments would bring savings and reduce pressure on quarries.** Regionally, countries with a shortage of aggregate stone (e.g. plain Vojvodina) could import recycled aggregate from their neighbours instead of taking out new ones. This would establish a cross-border value loop in the construction sector.

- **Biomass and agricultural residues:** Organic by-products from agriculture and the food industry – such as **cereal residues (straw), fruits and vegetables, pits, husks, wood biomass from wood processing** – can be converted into useful products or energy. **For example, sunflower husk (a by-product of oil mills) in the amount of several thousand tons per year can be used as biofuel or even as a raw material in the chemical industry.** Wood scraps from the furniture factory can be pelleted and used for heating. Biomass from one country (e.g. waste wood mass from Bosnia and Herzegovina) could be exported as fuel to biomass power plants in another (e.g. in Serbia or North Macedonia that are planning such power plants). There are also opportunities to produce compost from combined organic waste (e.g. municipal green waste plus agricultural residues), which would then be used to improve the soil regionally.
- **Water treatment plant sludge and industrial sludge:** With the construction of new wastewater treatment plants in WB6 (supported by the EU), the amount of **municipal sludge** requiring disposal is increasing. Instead of being disposed of in landfills, the sludge can be used for energy or construction purposes – dried sludge can be used as fuel for cement plants or thermal power plants, or it can be composted (if its composition is suitable) to obtain land amendments. **Industrial sludge** (e.g. from papermaking, leather, etc.) may also contain useful components (organics for energy, or minerals for secondary materials). **Cross-border symbiosis would allow sludge from one environment to be placed where there is a plant that can use it (e.g. a cement plant that does not have enough waste nearby as fuel can import sludge from the neighbouring regions).** This, of course, requires harmonised regulations on waste transport, but it represents a sustainable solution to the sludge problem that the region will increasingly have to solve.
- **Waste plastics:** Plastic waste (packaging, films, hard plastic products). **Currently, only a small fraction of the plastic in WB6 is collected and recycled, while the rest pollutes the environment (high levels of plastic pollution have been recorded along rivers and coasts).** Through industrial symbiosis, plastic waste can become an input for new products – e.g. recycled plastics for the production of pipes, bins, building boards or textile fibres. There are companies in the region that recycle certain plastics (e.g. **PET bottles** are processed into polyester fibers or plastic flecks). By networking these capacities regionally, collected plastics from a smaller country can be transported to a larger recycling plant in the neighborhood. Also, certain plastics that are not suitable for material recycling can be used as an alternative fuel in industries (cement plants can use RDF containing plastics). It is important to note that improving the collection and sorting of plastics is a prerequisite – this is where EPR (Extended Producer Responsibility) chamber systems must strengthen cooperation with each other, in order to collect as much plastic as possible and direct it to recycling instead of landfills.

In addition to the above, other streams can be considered, such as:

- *waste glass for new glass production*
- *waste tyres for use as fuel or granulation in rubber products*
- *textile waste for recycling into insulation materials*

The focus, however, is suggested to remain on the most abundant materials that offer quick synergies.

