INCIRCULAR

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R = Report, P = Prototype, D = Demonstrator, O = Other PU = Public PP = Restricted to other programme participants (including the Commission Services) RE = Restricted to a group specified by the consortium (including the Commission Services) CO = Confidential, only for members of the consortium (including the Commission Services) Restraint UE = Classified with the classification level "Restraint UE" according to Commission Decision 2001/844 and amendments Confidential UE = Classified with the mention of the classification level "Confidential UE" according to Commission Decision 2001/844 and amendments Secret UE = Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

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Executive Summary

Why this brief — Regions are pivotal to turn EU circular policies into real **investment, jobs and industrial change**. Slovenia, Spain and France show momentum but face **regulatory fragmentation**, **financing frictions** for first deployments, **uneven technical capacity** (especially in less developed regions), and price pressure from low-cost imports that weakens the business case for EU recyclates.

What's new — The brief maps the most relevant EU rules (**ESPR/Digital Product Passports, PPWR, WFD, Right to Repair, IED, Batteries, WEEE/RoHS, SUP, WSR**) and distils **what local authorities and SMEs must do first** (design-stage innovation, verification of recycled content, procurement specs). It also surfaces **national levers** and proposes **fast, low-risk actions** that can be launched within current mandates and budgets.

What INCIRCULAR contributes — Interregional pilots (sorting, quality control, process stability at industrial scale), **six cascade-funded SME projects**, and a **Replication Hub** that translates pilot evidence into **investment-ready playbooks, permitting templates and procurement specifications**—so other regions can copy and scale quickly.

Three actions now —
(1) **EU-wide harmonisation** where feasible: common End-of-Waste criteria and a **single method to calculate/verify recycled content** across PPWR/ESPR to cut audit costs and unlock cross-border trade in quality secondary plastics.
(2) **Set up a regional industrial-symbiosis hub** to broker feedstock, testing and data, aligned with Digital Product Passport requirements.
(3) **Use blended finance/guarantees** to de-risk first-of-a-kind SME upgrades (AI/NIR sorting, digital-twin control, tooling/compounding), coupled with technical assistance.

Outcome — Thie brief shall support regions to build **bankable pipelines** of circular projects, trigger **procurement-led demand** for verified EU recyclates, and shorten **time-to-market** for SMEs through crowding-in private capital by raising recycled content in products, and **scaling interregional replication**, including in **less developed regions**.

1. Introduction

a) Context:

The INCIRCULAR projects offers the first EU interregional lighthouse for repurposing recycled plastic within industrial symbiosis. The INCIRCULAR results should be shared with policymakers to fuel their thinking on promoting the circular economy.

Therefore, this Policy Brief aims to summarize our key activities and strategic orientations. This document will aim to highlight the critical role of government—particularly at the local and regional levels—in enabling and supporting circular investments. To do so, the report will shed some light on the regulatory and funding challenges encountered by partners in InCircular countries.

To ensure broad impact, the Policy Brief will be disseminated both through stakeholder networks and intermediaries as well as directly to relevant public administrations and agencies, considered as a group of ambassadors. Key EU-level networks and platforms—such as EISMEA, TSSP, the ICEI Alliance, the INTERREG Learning Platform, and CBE-JU—will serve as important channels for outreach.

To enhance engagement ambassadors will actively promote the Policy Brief, while also gathering feedback and perspectives from target audiences. These insights will feed directly into the development of WP4, especially in the design and refinement of the replication toolkit.

b) Key EU-level networks and platforms in a nutshell

- **TSSP (Thematic Smart Specialisation Platform):** TSSP facilitates interregional cooperation and the exchange of best practices among European regions under the Smart Specialisation Strategy (S3) framework. Its primary audience includes regional and local authorities, clusters, SMEs, and research institutions. Disseminating the Policy Brief through TSSP channels—such as newsletters, thematic workshops, and interregional meetings—ensures that key regional decision-makers and innovation stakeholders receive actionable recommendations and insights for enhancing sustainable practices and circular solutions in plastics.
- **ICEI Alliance:** The ICEI Alliance promotes circular economy principles within industry and supports technology transfer between European actors. The platform targets industrial companies, clusters, researchers, investors, and public authorities. Sharing the Policy Brief through ICEI workshops, sectoral events, and newsletters enables key industrial stakeholders and policymakers to adopt practical solutions and strategies that foster circularity and innovation along the plastics value chain.
- **INTERREG Learning Platform:** The INTERREG Learning Platform encourages knowledge exchange and cross-border learning among regions engaged in transnational projects. Its core audience includes local and regional administrations, clusters, universities, and innovative companies. Distribution of the Policy Brief via the platform's online resources, webinars, and newsletters ensures that interregional and cross-border project participants gain timely access to evidence-based recommendations and practical guidance for advancing circular plastics initiatives.
- **CBE JU (Circular Bio-based Europe Joint Undertaking):** CBE JU supports bio-based and circular innovation, fostering public-private collaboration and providing funding opportunities. Its audience includes SMEs, start-ups, investors, academic institutions, and industry actors. The Policy Brief can be disseminated through CBE JU events, project calls, newsletters, and webinars, offering stakeholders insights and recommendations to accelerate the adoption of circular economy solutions in plastics production and processing.

While the Policy Brief will be finalized and delivered by Month 24 (M24), its dissemination and promotion will continue through to the end of the project.

2. The INCIRCULAR project

The INCIRCULAR project — **INtegrating Cybernated Innovation to Raise the Scale of Circular Units Looping Allied Regions** — sets out to accelerate the transition toward a circular plastics economy by deploying advanced technologies, fostering interregional collaboration, and supporting innovation in regions that lag behind in recycling and valorisation.

In short, INCIRCULAR aims to build a "lighthouse" interregional hub that helps turn waste plastics into high-value, recyclable products, closing loops across industrial value chains and lowering dependency on virgin fossil feedstocks.

The project brings together eight partners from three European countries — France, Spain and Slovenia — representing the Auvergne-Rhône-Alpes (AURA) region in France, Andalusia in Spain, and the Vzhodna Slovenija (Eastern Slovenia) region in Slovenia. The design is explicitly to foster knowledge transfer and capacity building: more advanced regions (such as Rhône-Alpes) contribute technological know-how and demonstration experience, while less developed regions (in particular Andalusia and parts of Slovenia) receive support to scale up circular plastics solutions.

This focus on bridging regional disparities is essential: many less developed or peripheral European regions continue to lack investments, technical capabilities, infrastructure, or industrial ecosystems needed to capture value from recycled plastics. Without targeted support, they risk being locked into low-value waste export or landfill pathways while more advanced regions take the lead in high-value transformation. INCIRCULAR seeks to help redress that imbalance by providing both funding and a collaborative network that leverages cross-regional complementarities.

The six funded innovation projects

To stimulate innovation, INCIRCULAR launched a cascade funding (open call) scheme through which six SMEs (or small consortia) were selected (starting in March 2025) to receive up to **€60,000** each over a 12-month period.
These projects will be embedded within a large-scale industrial pilot at a Gorenje site (Slovenia) to help overcome "upscaling" barriers (e.g. process integration, digitalization, material quality, injection molding).
The six selected projects cover a range of key technical steps across the plastics recycling chain: sorting, shredding, purification, compounding, injection, and mold integration.

Figure 1: 7 funded SMEs from the 6 INCIRCULAR projects.

1. **PITS (Plastic Identification To Sorting)** — led by PLAS'TRI SAS (France), this project will develop a hyperspectral camera + AI system to identify plastic waste streams at the Gorenje site and integrate the algorithm into the industrial sorting flow, helping ensure a purer input feed.
2. **CLARA (Classification & Advanced Recognition Automation)** — led by Rovimática S.L. (Spain), CLARA aims to democratize plastic sorting via an affordable AI vision system that combines vision transformers, depth sensing, and self-learning to classify plastic types in real time for SMEs.
3. **MOIK (Metallization of Industrial Knives)** — co-led by Ekstera and Additio (Slovenia), MOIK seeks to metallize shredder and granulator knives using recycled superalloy powders to increase durability, reduce maintenance, and adapt to circular operation standards.
4. **SMART-MOLD (System for Machine Anomaly Recognition and Telemetry in Molding Operations for Lean Development)** — led by LOGIX (Slovenia), SMART-MOLD will create an open IoT / ML platform to monitor plastic injection molding lines (detecting anomalies, process deviations, energy use) to optimize operations and reduce waste.
5. **PLASTNIR** (**Plastic sorting with NIR and machine learning) -** The Project led by iSR proposes an automated system based on NIR (Near-Infrared) technology, multispectral imaging, and machine learning algorithms to identify and classify plastics with high precision. This solution optimizes recycling processes by reducing costs, enhancing the quality of recycled materials, and making them suitable for high-value industrial applications.
6. **WR Knives Project - Development of knives with significantly improved wear resistance for extended service life.** The INCIRCULAR project by TRO Cutting Tools aims to address a key challenge in the recycling industry: the efficient shredding of dense plastic lumps, which causes rapid wear and tear on conventional industrial knives.

Linking to national and regional policy challenges

INCIRCULAR's themes tie directly to several national and regional challenges in EU member states. For example, many countries struggle with limited capacities in sorting infrastructure, mismatches in recycled plastic quality, weak demand for secondary raw materials, and regulatory uncertainty over new technologies (e.g. chemical recycling, mass balance accounting).

- In Spain, for instance, regions such as Andalusia still face gaps in industrial absorption of recycled plastics and barriers to local SMEs entering higher-value recycling processes.
- In Slovenia, shifting from traditional waste export toward closed-loop plastics manufacturing requires investment and coordination in digital control, supply chains, and logistics.
- In France, while some regions are more advanced, investments for scaling up highly innovative technologies from leading clusters remains a policy challenge.

Across all three countries, regulatory alignment (e.g. standards for recycled content, incentives for circular feedstocks, procurement rules) is crucial to scale innovations beyond pilots.

By drawing together regional innovation systems, enabling SMEs through targeted grants, and embedding demonstration projects in industrial environments, INCIRCULAR sets up a testbed for policies that foster circular plastics at scale — especially in regions that currently lag behind. Its outcomes can inform how national and EU-level policy can more effectively channel investment, harmonize regulation, and support technical capacity building in underdeveloped regions.

3. Context and rationale

Why this policy brief matters.

The transition to a Circular Economy is critical to addressing some of today's most pressing challenges—climate change, resource scarcity, biodiversity loss, and economic resilience. Unlike the traditional linear model of "take-make-dispose," a circular approach emphasizes keeping materials in use, and regenerating natural systems.

At the EU level, the European Green Deal and the Circular Economy Action Plan (CEAP) set an ambitious roadmap toward climate neutrality and resource efficiency. However, translating these goals into concrete, territorially relevant actions requires strong alignment and support from local and regional governments, who are uniquely positioned to: shape procurement practices and infrastructure investments, foster regional innovation ecosystems, engage communities, and coordinate across value chains and sectors.

Despite this pivotal role, many territories face institutional, regulatory, and financial barriers to circular investment. Limited access to technical expertise, insufficient collaboration across administrative silos, and a lack of tested policy tools all hinder uptake.

This Policy Brief emerges from a broader effort to empower subnational actors by providing them with actionable insights, best practices, and stakeholder-driven recommendations. It also supports a multi-level governance approach—recognizing that sustainable circular transformation depends on co-creation among municipalities, regional authorities, industry, academia, and civil society.

By showcasing effective strategies and enabling conditions, we aim to strengthen policy coherence and practical uptake of circular economy principles at the territorial level—thereby accelerating Europe's green and just transition.

In July 2023, the European Court of Auditors published a special report on the circular economy (17/2023), highlighting the slow pace of transition across Member States despite guidance and policy frameworks provided by EU institutions.

The **report emphasizes the urgency of shifting to circular production and consumption models**, in line with the European Green Deal, the Circular Economy Action Plan, and related legislative initiatives.

Harmonizing plastic-related policies remains a persistent challenge, particularly between countries such as Slovenia, France, and Spain, where industrial standards and regulatory approaches still differ significantly. **A unified EU-wide definition of the circular economy is essential to align objectives in recycling, eco-design, and reuse.** Such harmonization would foster fair competition, stimulate innovation, and improve the efficiency of regulations, ensuring consistent implementation across borders.

Addressing plastic recycling and waste management has become increasingly urgent due to several factors:

- From a natural resource preservation perspective, increasing the use of recycled plastics and bioplastics reduces dependency on virgin raw materials, directly supporting global climate targets and CO_2 reduction.
- From an environmental impact standpoint, single-use plastics remain a major source of pollution, especially in marine ecosystems. New legislation such as the Packaging and Packaging Waste Regulation (PPWR) seeks to curb production and incentivize recycling to mitigate this damage.
- Finally, the circular plastics economy represents a significant economic opportunity, driving innovation through new technologies and business models, fostering job creation, and strengthening the competitiveness of European industry, while reducing resource wastage and import dependency.

The ECA's report underscores that product and process design are decisive, as up to 80% of a product's environmental impact is determined at the design stage. However, current EU monitoring and funding frameworks underweight design-related investments, focusing primarily on downstream waste management.

While the Commission and Member States have committed substantial EU funds to circular economy objectives, most of these resources are still concentrated on waste treatment and recycling infrastructure, rather than prevention or circular design measures.

Moreover, existing monitoring frameworks lack detailed indicators to track progress in areas such as design quality, repairability, modularity, and circularity performance.

To address these gaps, the ECA calls on the European Commission to analyze why uptake of EU funds for circular design remains low and to **introduce stronger incentives for investments in design-stage innovation** in future funding programmes. **This recommendation aligns closely with the objectives of the INCIRCULAR project, which aims to demonstrate scalable solutions and foster cross-regional learning in circular plastics value chains.**

The focus of this report is on **Slovenia, France, and Spain**, the three countries participating in the **INCIRCULAR project**, chosen for their **diverse yet ambitious approaches** to circular economy policies. However, the recommendations presented are designed to be **broadly applicable across the EU**, with particular attention to the **needs and challenges faced at the regional level**. This includes recognizing the differences between **less developed regions**, which often face capacity and infrastructure gaps, and **more developed regions**, which can act as leaders in innovation and knowledge transfer.

4. Overview of relevant Regulatory Frameworks

a) European Frameworks:

The European Union has built a comprehensive regulatory framework to steer the transition toward a circular economy, anchored in the European Green Deal and the Circular Economy Action Plan (2020). This framework combines product-focused measures, waste legislation, and sector-specific initiatives to ensure that circularity is embedded across value chains. Recent flagship acts, such as the Ecodesign for Sustainable Products Regulation (ESPR), the Packaging and Packaging Waste Regulation (PPWR), and the new Right to Repair Directive, place strong emphasis on product durability, reparability, and recyclability, while strengthening consumer rights and tackling greenwashing. Together with waste and industrial emissions legislation, these measures aim to harmonize standards across Member States, reduce environmental impacts from plastics and other materials, and unlock opportunities for eco-innovation and sustainable business models.

The European Green Deal and Circular Economy Action Plan.

- **Ecodesign for Sustainable Products Regulation (ESPR)** — *Regulation (EU) 2024/1781* establishing a framework for setting ecodesign requirements and enabling Digital Product Passports.
  This regulation establishes requirements for product durability, reparability, and recyclability, while introducing Digital Product Passports to provide traceable information on material composition and environmental performance. This enables manufacturers and regulators to monitor compliance, supports circular business models, and encourages eco-innovation. https://eur-lex.europa.eu/eli/reg/2024/1781/oj/eng eur-lex.europa.eu
- **Empowering Consumers for the Green Transition** — *Directive (EU) 2024/825* amending the UCPD and CRD to tackle greenwashing and improve information on durability/reparability.
  This directive strengthens consumer rights by improving transparency on durability and reparability, tackling greenwashing, and promoting informed purchasing decisions.

https://eur-lex.europa.eu/eli/dir/2024/825/oj/eng eur-lex.europa.eu

- **Right to Repair** — *Directive (EU) 2024/1799* on common rules promoting the repair of goods.
  This Directive ensures access to spare parts and repair information, encouraging longer product lifespans and contributing directly to circular economy objectives. https://eur-lex.europa.eu/eli/dir/2024/1799/oj/eng eur-lex.europa.eu

Waste, packaging & shipments

- **Packaging & Packaging Waste Regulation (PPWR)** — *Regulation (EU) 2025/40* replacing the old Packaging Directive, harmonising rules on prevention, reuse and recycling.
  This regulation establishes harmonised rules for prevention, reuse, and recycling of packaging across the EU. It sets mandatory targets for recycled content, encourages design for recyclability, and fosters reduction of unnecessary packaging, ensuring consistent practices across Member States. https://eur-lex.europa.eu/eli/reg/2025/40/oj/eng eur-lex.europa.eu
- **Waste Framework Directive (WFD)** — *Directive 2008/98/EC* (consolidated text) setting the waste hierarchy, EPR, end-of-waste criteria, etc.
  This directive provides the overarching framework for waste management in the EU. It defines the waste hierarchy, establishes requirements for extended producer responsibility (EPR), clarifies end-of-waste criteria, and promotes recycling and recovery over disposal. Together, these measures encourage circularity in product and material lifecycles, while reducing environmental impacts. https://eur-lex.europa.eu/eli/dir/2008/98/2024-02-18/eng eur-lex.europa.eu
- **Waste Shipments Regulation (WSR)** — *Regulation (EU) 2024/1157* tightening controls on cross-border shipments of waste.
  This regulation tightens controls on cross-border shipments of waste within and outside the EU. It ensures proper tracking, prevents illegal exports, and strengthens enforcement of environmental standards, thereby supporting responsible waste management throughout the supply chain. https://eur-lex.europa.eu/eli/reg/2024/1157/oj/eng eur-lex.europa.eu
- **Single-Use Plastics Directive (SUP)** — *Directive (EU) 2019/904* on reducing the impact of certain plastic products.
  This directive addresses the environmental impact of disposable plastic products, mandating reduction measures, promoting alternatives, and restricting the use of certain single-use items. This legislation targets the most polluting plastics and aligns with broader EU circularity objectives. https://eur-lex.europa.eu/eli/dir/2019/904/oj/eng eur-lex.europa.eu

Sector/material-specific

- **WEEE Directive (electronics take-back)** — *Directive 2012/19/EU* (recast).
  This Directive establishes requirements for the collection, treatment, and recycling of electrical and electronic equipment waste across the EU. Its goal is to ensure proper management of e-waste, maximize recovery of valuable materials, and minimize environmental and health risks from hazardous substances contained in electronic products. https://eur-lex.europa.eu/eli/dir/2012/19/oj/eng eur-lex.europa.eu
- **RoHS Directive (hazardous substances in EEE)** — *Directive 2011/65/EU* (latest consolidated version).
  This directive restricts the use of certain hazardous substances in electrical and electronic equipment. By limiting materials such as lead, mercury, and cadmium, the directive reduces environmental pollution, supports safer product design, and aligns with circular economy objectives by facilitating recycling and material recovery. https://eur-lex.europa.eu/eli/dir/2011/65/2025-01-01/eng eur-lex.europa.eu
- **Microplastics restriction (REACH)** — *Commission Regulation (EU) 2023/2055*
  This regulation targets intentionally added microplastics in products. It aims to prevent the release of persistent plastic particles into the environment, reduce ecological impacts, and promote the substitution of microplastics with safer or biodegradable alternatives, contributing to the EU's broader sustainability and circularity goals. https://eur-lex.europa.eu/eli/reg/2023/2055/oj/eng eur-lex.europa.eu

Industrial emissions & data transparency

- **Industrial Emissions Directive (IED) — revised** — *Directive (EU) 2024/1785* amending *Directive 2010/75/EU* to strengthen resource-efficiency and pollution controls.
  strengthens EU-wide controls on industrial pollution and promotes resource efficiency across sectors. It updates emission limit values, encourages the adoption of best available techniques, and integrates environmental performance standards to reduce the environmental footprint of large industrial installations. The directive ensures that industries align with climate, circularity, and sustainability objectives while protecting human health and ecosystems. https://eur-lex.europa.eu/eli/dir/2024/1785/oj/eng • Base act: https://eur-lex.europa.eu/eli/dir/2010/75/oj/eng eur-lex.europa.eu+1
- **Industrial Emissions Portal Regulation (IEPR)** — *Regulation (EU) 2024/1244* creating an EU-wide portal for emissions/resource-use data from installations.
  This regulation establishes a central EU portal for emissions and resource-use data from industrial installations. This regulation enhances transparency, enabling authorities, stakeholders, and the public to access verified environmental data. By supporting open data exchange, the portal facilitates benchmarking, compliance monitoring, and informed decision-making, while promoting trust and accountability in the management of industrial emissions. https://eur-lex.europa.eu/eli/reg/2024/1244/oj/eng eur-lex.europa.eu

Under development

- **Green Claims Directive (proposal)** — substantiation and communication of explicit environmental claims.
  The EU's proposed Green Claims Directive aims to ensure that any environmental claims made by companies—such as "eco", "carbon neutral" or "sustainable"—are substantiated with robust scientific evidence, verified by independent bodies, and communicated clearly to consumers. It is intended to complement existing rules by preventing greenwashing and ensuring consumers receive reliable, comparable, and verifiable information before making purchasing decisions. The directive is under negotiation and, once adopted, will require businesses to adapt product design, environmental reporting, and marketing practices. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52023PC0166 eur-lex.europa.eu
- **Circularity requirements for vehicles & End-of-Life Vehicles (proposal)** — would replace the ELV Directive with a regulation on design and end-of-life.
  This proposal seeks to replace the current ELV Directive with a regulation that covers a vehicle's full lifecycle—from design through to end-of-life treatment—with stronger requirements on reusability, recyclability, recoverability, and use of recycled content. It would also mandate clearer information and labelling of vehicle parts, extended producer responsibility for end-of-life vehicles, and stricter rules on exports of used vehicles. The aim is to drive resource efficiency and material circularity in the automotive sector, reducing environmental impacts and improving the quality of recycled materials obtained from scrapped vehicles. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52023PC0451 eur-lex.europa.eu

Overarching policy frameworks (context)

- **Circular Economy Action Plan (2020)** — Commission communication (2020, COM(2020) 98) setting the roadmap that underpins most files above.
  This upcoming plan provides a comprehensive roadmap for transitioning the EU toward a sustainable, circular economy. It sets out measures across product design, waste management, and resource efficiency to reduce environmental impacts and foster innovation in circular business models. The plan underpins key regulatory initiatives, including ecodesign, packaging, and industrial emissions policies, ensuring coherence and alignment of EU strategies for climate neutrality, sustainable consumption, and responsible production. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52020DC0098 eur-lex.europa.eu

b) National Policies:

Alongside EU-level legislation, Member States have adopted their own circular economy policies that reflect national priorities and implementation capacities. In the context of INCIRCULAR, the focus is on Spain, Slovenia, and France, which illustrate different yet ambitious approaches to plastics regulation and circular economy governance. Spain has introduced strict packaging rules and a plastic tax, Slovenia has aligned closely with EU directives while experimenting with targeted taxes and labeling, and France has advanced a comprehensive strategy through its AGEC Law and Climate Law, setting long-term targets for phasing out single-use plastics and promoting eco-design. Together, these frameworks highlight both the diversity of national pathways and the need for stronger harmonization to support cross-border circular value chains.

Spain:
Laws 7/2022 and Royal Decree 1055/2022 promote circular economy and extended producer responsibility. Includes bans on single-use plastics, mandates bulk sales, and introduces potential deposit systems. A tax of €0.45/kg is levied on non-reusable plastics.

Slovenia:
Closely aligns with EU directives. Enforces EPR, environmental taxes, and bans single-use plastics. Plastic labeling is mandatory, and a tax penalizes plastic packaging. A deposit system is authorized but pending implementation.

France:
Relies on the AGEC Law (2020) and Climate Law (2021). Targets phase-out of single-use plastics by 2040, mandates producer responsibility, promotes ecodesign, and discusses deposit systems. Includes environmental labeling and bans bisphenol A.

5. Financial Framework

Achieving the transition to a circular plastics economy requires not only regulatory ambition but also sustained and well-targeted investment. The European Court of Auditors (2023) highlighted that while the EU and Member States have allocated substantial resources to the circular economy, much of this funding has historically been directed towards waste management rather than upstream measures such as design innovation, prevention, and eco-innovation. To ensure that INCIRCULAR's outcomes can be scaled, regions and Member States must make full use of both EU-level programmes and complementary national instruments.

a) EU main sources

At EU level, several programmes provide funding opportunities for circular economy projects:

- **I3 programme** supports interregional innovation projects in the field of smart specialisation (S3) during their development phase and their steps towards commercialisation. This is the program funding the Incircular project.
- **Horizon Europe** and **CBE JU (Circular Bio-based Europe Joint Undertaking)** fund research, demonstration, and industrial scale-up projects targeting bio-based and circular solutions, including plastics.
- **Cohesion Policy Funds (ERDF, CF, Just Transition Fund)** can support regional investments in innovation, infrastructure, and SME capacity building, with particular emphasis on less developed regions.
- **LIFE Programme** finances pilot and demonstration projects in environmental innovation, circular value chains, and waste reduction.
- **InvestEU** and the **European Investment Bank (EIB)** provide financial instruments to de-risk private investment in circular projects, including loans and blended finance for SMEs.

- **Innovation Fund** (from EU ETS revenues) supports large-scale low-carbon and circular industrial projects, particularly those with strong emissions-reduction potential.

These mechanisms are central for mobilising cross-border collaboration, scaling innovative solutions from pilot to market, and addressing the investment gaps that hinder SME participation in the circular economy.

b) Main National Sources

In addition to EU programmes, national frameworks in the INCIRCULAR partner countries offer targeted support:

- **Spain** combines EU funds with national instruments under its **Circular Economy Strategy España Circular 2030**. This includes funding lines from the **Recovery and Resilience Plan (PERTE projects)** for sustainable industries, tax incentives linked to the plastic packaging tax, and regional calls managed by autonomous communities.
- **Slovenia** has integrated circular economy into its **Operational Programme for EU Funds** and the **Slovenian Industrial Policy**, which provide grants and co-financing for recycling infrastructure, eco-innovation, and SME transition projects. National environmental taxes also generate revenues that can be channelled into waste prevention and recycling programmes.
- **France** supports circular transition mainly through instruments linked to the **Loi AGEC** and the **France Relance Plan**, as well as the activities of **ADEME (the French Agency for Ecological Transition)**, which manages funding calls for eco-design, plastic recycling, and industrial symbiosis. Extended Producer Responsibility (EPR) schemes also provide a steady stream of funding for waste management and recycling innovation.

b) Private Investments

Private investment in **natural capital**, **ecosystem restoration**, and **circular economy projects** is steadily increasing, as financial actors recognize both the environmental urgency and the long-term business opportunities these sectors provide. According to recent analysis, **private investment in the circular economy across EU countries has grown by almost 45 % over the past decade**, although its relative weight in GDP remains modest. At the same time, the **European Investment Bank (EIB)** reports having invested more than **€5.1 billion in 153 circular projects between 2020 and 2024**, covering advanced recycling, reuse, and resource-efficiency initiatives.

These capital flows remain uneven: investors tend to focus on **infrastructure and recycling capacity** rather than **early-stage design innovation** or new circular business models. Bridging this gap requires de-risking mechanisms, blended finance, and stronger pipelines of bankable projects—an area where initiatives such as INCIRCULAR can play a catalytic role by producing investment-ready case studies and scaling SME innovation.

Several funds and accelerators already demonstrate the potential for mobilising private capital in partner countries:

- **France**: The **Circular Innovation Fund (CIF)**, managed by Demeter and Cycle Capital, targets growth-stage companies with circular solutions. Asset manager **Mirova** and private equity firm **Eurazeo** (through its planned €750 million *Planetary Boundaries Fund*) also channel significant resources into circularity, green industry, and natural capital.
- **Spain**: A growing sustainability VC ecosystem supports circular startups, while large infrastructure projects combine EIB finance with private capital. Spanish SMEs can also access European-scale funds such as the CIF.
- **Slovenia and Central Europe**: Although smaller in scale, regional actors such as the **Vesna Fund** target deep-tech and climate innovation, including materials and recycling, providing an entry point for Slovenian innovators into cross-border finance networks.

6. Identified Challenges and Obstacles

The challenges and obstacles described in this section were identified through **a series of online interviews** conducted via Microsoft Teams with members of the INCIRCULAR Consortium as well as SMEs and entities that received financial support through FSTP (Financial Support to Third Parties) to develop new projects in the field of circular economy. These discussions provided valuable first-hand insights into the realities faced by companies across France, Spain, and Slovenia.

They highlighted how **regulatory complexity, high production costs, fragmented infrastructures, limited public acceptance of recycled materials, and gaps in funding mechanisms continue to hinder progress toward circularity**. By capturing the perspectives of both industrial actors and innovation-driven SMEs, the findings reveal not only the systemic barriers slowing down transition but also the urgent need for harmonised standards, targeted incentives, and stronger support structures to ensure that circular practices can be scaled effectively across the plastics and composites sector.

Complex and Heterogeneous Regulations:

The comparison below highlights how France, Spain, and Slovenia differ in their regulatory approaches and public perceptions of recycled plastics, while also illustrating the common challenges that European legislation such as the PPWR seeks to address.

Aspect	France	Spain	Slovenia
Regulatory perception	France leads with a dense regulatory framework	Spain offers strong economic incentives and quantitative goals	Slovenia is proactive but still institutionalizing its approach
Public Perception of Recycled Plastics	Mixed views; concerns remain regarding food-grade safety	Generally positive, driven by local initiatives.	Moderate acceptance; distrust over food packaging safety.

France:
In France, for example, companies such as SIMCON and SISE report that regulations are evolving too rapidly, with limited operational clarity. The French AGEC Law, which sets ambitious targets for reducing waste and encouraging the use of recycled content, is widely seen as disconnected from industrial realities. For many SMEs, aligning with such regulatory frameworks is nearly impossible without additional technical or financial support. SIMCON notes that investment in recycling infrastructure, although desirable, is simply not viable without guaranteed demand or targeted incentives. Additionally, the cost of recycled materials remains higher than virgin plastics, which diminishes the business case for transitioning to circular production models.

Spain:
In Spain, the situation is similarly complex, particularly in regions such as Andalusia. There, companies face the combined challenge of insufficient infrastructure and fragmented policy implementation. ISR and ECOCASTULUM have highlighted how local infrastructure is underdeveloped, and manual sorting is still the norm, leading to higher contamination rates and costs. While EU and national circular economy policies exist, there is often no structured or coordinated support at the regional level to help companies meet these objectives. In ECOCASTULUM's experience, unclear and inconsistent certification procedures—often varying from one administrative region to another—can delay projects and increase uncertainty. ROVIMATICA adds that although Spanish national regulations offer some support mechanisms for SMEs, the

enforcement of these policies and their alignment with EU objectives are still weak. The lack of technical assistance and guidance further complicates efforts to comply with evolving legislation or to adopt innovative circular business practices.

Slovenia:
In Slovenia, regulatory fragmentation is equally problematic. Stakeholders such as EKSTERA and TECOS report that existing regulatory frameworks are outdated and ill-suited to support innovation or circularity. According to TECOS, there is a visible gap between what EU or national regulations prescribe and how they are enforced or interpreted at the municipal or regional levels. This discrepancy leads to inconsistent enforcement, confusion among stakeholders, and missed opportunities to apply circular principles in a coherent and scalable way. Moreover, SMEs are often excluded from funding opportunities due to a lack of clarity regarding eligibility or insufficient policy coordination. Without clear guidance, local actors are unsure how to align with EU objectives or how to structure investments in circular infrastructure or technologies. In sum, across all three countries, companies report that circularity goals are undermined not by a lack of ambition, but by a lack of alignment, coordination, and operational support.

Public Perception of Recycled Plastics

Even as industrial capabilities improve and technical barriers are gradually reduced, public acceptance of recycled plastics remains fragile. This is especially true in sectors where safety, hygiene, or aesthetic performance are of paramount importance, such as food packaging, medical devices, and consumer electronics.

France:
In France, the general perception of recycled plastics is slowly improving. The public is increasingly aware of the environmental value of circular products, and there is a growing interest in sustainability. However, there is still no widespread consumer preference for recycled over virgin materials. According to feedback from SISE and SIMCON, recycled plastics are rarely promoted as high-quality or innovative materials. Marketing efforts and awareness campaigns remain limited, and communication around recycled content typically lacks both clarity and impact. While public sensitization is advancing, it is not yet driving market behavior on a significant scale.

Spain:
The Spanish context reflects a more pronounced skepticism toward recycled plastics. In Andalusia, stakeholders such as ISR and ECOCASTULUM report that recycled materials are widely perceived as lower in quality, less safe, or less durable than virgin alternatives. This is particularly true in sectors requiring high precision or strict compliance with health standards. Consumers often distrust the origin, traceability, or performance of recycled content, even when technical specifications are met. Virgin plastics are still considered more reliable and better documented. However, there are signs of changing mindsets. As ISR notes, many consumers—especially younger generations—are increasingly aware of the environmental stakes. Public communication, however, is either too general or absent altogether. There is a clear need for targeted education campaigns that emphasize the safety, reliability, and performance of recycled materials, including their compliance with European standards.

Slovenia:
In Slovenia, TECOS and EKSTERA observe deeply rooted cultural and behavioral barriers to the adoption of circular practices. Concepts such as reuse, repair, or buying second-hand remain uncommon, and the value of recycled materials is not widely recognized. TECOS specifically points out that public trust in recycled plastics is limited due to persistent misconceptions about their hygiene and lifespan. Moreover, there is little demand from either consumers or public procurement agencies for products made with recycled content. National campaigns promoting circular consumption are few, and there is insufficient communication from government or industry to counteract prevailing doubts. Without a sustained, multi-channel effort to raise awareness and build trust, both consumer acceptance and public-sector leadership in recycled product adoption will remain low.

This situation is further aggravated by competition from low-cost countries such as China and India, which supply replacement knives at far lower prices than Slovenian manufacturers and offer plastic recyclate at levels that cannot be matched by local recycling, creating additional pressure on domestic industry.

Sector-Specific Challenges and Funding Needs

Despite strong motivation from many companies to embrace circularity, significant barriers remain—particularly in terms of technology, financing, and access to reliable data. Further efforts are essential to standardize circular practices and ensure they are adequately supported across different industries

France:
In the French plastics sector, stakeholders such as SIMCON and SISE describe a lack of access to affordable and efficient recycling technologies. Companies often do not have the tools needed to track or certify recycled content, making it difficult to meet regulatory requirements or customer expectations. A broader issue is the absence of shared databases—whether for life cycle assessment (LCA) data, recycled material quality, or hazardous substance testing—which hinders informed decision-making and slows down innovation. Companies are willing to improve their processes but lack the technical and digital infrastructure needed to do so effectively.

Slovenia:
Slovenia faces comparable challenges. EKSTERA points out that the infrastructure needed to support circular practices remains underdeveloped, especially for smaller manufacturers. Many companies still operate in linear models, not because of lack of interest, but because circular alternatives are often more costly, more complex, or more risky. TECOS emphasizes the urgent need for standardization in secondary plastics: without clear guidelines or technical standards, recycled materials cannot be reliably integrated into design, production, or procurement processes. This gap affects everything from quality control to customer confidence.
Financing is a cross-cutting issue in all countries. While funding mechanisms do exist at the EU and national levels, SMEs often struggle to access them. The application processes are perceived as too complex, the eligibility criteria too narrow, and the administrative burden too high. EKSTERA and TECOS both note that many projects contributing to circularity are not recognized as such under current funding definitions and are therefore excluded. At the same time, companies frequently lack the internal capacity to navigate these processes or the external support to develop viable proposals. This mismatch between available funding and actual project needs is one of the most frequently cited frustrations among stakeholders.

Spain:
In Spain, the situation is similarly constrained. Manual sorting remains widespread, particularly in regions like Andalusia, which leads to higher rates of contamination in recyclates. ISR and ECOCASTULUM report that access to spectral data and standardized quality information is extremely limited, making it hard for companies to validate the performance of recycled inputs. Traceability is another major concern, with companies often having to invest significantly in additional testing and certification just to ensure regulatory compliance. These issues are compounded by a lack of harmonized standards across sectors and regions, which means that companies face inconsistent demands depending on where they operate or who their clients are.

7. InCircular's Contribution

How INCIRCULAR contributes to addressing these challenges. InCircular is a three-year, EU-co-funded project funded under the Interregional Investment Programme I3. Launched in October 2023, it acts as an interregional lighthouse to accelerate circular plastics across Slovenia, Spain and France. It builds a collaborative **Interregional Symbiotic Hub** that connects recyclers, manufacturers and tech providers to remove practical barriers to circularity and scale proven solutions across regions.
Who is involved. The consortium brings together **8 partners** from **3 regions**—Vzhodna Slovenija, Andalusia and Auvergne-Rhône-Alpes—covering the full value chain from waste valorisation to advanced manufacturing and market uptake. TECOS (Slovenia) coordinates; Gorenje (Slovenia) hosts a key pilot site; Omaplast (Slovenia) contributes recycling and compounding; Polymeris (France) drives cluster-to-cluster transfer; SIMCON and SISE (France) provide digital-twin/simulation and process control; the University of Jaén (Spain) leads the **Interregional Symbiotic Hub & Replication**; EcoCastulum (Spain) supports industrial symbiosis and SME uptake.

Addressing barriers identified in this Policy Brief

Technical bottlenecks. INCIRCULAR pilots at Gorenje, reinforced by Omaplast's compounding upgrades, integrate AI-based vision systems, NIR/hyperspectral identification, and digital-twin process control. These improve recyclate purity, enhance process stability, and reduce scrap rates in injection moulding with secondary feedstock.

SME adoption and cost/risk. To lower entry barriers, INCIRCULAR has launched a cascade funding mechanism, granting €60,000 to six SME-led innovation projects. These include CLARA (Spain, low-cost AI sorting), PLASTNIR (Spain, multispectral + ML for technical plastics), PITS (France, hyperspectral AI for sorting lines), SMART-MOLD (Slovenia, IoT anomaly detection for molding), WR Knives (Slovenia, wear-resistant knives for dense plastics), and MOIK (Slovenia, metallisation of shredder knives). By de-risking first deployments, these pilots strengthen SMEs' capacity to scale and integrate into industrial ecosystems.

Replication and capacity building. INCIRCULAR drives peer-learning, emulation sessions, and replication toolkits. These include playbooks for technology transfer, procurement models, and data-sharing templates—designed to make circular plastics solutions transferable across borders and adaptable to less developed regions.

Policy feedback loop. Evidence from the pilots (e.g. sorting accuracy, recyclate quality, tool lifetimes, machine stability) is translated into policy guidance for local and regional authorities, particularly in areas of investment planning, procurement, and permitting. This ensures that project results directly inform national and EU-level policymaking and strengthen regional smart specialisation strategies.

Timeline and long-term impact. In its first three years (2023–2026), INCIRCULAR aims to demonstrate pilots, fund SMEs, and validate replication approaches. From years 4–7, the focus shifts to scaled industrial integration, including expanded recycling and compounding capacity around the Gorenje–Omaplast ecosystem and new interregional investment partnerships. The long-term vision (10–15 years) is to foster wider market uptake of eco-designed, high-recycled-content products, supported by expanded industrial capacity and harmonised policy frameworks.

By combining technical innovation, SME empowerment, replication mechanisms, and a structured policy feedback loop, INCIRCULAR goes beyond demonstration: it provides a scalable model for interregional cooperation, helping both advanced and less developed regions move faster toward a sustainable circular plastics economy.

8. Policy Recommendations & conclusion

Turning circular ambition into investable demand requires three things at once:

- clearer and more coherent rules,
- predictable markets for high-quality EU recyclates, and
- easier access to finance for first deployments—especially for SMEs.

Across Slovenia, Spain and France, stakeholders report that the barrier is not lack of will but uncertainty: fragmented standards, uneven enforcement, and high upfront costs make it difficult to invest in sorting, digital control, tooling and compounding that would stabilise recycled inputs.

Action points

Harmonise definitions, standards and conformity across the EU. A key priority is a common technical language for secondary plastics. This reduces today's regional divergence that delays investments and raises audit costs, and it gives buyers confidence to specify recycled grades across borders.

1. **Common technical standards for secondary plastics.** Mandate CEN/CENELEC workstreams to align identification, quality classes and contaminant thresholds for recycled polymers used in packaging, EEE and household goods—enabling cross-border trade and design-for-reuse.
2. **EU-wide End-of-Waste criteria for key plastic streams.** Under the WFD, adopt harmonised criteria (incl. input specs and QC testing) to avoid regional fragmentation that today delays investments.
3. **One method for recycled-content calculation and verification.** Align rules across PPWR/ESPR and sectoral law to cut auditing costs for SMEs and support cross-border supply chains.

Create strong, predictable market pull. Public procurement with **minimum recycled-content thresholds**

4. **Introduce stronger incentives** and tailored instruments to prioritise eco-design, repairability, and modularity, complementing downstream recycling investments.
5. **Green public procurement (GPP) with recycled-content minima.** Require minimum thresholds for plastics in municipal equipment, furniture, bins, construction products and non-food packaging; allow functionally equivalent bio-based/recycled blends where appropriate.
6. **Modulated EPR fees & fiscal nudges.** Differentiate EPR contributions by reparability/recyclability and verified recycled content; consider **VAT reductions** or targeted tax credits for certified recycled plastic feedstock and repair/refurbishment services.

De-risk SME investments and accelerate deployment. By combining public support with private capital, the circular plastics transition can scale more rapidly and sustainably, particularly in **less developed regions** where financial risk remains a barrier.

7. **Scale i3-style cascade funding and TA.** Expand interregional "first deployment" grants and advisory support (project design, permitting, conformity, market access) with simplified calls for SMEs and mid-caps—building on InCircular's portfolio of six projects.
8. Translating pilot outcomes into **investment-grade evidence** (cost savings, risk reduction, lifecycle benefits).
9. **Guarantees + blended finance.** Encouraging **regional co-investment vehicles** that blend EU/national funding with private capital. For example, use InvestEU and other instruments to back working-capital and equipment loans for sorting (NIR/hyperspectral) and process-control/digital-twin upgrades that stabilise recycled feedstock use.
10. **Early investor engagement.** Engaging investors directly in project pipelines (e.g. as observers in cascade calls or participants in demo days) to align innovation with financial expectations.

Unlock data for Digital Product Passports (DPP) & better permitting

11. **Fund open spectral libraries and datasets.** Publicly support datasets from AI-sorting pilots (like CLARA/PLASTNIR/PITS) to improve accuracy and trust; standardise data fields that can later feed **DPPs** under ESPR.
12. **Modernise permitting with data-by-design.** Encourage regional regulators to accept digital-twin/process-data evidence (e.g., SMART-MOLD outputs) for faster changes of operation and end-of-waste assessments.

Build skills and public confidence

13. **Targeted upskilling.** Vocational modules for maintenance, quality and process engineers on recycled-material handling, AI-based sorting and moulding with recyclate; training vouchers for SMEs.
14. **Evidence-based communication.** Co-create campaigns with consumer protection agencies and clusters to address food-contact and performance concerns; publish independent test results and conformity certificates in plain language.

Secure EU sovereignty in recycling and closing the loop

15. **Undercutting low-cost imports -** Investment hesitation is exacerbated as both **finished goods** (e.g. industrial knives) and **plastic recyclates** from e.g. China and India, are often offered at price levels that EU producers using compliant processes and labour standards simply cannot match. In this context, policy must both **lower risk for first movers** and **protect market integrity** so that verified EU recyclates can compete on quality rather than be displaced on price.
16. **Use trade defence** (anti-dumping/anti-subsidy) where evidence shows injury from third country imports of recyclates or circular tooling (e.g., industrial knives).

Regional actions to start now

17. **Industrial symbiosis hubs.** Replicate the InCircular hub model within regional innovation ecosystems, with brokerage between waste holders, recyclers and OEMs.
18. **Procurement pilots.** Run municipal pilots purchasing items with ≥30% verified recycled plastic where feasible (bins, street furniture, casings), using open specs that reference harmonised standards rather than brand-specific solutions.
19. **Aligned collection & feedstock prep.** Adjust local collection/sorting to produce the feedstock that NIR/hyperspectral systems can separate reliably; share results publicly to crowd in private investment.
20. **Focus more on the design-stage of the full Innovation process** in future funding programmes

Conclusion. InCircular demonstrates that **practical, data-driven innovations plus interregional cooperation** can overcome the bottlenecks identified in this brief—especially for SMEs. By adopting the actions above, EU, national and regional authorities can cut compliance friction, crowd-in private investment, and create confident demand for high-quality recycled plastics. The project team will continue turning pilot evidence into **replication tools (WP4)** and hands-on support for territories—so local administrations and SMEs can scale solutions now, not years from now