ToCoReRaM

Tool for Complete Recovery of Raw Materials

Brussels
13th November 2025

Workshop on raw material recovery
Report

Let's rethink raw materials - together

Ostfalia University of Applied Sciences

Ollscoil Teicneolaíochta an Atlantaigh
Atlantic Technological University

UNIVERSITY OF GRAZ

Supported by:

Federal Ministry
for the Environment, Climate Action,
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based on a decision of
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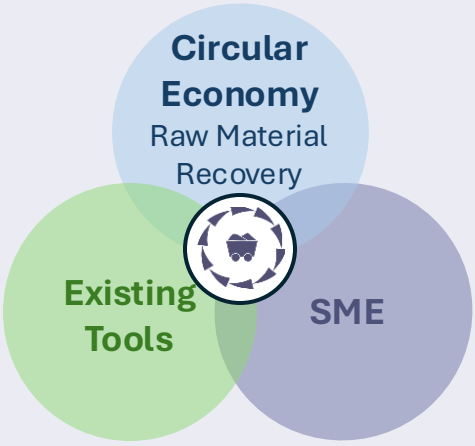
Summary: Project & Discussion

Project Mission

- **Impact** — Boosting recycling and reuse of materials in the EU
- **Outcome** — Requirement specifications for a tool to help SMEs efficiently use and recover raw materials in line with EU sustainability goals
- **Output** — Survey, interviews, benchmarking of existing tools, workshop and conference, scientific papers

Project: Motivation & Focus

- Supporting SMEs in integrating raw material recovery strategies in the product development process



Key Discussion Findings

Policy & Regulation Landscape	• Regulations are overwhelming, unclear, and inconsistent across the EU and frequently clash with other sectoral rules • Possible Solution: Digital Product Passport, but interoperability and practical rollout remain unclear
Awareness and Social Impact	• Need for training and education across industry, authorities, designers, and consumers to build circular mindset • Circularity should be framed positively, supported by incentives to shift behaviour
Tools and Digital Enablers	• Strong need for trusted, standardized tools and platforms (current solutions lack credibility or usability) • Tools must be sector-specific and adaptable

1. Workshop & Discussion Structure

Workshop Structure

The workshop took place in the EU-representation of lower saxony in Brussels.
The event started with an introduction of the project *ToCoReRaM*, its motivation, focus, and outcomes. Following, a presentation about first findings of interviews and a survey, conducted in the project, were presented to the participants. The first part of the workshop was concluded with a review on existing tools supporting the implementation of raw material recovery processes and further circularity measures. An overview of the presentations can be found on the next pages. The second part consisted of round-table talks, the main event of this workshop. Participants were asked to discuss three topics (see below) relevant for raw material recovery in SMEs in small groups. A final feedback from the workshop participants is further analysed and displayed in the Appendix A.

Roundtable Talk - Topics

Policy & Regulation Landscape:

- Attendees were asked to share their experiences with current and emerging policies and to reflect on how existing regulations support or fail to support SMEs. They were also asked to discuss necessary and/or desirable steps for future regulations with a stronger focus on the needs of SMEs.

Awareness & Social Impact:

- This topic focused on foundations required to enable circular adaptions. Without sufficient awareness of environmental or circular aspects, making change is difficult to achieve. Participants were asked to discuss how awareness could be increased among different stakeholders and how customer demand and expectations affect product planning processes within companies.

Tools and Digital Enablers:

- The third topic addressed the support and information needs of SMEs through tools. While many tools already exist, they often require extensive knowledge or implementation is expensive. Participants were asked how a support-tool focused on raw material recovery should look like, that it is easy to use, affordable, but still of high value and use for manufacturing SMEs.

2. Project Overview

Why was ToCoReRaM established? A short Story of the Project

The Urgency of Sustainable Product Development in the EU

The European Union has taken a decisive step toward a circular economy with the adoption of the Ecodesign for Sustainable Products Regulation (ESPR), which entered into force in 2024. This landmark legislation represents a paradigm shift in how products are designed, manufactured, used, and ultimately disposed of. It mandates that all products placed on the EU market—from electronics and textiles to furniture and machinery—must meet strict sustainability criteria throughout their entire life cycle. The regulation aims to reduce environmental impacts, promote resource efficiency, and ensure that products are durable, repairable, recyclable, and made from sustainable materials.

At the heart of the ESPR lies the requirement to close material loops, a core principle of the circular economy. This means that raw materials must not be used once and discarded, but instead recovered, reused, and reintegrated into new products. The regulation also introduces Digital Product Passports (DPPs) and extended producer responsibility (EPR) schemes. This will especially challenge small and medium-sized enterprises (SMEs). ToCoReRaM is not just a technological innovation project, it is a strategic response to the challenges posed by the ESPR, offering SMEs a practical, scalable, and user-centered tool to embed sustainability into their Product Development Processes (PDP) and close material loops effectively.

Motivation: What is the Driving Force?

Beside the political and legal restriction, the limited resources, especially in raw materials, threaten the European Market and all companies in Europe. Restrictions for the export of Critical Materials e.g. from China are showing how sensitive the European industry is regarding the import of raw materials. Closing the loop for materials is not only a step to a more sustainable production, it will also straighten the European economy against external influences and foster the European resilience. The idea for a totally closed loop of raw materials in Europe is the basic motivation for the project ToCoReRaM. At the end, only materials exported as products have to be replaced by new materials from outside EU.

2. Project Overview

The Challenge: Why SMEs Struggle with the ESPR 2024

While large companies often have dedicated sustainability departments, R&D budgets, and compliance teams, SMEs face significant barriers in adapting to the new regulatory landscape.
Key challenges include:

- Complexity of Life Cycle Assessment (LCA): SMEs often lack access to tools and expertise to conduct accurate LCAs, which are now mandatory under ESPR for many product categories.
- Limited access to secondary raw materials: Sourcing recycled or bio-based materials is difficult due to inconsistent supply chains, higher costs, and quality variability.
- High upfront investment in sustainable design and production: Retrofitting production lines or redesigning products for modularity and recyclability requires capital that SMEs may not have.
- Digital product passport (DPP) implementation: Creating and maintaining DPPs demands digital transformation, data management systems, and interoperability—resources often beyond SMEs' reach.
- Lack of standardized frameworks: Without clear, accessible guidelines tailored to SMEs, many struggle to know where to start.
- SMEs are limited not only in budget but also in staff. The new Challenge ESPR will cause more work and specific competences in the SMEs. Additional capacity building in all stages of education will be necessary to foster the process.

These challenges are not just technical, they are economic and strategic. Without support, SMEs risk being excluded from the EU market, losing competitiveness, or facing penalties.

Implementing Sustainability in the Product Development

ToCoReRaM integrates sustainability into the core of the product development process, starting with design. The project will create a tool and a new way of thinking in the PDP. There have to be a Mindshift, to focus more on sustainability and a circular economy. This can get an advantage in design and production for European companies against other markets. To operationalize this shift, ToCoReRaM addresses sustainability and circularity across multiple stages of the Product Development Process, covering the following key areas:

- Product Design & Development (durability, modularity, recyclability)
- Material Selection & Procurement (sustainable and secondary raw materials)
- Production & Processes (resource efficiency, waste reduction)
- Use & Reuse (sharing, repair, refurbishment)
- Recycling & Material Recovery (end-of-life management, closed-loop systems)
- Political & Economic Frameworks (regulations, incentives, standards)
- Business and Economic Aspects (small and medium-sized enterprises, business models, value chains)
- Policy and Regulatory Frameworks (regulations, incentives, standards)

Especially the aspect of Business and Economic Aspects is immanent for SMEs because of the more limited budget compared to bigger enterprises.

ToCoReRaM: Mediator between Circular Economy, Existing Tools and SMEs

Creating a new tool needs at first a benchmarking of existing tools in the market. Therefore one aspect of the project is to check tools and literature of this topic. SMEs have some special requirements for using tools.

- Tools have to be simple to understand and handle. Special training of the staff has to be minimized.
- The cost of a tool and training sessions have to be limited.
- All information and technical data feed into the tool have to be secure. Cloud solutions are not so popular for SMEs, in particular if the servers are not located in the EU.

Circular Economy is interesting for SMEs if they can reach higher sales and profits, for example by creating higher acceptance among environmentally aware customers, using materials more efficient or developing new sustainable materials. These can cause new innovation and new markets for products. Of course, CE also poses risks due to increased bureaucracy and restrictions.

Goals and Impacts: What are the goals and desired imparts of the Project?

- Output: ToCoReRaM carries out a survey, interviews, creates a benchmarking of existing tools, conducting workshops and conferences and will publish scientific papers.
- Outcome: The Project will define requirement specifications for a tool to help SMEs efficiently use and recover raw materials in line with EU sustainability goals.
- Impact: ToCoReRaM tries to boost recycling and reuse of materials in the EU, not only by creating a tool but also by initiating a shift to a more sustainable thinking along the PDP.
- The goal of the project team is to support and motivate SMEs to work more sustainable and foster Circular Economy in Europe.

How does ToCoReRaM approach this Goals?

The project team will perform the following activities to achieve these goals:

- Conducting interviews and surveys with SMEs in Germany, Ireland and Austria
- Analysing best practice and existing digital tools
- Creating a Literature review

Based on these results we want to understand what kind of support SMEs require to close raw material loops and create a list of requirements for a new tool. This is only the first step on the way to create a useful and effectively tool and technology to support SMEs on their way to a Circular Economy in Europe.

Why ToCoReRaM Matters: Alignment with the UN Sustainable Development Goals (SDGs)

ToCoReRaM's impacts extends beyond compliance. It contributes directly to several UN Sustainable Development Goals (SDGs):

- SDG 12: Responsible Consumption and Production: By promoting durable, repairable, and recyclable products, ToCoReRaM reduces waste and resource depletion.
- SDG 9: Industry, Innovation, and Infrastructure: The project fosters innovation in sustainable manufacturing and supports the development of green industrial ecosystems.
- SDG 13: Climate Action: Through reduced material extraction, lower carbon emissions from production, and energy efficient processes, ToCoReRaM helps mitigate climate change.
- SDG 10: Reduced Inequalities: By empowering SMEs with accessible tools and knowledge, ToCoReRaM helps level the playing field in the green transition.

Conclusion: A Blueprint for SMEs in the Age of ESPR 2024

The Ecodesign for Sustainable Products Regulation (ESPR) 2024 is not just a regulatory hurdle, it is a transformative opportunity to build a more sustainable, resilient, and inclusive economy. However, this transition will only succeed if SMEs are empowered to participate.

The ToCoReRaM project provides exactly that: a practical, scalable, and user-centered framework that embeds sustainability into every stage of the product development process. By focusing on closed material loops, modular design, secondary raw materials, and digital traceability, ToCoReRaM enables SMEs to comply with the ESPR while improving competitiveness, reducing costs, and enhancing brand reputation.

As the EU moves toward a circular economy by 2030, projects like ToCoReRaM are not just helpful, they are essential. They represent a new model of innovation: one that is technologically advanced, socially inclusive, and environmentally responsible.

Let's Rethink Raw Materials – Together

The future of manufacturing is circular. The future is sustainable. And the future is within reach, especially for SMEs who are supported by initiatives like ToCoReRaM.

3. Preliminary Research Results

Summary of Presentation on "Preliminary Research Results"

The presentation summarized the project results obtained at the time of the workshop. Using a multi-method research approach, the project generated comprehensive insights into barriers, opportunities and support needs of SMEs. First, semi-structured interviews with different stakeholders were conducted to identify the current state of RMR and barriers hindering the implementation. Building on these insights, a survey targeting manufacturing companies across multiple industries was developed.

The results indicate that circular design strategies are already applied in practice (e.g. modularity, reuse, longevity), however, the circular material use rate remains low. At the same time, multiple barriers hindering RMR in SMEs were identified, including economic (e.g. limited funding), technical (e.g. infrastructure limitations), and social factors (e.g. low awareness). The observed gap between intention and behaviour highlights the need for targeted support measures. Identified tool-related requirements focus on affordable, easy-to-use, and transparent solutions, that offer reliable data and networking decisions. In general, the majority expressed interest in a tool that supports RMR.

Overall, the findings suggest that enabling RMR in SMEs require a broad approach, including raising awareness, formulating realistic regulatory frameworks, and tailored support tools.

Graphic 1. Multi-Method Research Approach.

Summary of presentation on "Useful tools for incorporating sustainability, circularity and material recovery"

80% of a product's environmental impact is determined during the design phase[1]. In incorporating RMR into PDP, there are several tools and aids available for use [1]. Appendix B provides a more detailed overview of tools that support the integration of sustainability, circularity, and RMR within the PDP.

Software applications: There are many software applications used by the industrial experts which aids companies to embrace circular, sustainable and high recovery processes focusing on ESG & sustainability reporting, material flow analysis(MFA), material database, life cycle analysis (LCA), process flow analysis and design support. While there are many important features accommodated with these applications, high cost and the expertise requirements generate separate set of challenges for SMEs to use them within their companies.

Web Based Tools: Web-based tools such as digital product passports (DPP) & traceability platforms, toolkits & guidance portals, circularity assessment platforms, excel/spreadsheet templates, and decision tree/interactive guided process flows, can also contribute to PDP especially to incorporate RMR related strategies. Since these tools are freely available for anyone to access, they can be easily used by SMEs. Conversely, there can be concerns such as IP related security risks and context of the tool not being sufficient to be used in PDP.

Other tools and aids: Apart from the mentioned tools card games and workshops could also be useful for SMEs to incorporate more RMR based or circular product development strategies. These are suitable for more focused and individual product development, given that products vary across industries and production capabilities.

Existing tools show several clear gaps, especially when viewed from the perspective of SMEs and RMR. Most tools are not designed for SME needs, often being expensive, complex, and requiring specialist skills that smaller companies typically lack [2] [3]. Security and IP-related concerns also discourage tool adoption, particularly for platforms requiring detailed product data. Current solutions tend to prioritise analysis rather than supporting early stages of PDP [4] where design decisions strongly influence recoverability. Similarly, many tools focus on extending product lifetime but provide limited support for RMR from EOL products. Moreover, limited awareness and accessibility further reduce their practical impact. These gaps show that while tools exist, they do not fully address the specific challenges SMEs face when integrating RMR into their PDP.

The combined findings from the literature review, interviews, and surveys have the main similarity for simplicity, affordability, and practical guidance [5] [6]; the main difference is that practitioner feedback highlights everyday usability and training needs, while the literature emphasises technical integration and data-driven features such as DPP and embedded KPIs. Visual feedback, dashboards, and scoring were consistently valued across sources, as was the ability to integrate seamlessly into existing PDP.

[1] https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits
[2] https://www.mdpi.com/2071-1050/14/4/2364
[3] https://pmc.ncbi.nlm.nih.gov/articles/PMC11098482/?
[4] https://www.frontiersin.org/journals/built-environment/articles/10.3389/fbuil.2022.744946/full
[5] https://www.mdpi.com/2071-1050/14/11/6493
[6]https://jsbs.scholasticahq.com/article/126636-technology-driven-sustainability-in-small-and-medium-sized-enterprises-a-systematic-literature-review

4. Roundtable talk –Key Findings

Group 1 (Moderator: Aurora Dimache, ATU)
- Fabian Gems, SUPASO, Austria
- Hans-Christian Eberl, European Commission
- Jim Briscoe, Speco, Ireland
- Denis Kearney, HT Material Science, Ireland

Policy & Regulation Landscape:
Current regulations are highlighted as excessive, unclear and sometimes conflicting and therefore burdening SMEs rather than supporting them. Inconsistent implementations across EU is seen as another barrier. Digital Product Passports was highlighted as a potential tool enabling clarity and transparency.

Awareness & Social Impact:
Circularity and sustainability is more often viewed as additional cost, while decisions are driven mainly by cost-benefit. They suggest a positive reframing of sustainability as a competitive advantage. Education and training gaps among relevant stakeholders are identified as key challenge.

Tools & Digital Enablers:
Digital tools should be trustworthy and transparent to connect supply and demand for waste and secondary materials. Different applied areas were identified (e.g. logistics, material marketplaces) alongside the need for knowledge-sharing networks.

Group 2 (Moderator: Deborah Huber, University of Graz)
- Michaela Stephens, MATR, Austria
- Fernanda Rocha, Irish Green Building Council, Ireland
- Clemens Rosenmayr, WKÖ Austria

Policy & Regulation Landscape:
The current regulatory environment is perceived as complex, unclear, and overwhelming, particularly for SMEs with limited resources. They emphasize the need for a stronger EU-wide standardisation (e.g. for digital product passport) along with clearer definitions and realistic implementation timelines.

Awareness & Social Impact:
Awareness-enhancing efforts should not only target consumers but also authorities and supply-chain actors. Strengthening early education was established as essential for increasing the acceptance of circular products.

Tools & Digital Enablers:
There is a need for practical, credible, and standardised tools tailored to companies. They emphasized that a tool should be sector-specific, with support in early-stages and best-practice examples to enable business model transformation. Transparency is mentioned as crucial to build trust in digital enablers.

Conclusion

The workshop proved to be an effective platform for bringing together key stakeholders from research, industry, and policy, creating a strong basis for collaboration and open exchange of information. This close interaction enabled the validation of perspectives, identification of shared challenges, and alignment of expectations regarding circular product development and RMR in SMEs.

The discussions revealed that the current EU regulatory landscape is widely perceived as complex, unclear, and inconsistently implemented, placing a disproportionate burden on SMEs. Stronger EU-wide standardisation, clearer definitions, and realistic implementation timelines, particularly for DPP, are essential to improve transparency and regulatory usability.

Furthermore, circularity is still often viewed as a cost rather than a strategic opportunity. Increasing awareness among consumers, authorities, and supply-chain actors, supported by education and training, is critical to improve acceptance of circular products. Existing tools and digital enablers, while numerous, frequently fail to meet SME needs due to complexity, cost, and required expertise. There are many existing tools and digital enablers but many of them fail to meet SME needs due to complexity, cost, and required expertise. There is a clear demand for simple, affordable, and trustworthy tools that support early stages of the product development process, where design decisions have the greatest environmental impact.

Overall, the workshop discussions underline the importance of continuous stakeholder dialogue to ensure practical relevance. The insights gained will be further integrated into project publications and the final project conference in May 2026.

Key Takeaways

Collaboration: Workshops enable effective stakeholder exchange and form a strong foundation for cooperation.

Regulation: Clearer, harmonised EU regulations and standardised Digital Product Passports are essential for SMEs.

Awareness: Sustainability must be reframed from a cost factor to a competitive advantage.

Tools: SMEs require simple, affordable, and transparent tools focused on early design stages.

We like to thank all our participants for taking part in our workshop!

Appendix A: Feedback from Workshop Participants

The workshop held in Brussels was received very positively by participants. Overall satisfaction was high, with the organisation rated excellent. Participants found the workshop engaging and interactive, and the information, methods and results shared by the project group were considered useful both in general and for informing future decisions or activities in their field.

The most valuable aspects highlighted were networking opportunities, open discussions, idea sharing, and the chance to receive honest feedback. These elements suggest the workshop successfully created a collaborative and trust-based environment.

Suggested improvements focused mainly on logistics and outreach rather than content. Participants recommended involving more companies/SMEs, sharing more information in advance, and sending invitations earlier. Additional remarks reinforced the positive atmosphere, describing the meeting as well run with a friendly and approachable group, and expressing interest in maintaining connections.

Overall, the feedback indicates a well-executed and impactful workshop, with clear opportunities to increase reach and preparation for even greater engagement in future editions.

Workshop was well organized.	5/5
The information, methods & results shared by the project group were useful.	4,3/5
The information shared by the project group is useful for future decisions or activities in my field.	4,17/5
The worshop was engaging and interactive.	4,67/5
Overall, I am satisfied with the workshop.	4,67/5
What could have been improved?	• More companies/ SMEs involved • More information before meeting • Sent invitation earlier
What were the most valuable aspects for you?	• Networking • Sharing ideas • Discussion • Honest feedback
Any additional feedback/remarks	• Ask for connection • Well run meeting • Nice group, nice people

Appendix B: Useful tools for incorporating sustainability, circularity and material recovery

Type of tool	Definition	Examples
Software applications		
ESG and Sustainability Reporting Software	Track and report environmental, social, and governance data	Workiva, IBM Envizi ESG Suite
MFA Software	Visualize material loops to identify losses and recovery opportunities	STAN, umberto
Material Database	Enable designers to choose materials for higher RMR and assess substitution options	MatWeb, Ansys, CES EduPack
Life Cycle Analysis Software	Assess environmental impacts across their full life cycle	SimaPro, sphera
Process Flow Analysis Software	Model and analyse industrial processes to identify inefficiencies and recovery paths	openLCA, Technomatix, anylogic
Design support Software	Provide design-stage decision support and scenario modelling	SOLIDWORKS SUSTAINABILITY, EcoDesigner
Web based tools		
Digital Material Passports & Traceability Platforms	Provide material lists, disassembly steps, recovery codes, and routing to recovery facilities.	PSQR Circularise Minespider
Online LCA / Footprint Calculators	Online environmental-impact assessments across product life stages	EPLCA Eco Impact Calculator MÅLBAR tool
Toolkits & Guidance Portals	Package including explanations, questionnaires, articles, case studies, downloadable checklists and/or online quizzes to aid designing process	Circular Economy Toolkit Tools by Ellen MacArthur Foundation Eco Design Kit
Circularity Assessment Platforms	Assess product circularity through a questionnaire comparing it to a benchmark across lifecycle phases with scoring.	Circularity Potential Indicator (CPI) Tool BLUEfasma
Cloud Excel/Spreadsheet Templates	Simple, shareable scoring matrices, checklists, or guidelines to ensure raw material recovery in product development.	VSME Digital Template (by EFRAG) circitnord
Decision Trees / Interactive Guided Process Flows	Decision-support tool using predefined logic to give design-for-recovery recommendations and workflows with material data links.	Circular Business Development Canvas Pack
Other tools		
Card Games	Printable strategies included card game Targeted to SME to help them develop business strategies suitable for a Circular Economy	2030 SDGs GAME Make it circular! game