Interreg Danube Region

Co-funded by the European Union

Plan-C

Strategy development of transformation roadmaps for plastic processers

Deliverable D.3.2.1

Responsible Partner: Business Upper Austria

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1 Introduction

The plastics industry is at a critical turning point, facing mounting environmental and economic challenges that demand a shift from the traditional linear model of production, use, and disposal toward a circular economy. Circularity in plastics means designing products and systems that prioritize reuse, recycling, and long-term value retention, reducing waste and conserving resources. This transformation is not only essential for sustainability but also for compliance with evolving regulations, such as the EU target to recycle 50% of plastic packaging by 2025.

Despite these ambitions, many countries in the Danube Region struggle with weak recycling infrastructure, outdated waste systems, and gaps in technical expertise. Regulatory pressures, consumer expectations, and oversight from international bodies add complexity, while economic uncertainties—such as fluctuating markets, tariffs, and geopolitical risks—disrupt supply chains. Technological barriers, including inefficient recycling processes and contamination issues, further hinder progress.

Embracing circular principles offers significant benefits. Environmentally, it reduces plastic pollution and conserves natural resources. Economically, it lowers production costs and creates new business opportunities through innovative models like recycling, remanufacturing, and product-as-a-service systems. These approaches not only minimize waste but also generate continuous revenue streams and strengthen competitiveness. Initiatives such as Plan-C demonstrate the feasibility of circularity, providing practical solutions and fostering collaboration across sectors to drive sustainable industrial development.

This report explores how strategy development and transformation roadmaps can guide plastics processors toward circularity, outlining key challenges, regional differences, and actionable measures to achieve a resilient and resource-efficient plastics value chain.

1.1 Plan-C project

Moving Plastics and mAchine iNdustry towards Circularity (Plan-C) is an ambitious initiative aimed at transforming the plastics and machinery industries in the Danube Region towards a circular economy. The project brings together 14 partners from countries including Germany, Austria, Czechia, Slovakia, Hungary, Serbia, Bosnia and Herzegovina, Romania, and Moldova.

By fostering transnational cooperation among plastics processors, producers, and the machine industry, Plan-C seeks to develop innovative solutions that emphasize reuse, recycling, and long-term value retention. The core objectives of Plan-C include:

- Co-creating circular plastic solutions through collaboration and design thinking, resulting in practical prototypes and guidelines for SMEs.

- Redesigning machinery for reuse and recycling, covering the entire lifecycle and exploring digital opportunities.
- Developing a transnational action plan that aligns with EU regulations and national strategies, ensuring long-term impact through policy integration and SME support.

Plan-C aims to address significant barriers such as weak recycling infrastructure, outdated waste systems, and gaps in expertise. By promoting reuse, repair, remanufacturing, and smart recycling, the project aspires to accelerate clean growth in manufacturing sectors and strengthen business competitiveness across the region.

1.2 Objective

The goal of the workshops was to accelerate the transition of the plastics and machinery sectors in the Danube Region toward a circular economy by identifying barriers to circularity and co-creating practical solutions. They aimed to engage stakeholders in a collaborative process to map critical lifecycle stages, uncover systemic hurdles, and propose actionable "lifts" that enable circular practices. This included fostering cross-sector dialogue between machine producers and plastics processors to ensure holistic solutions.

The scope of the workshops covered the entire product lifecycle—from design and production to operation, maintenance, end-of-life, and reuse—addressing technical, economic, and regulatory challenges. The methodology emphasized regional diversity, ensuring that insights reflect local realities while contributing to a unified transnational strategy.

The ultimate aim was to generate knowledge and strategies that feed into the Plan-C transformation roadmap and transnational action plan, providing a foundation for policy recommendations, investment priorities, and collaborative projects that support circularity across the plastics value chain.

2 Methodology

The workshops were designed as interactive sessions to identify hurdles and opportunities for circularity within the plastics and machinery sectors. The approach followed a structured yet collaborative format, encouraging participants to actively engage in problem-solving and idea generation. At the outset, participants were divided into two groups—one representing machine producers and the other plastics processors—regardless of their actual roles. This role-play method fostered empathy and cross-sector understanding.

The sessions began with a brief introduction to the Plan-C project and an icebreaker to create an open and creative atmosphere. Participants then mapped the key lifecycle stages of a product, such as production, operation, end-of-life, and repurposing, and ranked these stages by importance. This exercise provided a clear framework for identifying where circularity faces the greatest resistance.

Next, participants brainstormed specific hurdles within these stages, documenting them on notes. Through the “Note Game,” these hurdles were shared and discussed, promoting dialogue and deeper insight into systemic challenges. After ranking the importance of each lifecycle stage, the groups switched tables to review the other group’s hurdles and propose potential solutions—referred to as “lifts.” This step encouraged collaborative thinking and generated a wide range of ideas, from practical measures to visionary concepts.

Where time allowed, the feasibility and usefulness of proposed solutions were assessed, helping prioritize actions for future implementation. All results were documented through photos and written summaries, forming the basis for comparative analysis across workshops. These insights will feed into the transnational action plan, ensuring that identified hurdles and lifts translate into concrete measures and projects aimed at accelerating the transition to a circular economy.

3 Strategy development for plastics producers

For the development of a joint strategy development for plastics producers transnational workshops were held. The workshops were conducted in following groups: Austria with Germany (Baden Württemberg), Bosnia and Herzegovina with Hungary and the Republic of Serbia, Czech Republic with Slovak Republic and Moldova with Romania. The objective was to map the key lifecycle stages influencing circularity, identify existing hurdles within each stage, and assess their relative importance for future strategic action.

3.1 AT|Austria / DE|Germany, Baden-Württemberg

The Austrian and German partners—Business Upper Austria, AWS, and Technology Center Horb—held their joint workshop during the K-Fair 2025 in Düsseldorf, the leading global event for the plastics industry. The session focused on identifying the most critical stages in a product's lifecycle for achieving circularity and analyzing the barriers that hinder progress.

Participants agreed that four lifecycle stages are central to circularity: production, operational management, repair and maintenance, and logistics. Among these, production emerged as the most influential stage because design and material choices made at this point largely determine whether products can be reused or recycled. Challenges in production include the higher cost of recyclates compared to virgin materials, poor product design for circularity, and inconsistent quality of recycled materials, which often leads to contamination and machine damage.

Logistics was ranked second in importance due to its systemic impact on recycling loops. High transport costs for bulky recyclates, complex return systems, and inefficient sorting technologies significantly reduce the quality and quantity of recovered materials. Operational management was considered moderately important, with hurdles such as high investment costs for circular technologies and growing regulatory requirements under EU frameworks like PPWR and EPR. These factors add complexity, particularly for SMEs. Repair and maintenance were seen as less critical but still relevant, as machine specifications are often incompatible with variable recyclate properties and product designs limit repairability and reuse.

Overall, the workshop highlighted that structural challenges in production and logistical inefficiencies are the main obstacles to circularity. Strategic efforts should therefore prioritize design innovation, material optimization, and improved collection and sorting systems, while supporting companies in meeting regulatory demands and investing in circular technologies.

3.2 BiH|Bosnia and Herzegovina / HU|Hungary/ RS|Republic of Serbia

The transnational workshop for Bosnia and Herzegovina, Hungary, and Serbia was held during the Central European Plastics Meeting in Budapest. The session gathered industry representatives and technology experts to identify key lifecycle stages for circularity and the hurdles preventing plastics producers from adopting circular practices.

Participants ranked production as the most critical stage, followed by recycling, usage, collection, and regranulation. Production challenges were dominated by economic and technical factors: virgin materials remain significantly cheaper than recyclates, while recycled feedstock often lacks consistency in quality and purity. Equipment incompatibility with recyclates, high energy requirements, and overproduction further complicate efforts to close material loops. Design-related issues, such as unnecessary packaging and lack of optimization, were also highlighted.

In the usage phase, societal behavior and customer acceptance emerged as major obstacles. Short product lifespans, overuse of packaging, and consumer distrust toward recycled materials limit circularity. Regulatory constraints and safety standards add complexity, particularly for applications requiring high material performance.

Collection and logistics were identified as systemic bottlenecks. Separate waste collection infrastructure is insufficient, bins are undersized, and public awareness remains low. Education and motivation of end-users, combined with weak enforcement, hinder effective material recovery. Similarly, regranulation and recycling stages face technical hurdles such as inconsistent viscosity, contamination, and energy-intensive processes. Recycling suffers from low waste availability, lack of advanced technology, and difficulties in processing non-monomaterial products, leading to quality loss and limited recycling cycles.

The workshop concluded that production and collection infrastructure require the most urgent attention, as they have the highest systemic impact. Proposed solutions included financial incentives for using recyclates, stricter regulations, improved sorting technologies, and education campaigns to shift consumer behavior. Technological innovations such as AI-driven process control and dedicated recycling technologies—was also seen as essential for overcoming technical barriers.

3.3 CZ|Czech Republic / SK|Slovak Republic

The workshop for plastics processors and machine manufacturers from the Czech Republic and Slovakia took place at Hotel Kontakt in Stará Lesná, Slovakia, with 33 participants representing universities, SMEs, and research institutions. The session aimed to identify key hurdles in achieving circularity in plastics and propose actionable solutions using the "Hurdles & Lifts" methodology.

The workshop began with an introduction to project objectives, outputs, and the roadmap method, followed by a review of EU circular economy policies and the Slovak Circular Economy Action Plan. Participants then prioritized five critical lifecycle stages: design (material and technology), production process, end-of-life (EOL), raw material sourcing, and product use. Design was ranked as the most influential stage, followed by production and EOL.

Key obstacles identified included insufficient consideration of environmental impacts during design, shortage of specialists, poor raw material quality, and technological limitations in production. Systemic issues such as complex legislation, lack of vocational knowledge, and financial challenges in sourcing new materials and funding research were also highlighted. At the consumer level, limited usability and low acceptance of recycled products remain barriers.

Proposed solutions focused on rationalizing production processes, increasing the proportion of recycled materials, and implementing Design for Recycling (D4R). Systemic measures included active participation in EU legislative processes, strengthening dual education systems, and promoting lifelong learning for technical staff. Participants also emphasized the need for modernization of technologies and bio-based resources, although feasibility scores for these were lower compared to education and process optimization.

Feasibility and usefulness were assessed on a 0–5 scale. The highest-rated solutions were dual education and training (5:5), rationalization of production (4:5), and reducing energy intensity (4:5). Legislative simplification and bio-based resources scored lower on feasibility. Urgent priorities identified were addressing the shortage of specialists, optimizing production processes, and clarifying EOL legislation.

The workshop concluded with mapping outputs to the Action Plan and defining evaluation criteria for implementation. Participants agreed that collaboration between plastics processors and machine manufacturers, combined with systemic education and legislative engagement, is essential for accelerating circularity in the region.

3.4 MD|Moldova/ RO|Romania

The Strategic Development Workshop on Circular Economy in the Plastics Industry was held in Chișinău, Republic of Moldova, on 13 November 2025. Organized by CLUSTERO, the "Petru Poni" Institute of Macromolecular Chemistry (ICMPP), and the SORINTEX Textile Cluster, the event brought together representatives from industry, research, and business support organizations from Romania and Moldova. The goal was to identify barriers to circularity in the plastics sector and propose actionable solutions to accelerate the transition toward sustainable practices.

Discussions focused on five key lifecycle stages: Waste Collection, Waste Sorting, Reintegration of Recycled Plastics, Product Design, and Use/Reuse. Participants agreed that Product Design and End-of-Life management (collection and sorting) are the most critical stages for achieving circularity. Design decisions determine recyclability and reuse potential, while efficient collection and sorting systems are essential for closing material loops.

Several major hurdles were identified. Poor design choices, such as the use of mixed or non-recyclable materials, limit recyclability from the outset. At the end-of-life stage, insufficient infrastructure for waste collection and sorting, combined with low public awareness and weak enforcement, results in significant material losses. Economic and technological barriers also persist, recycling remains costlier than producing virgin plastics, and many companies lack access to advanced sorting and processing technologies. Regulatory gaps and unclear standards further slow progress, while low levels of digitalization and limited funding opportunities hinder innovation and scalability.

To overcome these challenges, participants proposed a set of enabling measures. These included favorable legislation to support collection and recycling, eco-design principles to ensure products are easier to reuse and recycle, and digitalization of the recycling chain for better tracking and efficiency. Other recommendations involved public-private partnerships to develop regional recycling infrastructure, cluster-based cooperation models to foster innovation, and educational campaigns to raise awareness among consumers and producers. Access to EU and national funding was highlighted as essential for financing green technologies and modern equipment.

The workshop also assessed the feasibility and usefulness of proposed solutions. Education and eco-design scored highest for both feasibility and impact, followed by collaboration networks and reuse strategies. Advanced recycling technologies and digitalization were considered highly useful but less feasible in the short term due to cost and complexity. Policy support and funding mechanisms were seen as critical enablers for all other measures.

In conclusion, the workshop emphasized that achieving circularity in the plastics industry requires a systemic approach combining design innovation, infrastructure development, regulatory clarity, and cross-border collaboration. By aligning efforts across Romania and Moldova, stakeholders aim to create a competitive, sustainable plastics ecosystem that reduces waste, conserves resources, and drives economic growth.

4 Summary and Comparison

The workshops reveal not only differences in priorities, but also structural asymmetries in how circularity is perceived, enabled, and constrained. These asymmetries shape both the ambition and feasibility of circular strategies across regions.

4.1 Circularity as an Optimization Problem vs. a System-Building Problem

A clear difference emerged in how circularity was discussed and prioritized across regions.

- **Austria/Germany** and **Czech Republic/Slovakia** predominantly discussed circularity in relation to improving existing processes and frameworks. Workshop participants focused on optimizing production efficiency, integrating recycled materials, improving design choices, and meeting regulatory requirements. Discussions assumed the presence of functioning production systems, established supply chains, and operational governance structures, enabling a focus on refinement and improvement rather than system creation.

- **Bosnia and Herzegovina/Hungary/Serbia** and **Moldova/Romania** framed circularity more strongly around the need to address foundational constraints. Participants emphasized insufficient or inconsistent waste collection and sorting infrastructure, limited recycling capacity, weak enforcement of regulations, and restricted access to financing. These elements were repeatedly identified as prerequisites for advancing circular practices, with optimization measures discussed as secondary or longer-term objectives.

Overall, workshop discussions indicate that circularity efforts are shaped by regional context. In regions where industrial systems and regulatory frameworks are already in place, attention centers on upstream improvements such as design and production optimization, whereas in other regions greater emphasis is placed on downstream and institutional measures required to establish the basic conditions for circularity.

4.2 Design for Circularity: Strategic Lever or Unrealized Potential

All regions acknowledged the importance of design, but the extent to which circular design principles are reflected in current practice varied significantly.

- **AT/DE** and **CZ/SK** treated design for recycling, modularity, and material reduction as actionable levers. Design choices were explicitly linked to recyclate quality, repairability, process stability, and regulatory compliance.

- **BiH/HU/RS** and **MD/RO** also identified design as important, but discussions focused more strongly on economic, infrastructural, and regulatory constraints that currently limit the practical uptake of eco-design principles.

These differences indicate that the role of design in circularity is closely linked to enabling conditions such as market demand, infrastructure performance, and regulatory clarity, which vary across regions.

4.3 Market Signals and Risk Distribution

Differences in how risks were discussed and assessed influenced regional priorities.

- **AT/DE** workshop discussions referenced regulatory compliance, evolving EU requirements, and market expectations. Participants highlighted the need to adapt production processes and material choices to avoid regulatory non-compliance and reputational impacts, which positioned investments in circular solutions as a strategic response despite cost uncertainty.

- **CZ/SK** participants discussed risk in relation to both regulatory requirements and economic feasibility. Considerable attention was given to workforce availability, process efficiency, and legislative complexity, indicating a balancing of compliance-related pressures with concerns about implementation capacity and cost-effectiveness.

- **BiH/HU/RS** and **MD/RO** workshops placed stronger emphasis on financial and market-related risks. Participants highlighted the cost gap between virgin and recycled materials, unstable supply of quality recyclates, limited market demand, and uncertainty regarding policy enforcement. Investments in advanced technologies or higher shares of recyclates were therefore discussed cautiously and often linked to the need for external support.

Taken together, the workshops indicate that in regions facing higher financial and market uncertainty, proposed measures focused more strongly on mechanisms to reduce economic risk, such as financial incentives, clearer regulatory frameworks, and support instruments—rather than on stand-alone innovation incentives.

4.4 Infrastructure Quality and Its Systemic Effects

Differences in infrastructure quality influenced how material-related challenges were discussed across regions.

- **AT/DE** and, to a lesser extent, **CZ/SK** workshop participants referred to existing collection, sorting, and logistics systems that enable access to relatively consistent recyclate streams. This context allowed discussions to focus on increasing recyclate shares, improving process control, and testing material and process adaptations.

- **BiH/HU/RS** and **MD/RO** participants emphasized limited or inconsistent collection and sorting infrastructure. Recyclates were described as highly variable in quality, with contamination and inconsistent material properties frequently mentioned. These issues were linked to higher processing costs, equipment wear, and reluctance to increase the use of recycled materials.

Across the workshops, technical incompatibility with recyclates was therefore discussed less as an isolated machine-level issue and more in connection with the quality and reliability of upstream collection and sorting systems, highlighting the systemic role of infrastructure performance.

4.5 Technology Adoption Pathways

Differences emerged in how technological development and adoption were discussed across regions.

- **AT/DE** workshop discussions focused on upgrading and optimizing existing technological systems, including sorting technologies, logistics solutions, and process control, with an emphasis on maintaining production stability and compliance while gradually increasing circular performance.

- **CZ/SK** participants discussed technological measures alongside skills development, education, and applied research. Proposed solutions combined moderate technology upgrades with capacity-building measures, reflecting attention to both technical capability and the availability of qualified personnel to operate and adapt new technologies.

- **BiH/HU/RS** and **MD/RO** workshops framed advanced technologies primarily as longer-term objectives. Participants linked their adoption to prerequisites such as access to funding, improved infrastructure, workforce skills, and clearer regulatory frameworks, and emphasized more immediate needs related to basic system functionality.

Overall, the workshops indicate that the effectiveness of technological measures depends not only on access to technology but also on the surrounding capacities—such as skills, infrastructure, and organizational readiness—which were discussed to varying degrees across regions.

4.6 Human Capital: Bottleneck or Multiplier

Differences were observed in how human capital and skills-related issues were discussed across regions.

- **CZ/SK** participants repeatedly highlighted shortages of qualified specialists and technical staff as a major barrier to process optimization, innovation, and the adoption of circular practices. Education, vocational training, and dual education systems were therefore discussed as high-priority and high-impact measures.

- **AT/DE** workshop discussions referred to skills mainly in the context of implementing regulatory requirements, adapting processes, and integrating new technologies. Skills were discussed less as a limiting factor and more as an enabling condition for ongoing adaptation.

- **BiH/HU/RS** and **MD/RO** workshops placed stronger emphasis on general awareness, operational practices, and basic competencies. Participants highlighted challenges related to waste separation, quality control, and consumer behavior, alongside limited access to specialized training.

Taken together, the workshops indicate that education-related needs differ by context, ranging from advanced vocational and specialist training to broader awareness-raising and operational capacity-building.

4.7 Repair and Reuse as Dependent Strategies

Across regions, repair and reuse were discussed less prominently than production, design, and recycling, but for different reasons.

- **AT/DE** and **CZ/SK** workshops referred to repair and reuse mainly in relation to design choices, standardization, and economic efficiency. Participants indicated that limited modularity, product complexity, and cost considerations reduce the feasibility of repair, even where technical capabilities are available.

- **BiH/HU/RS** and **MD/RO** discussions linked limited repair and reuse primarily to market and product-related factors. Participants highlighted short product lifetimes, low consumer willingness to pay for repair, and the absence of standardized components as key constraints, alongside broader economic pressures.

Overall, workshop discussions suggest that repair and reuse are strongly influenced by upstream design decisions, market conditions, and user behavior, rather than by technical feasibility alone.

4.8 Implications for Transnational Strategy

The comparative analysis highlights several strategic implications derived from recurring patterns across the workshops:

- Circular transformation follows different sequences across regions. In some regions, workshop discussions focused first on optimizing existing production, design, and regulatory frameworks and then on scaling circular solutions. In other regions, participants emphasized the need to strengthen foundational elements—such as collection infrastructure, sorting capacity, enforcement mechanisms, and financing—before optimization measures can be effectively pursued.

- Transnational cooperation addresses different needs across contexts. Workshop outcomes indicate that some regions benefit primarily from knowledge exchange related to design practices, regulatory implementation, and process optimization, while others emphasized the importance of financial support, institutional strengthening, and infrastructure development as prerequisites for circularity.

- Policy instruments require contextual differentiation. Discussions suggest that where regulatory frameworks and enforcement are already functioning, policy measures tend to focus on design requirements and compliance mechanisms. In other contexts, participants highlighted the need for incentives, clearer rules, and improved enforcement to support initial adoption of circular practices.

- Transformation roadmaps benefit from reflecting regional starting points. Rather than applying uniform timelines or targets, workshop results indicate the importance of aligning actions with regional capacities, infrastructure conditions, and market realities.

Overall, the workshops show that circularity in the plastics industry is pursued through multiple, context-dependent transition pathways. These pathways are shaped by differences in economic conditions, governance structures, infrastructure performance, and industrial organization. Acknowledging these differences supports the development of more realistic, credible, and effective transnational transformation strategies.

5 Conclusion

The transnational workshops conducted within the Plan-C project provide a comprehensive and evidence-based understanding of how circularity in the plastics industry is currently perceived, constrained, and advanced across different regional contexts.

Across all regions, participants identified similar core lifecycle stages—design, production, end-of-life, and recycling—as critical for circularity. However, the way these stages were prioritized and addressed differed markedly depending on existing industrial structures, infrastructure performance, regulatory conditions, and market dynamics. In regions with established production systems and regulatory frameworks, discussions focused primarily on optimizing existing processes through improved design, material choices, and technological upgrades. In other regions, circularity was discussed more in relation to building or strengthening foundational conditions, such as waste collection and sorting infrastructure, enforcement mechanisms, access to finance, and basic market functionality.

Design emerged as a universally acknowledged lever for circularity, yet its role in practice varied. Where enabling conditions were in place, design for recycling and modularity was treated as an operational tool directly linked to recyclate quality, repairability, and compliance. Elsewhere, design-related measures were discussed alongside broader systemic and economic constraints, reflecting the need to address multiple barriers in parallel rather than sequentially.

The workshops also highlighted differences in market signals, risk perception, infrastructure quality, technological readiness, and human capital that shape feasible pathways toward circularity. Repair and reuse, while recognized as relevant, were consistently framed as dependent strategies whose viability is determined by upstream design decisions, market acceptance, and system-level conditions.

Taken together, the results demonstrate that the transition toward a circular plastics economy cannot be understood or implemented as a single, linear process. Instead, it consists of multiple, context-dependent transition pathways that reflect regional starting points and capacities. These findings underscore the importance of differentiated yet coordinated approaches at the transnational level - combining knowledge exchange, targeted policy instruments, and context-sensitive investment and support measures.

By grounding strategic development in workshop-based evidence and comparative analysis, this work provides a realistic and credible basis for developing transformation roadmaps that are both regionally appropriate and aligned with shared European circular economy objectives.

6 Annex

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Strategy development with transformation roadmaps with plastics processers

DE/AT

All interregional groups are responsible for evaluating and completing this check list, which contains individual parameters that should be evaluated and recorded during workshop D.3.2.1. In some cases, short statements are sufficient; in other cases, please provide an evaluation comment, upload files, photo documentation, etc.

Involved Partners:	TZH / Biz-Up / AWS
Participants:	8 participants
Date of proceeding:	10.10.2025
Place of proceeding:	Messe K - Düsseldorf

Proposed Workshop topic:
Hurdles & Lifts - Plastics Processors identify hurdles in in the circularity of their products. - Each Participant then seeks a way to "lift" machine producers over their hurdles.
Short description of the workshop, possible images, photos, etc.:
The workshop was centered on determining key struggles of plastics processors as well as ways for them to help machine producers become more circular.

Results and discussion of the Workshop step-by-step:

Step 1. **Identifying 5 track sections for plastics producers** What sections during a products lifetime are the most important for circularity?
- **1. Production** - **2. Operational procedures/Management** - **3. Repair and maintenance** - **4. Logistics** **(The sections are sorted by their importance.)**
Step 2. **Identifying hurdles on the track** What keeps a product / process from becoming circular? What problems arise during the transformation towards circularity?

1. Production
- **Economic Aspects**
  o Recyclates are usually more expensive than virgin materials
- **Design Aspects**
  o Products are often not designed for reuse, repair or recycling (e.g., mixed materials, inseparable parts).
- **Technical Aspects**
  o Recyclates have inconsistent properties (e.g., color, viscosity).

- Contamination can lead to machine damage or product defects.

2. Operational Procedures / Management

- **Economic Aspects**
  - High investment costs for new technologies (e.g., chemical recycling).
- **Regulatory Aspects**
  - Increasing requirements for traceability and quality assurance.
  - Regulatory Pressure: Compliance with EU directives like PPWR (Packaging and Packaging Waste Regulation) and EPR (Extended Producer Responsibility).

3. Repair and Maintenance

- **Technical Aspects**
  - Machines requirements do not fit all the time the material inflow properties (e.g. melt flow index, purity, etc.)
- **Design Aspects**
  - Products are often not designed for reuse, repair or recycling (e.g., mixed materials, inseparable parts).

4. Logistics

- **Economic Aspects**
  - High transport costs due to the bulkiness of recyclates.
  - Complex and costly return systems.
- **Design Aspects**
  - Consumer behavior—improper disposal disrupts material flows.
- **Technical Aspects**
  - Inefficient sorting and separation of plastic types. More efficient sorting by polymer type is technically demanding.

Step 3.

Assigning problems to track sections

At which point in a product's lifetime does each hurdle occur? What are the consequences of each hurdle?
1. Production Stage - **This includes product design, material selection, and manufacturing.** - **Economic Hurdle:** *Recyclates are mostly more expensive than virgin materials.* → This discourages manufacturers from using recycled content, limiting circularity and keeping demand for virgin plastics high. - Design Hurdle: *Products are often not designed for reuse, repair, or recycling (e.g., mixed materials, inseparable parts) or "designed for the dump"* → This leads to poor recyclability, short product lifespans, and increased waste. - **Technical Hurdles:** *Recyclates have inconsistent properties (e.g., color, viscosity).* → This affects consistent high product quality and limits their use in high-performance applications. *Contamination can lead to machine damage or product defects.* → This increases maintenance costs and production downtime. **2. Operational Procedures / Management Stage** - **This includes process implementation, compliance, and strategic decisions.** - **Economic Hurdle:** *High investment costs for new technologies (e.g., chemical recycling).* → Companies may delay or avoid adopting innovative recycling methods, slowing down progress.

- **Regulatory Hurdles:**

  Increasing requirements for traceability and quality assurance.

  → Adds complexity and cost to operations, especially for SMEs.

  Compliance with EU directives like PPWR and EPR.

  → Non-compliance risks fines or market restrictions, pushing companies to adapt quickly.

3. Repair and Maintenance Stage

- **This occurs during the product's use phase.**
- **Technical Hurdle:**

  Machine requirements do not always match the material inflow.

  → Leads to inefficiencies, frequent adjustments, and potential equipment incompatibility.
- **Design Hurdle (repeated):**

  Products are not designed for reuse, repair, or recycling.

  → Makes maintenance difficult or impossible, increasing waste and replacement costs.

4. Logistics and End-of-Life Stage

- **This includes collection, sorting, transport, and recycling.**
- **Economic Hurdles:**

  High transport costs due to the bulkiness of recyclates.

  → Reduces profitability of recycling operations and discourages participation.

  Complex and costly return systems.

  → Limits the effectiveness of take-back schemes and circular logistics.
- **Design Hurdle:**

  Consumer behavior—improper disposal disrupts material flows.

→ Leads to contamination, lower recycling rates, and increased sorting costs. - **Technical Hurdle:** *Inefficient sorting and separation of plastic types.* → Results in low-quality recyclates and high rejection rates, making recycling less viable.
Step 4. **Determining importance of track sections** Which sections are the most important to tackle? Do these sections have many problems that need to be solved or little problems that are very important? Include a graphic representation of the importance (photograph of flipchart or processed data)
1. Production - **Why it's important:** This is where the foundation for circularity is laid. If products are poorly designed or unsuitable materials are chosen, it becomes nearly impossible to repair, reuse, or recycle them later. - **Nature of problems:** **Many problems, and they are structural—affecting everything downstream.** o Design flaws o Material inconsistency o Contamination risks - **Impact:** High. These issues directly affect recyclability, product quality, and cost-efficiency.

2. Logistics

- **Why it's important:**

  Even if products are recyclable, poor logistics and waste management can prevent materials from ever reaching recycling facilities.

- **Nature of problems:**

  Fewer in number, but very critical.

  - Consumer behavior
  - Sorting inefficiencies
  - High transport costs

- **Impact:**

  High. These problems disrupt material flows and reduce recycling rates significantly.

Moderately Important Sections

3. Operational Procedures / Management

- **Why it's important:**

  This governs how well companies can adapt to circular practices and regulations.

- Nature of problems:

  Fewer, but strategically important.

  - Investment barriers
  - Regulatory pressure

- **Impact:**

  Medium to high. These can block innovation or lead to non-compliance, but they are often solvable with policy support or funding.

Lower Priority (but still relevant) **4. Repair and Maintenance** - **Why it's important:** Extending product life is key to circularity, but this stage is often overlooked. - Nature of problems: Fewer and repetitive (mostly design-related). o Lack of modularity o Equipment mismatch - **Impact:** Medium. Important for certain sectors (e.g., machinery, electronics), but less universal than production or logistics.

Fill out this part only after completing "Step 9" of the Workshop Concept:

Step 5. **Considering the hurdles of machine producers** What are their most important hurdles? Which hurdles can we as plastics processors help them overcome? And how?
- **What are their most important hurdles?** - **Which hurdles can we as plastics processors help them overcome? And how?**
Step 6. **How feasible are these solutions? How useful would overcoming this hurdle be?** **(score of 1-10 for each)** Which lifts have the highest score overall? Include a picture of the Feasibility/Usefulness scale (photograph or processed data)
- **Which lifts have the highest score overall?** - **Include a picture of the Feasibility/Usefulness scale (photograph or processed data)**

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Involved Partners:	Hungary / Serbia / Bosnia & Herzigovina
Participants:	17 Participants
Date of proceeding:	
Place of proceeding:	Central European Plastics Meeting, EIFFEL ART STUDIOS BUDAPEST // 30 Kőbányai út, 1101 Budapest, Hungary

Proposed Workshop topic:
Hurdles & Lifts - Machine producers identify hurdles in the circularity of their products. - Each Participant then seeks a way to "lift" plastics processors over their hurdles.
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Results and discussion of the Workshop step-by-step:

Step 1. **Identifying 5 track sections for plastics producers** What sections during a products lifetime are the most important for circularity?
- **Production, 5** - Recycling, 4 - Usage, 3 - Collection, 3 - Regranulation, 3 -
Step 2. + 3. **Identifying hurdles on the track** What keeps a product / process from becoming circular? What problems arise during the transformation towards circularity? **Assigning problems to track sections** At which point in a product's lifetime does each hurdle occur? What are the consequences of each hurdle?

Production,

comparatively low price of virgin material

equipment not suitable for recyclates

recyclate not up to final product standard

unavailability of recycled material

inhomogenity if recyclate feedstock is used

high energy needs of production

overproduction

uncessary use of packaging

too much negative environmental effect

optimization of material needs too much precision

purity of feedstock

price fluctuation of material

cost of virgin material too low

Usage,

quality of raw material and safety

regulations pose limitation

customer response / reception

not suitable for certain purposes

overuse of packaging material

unnecessary applications

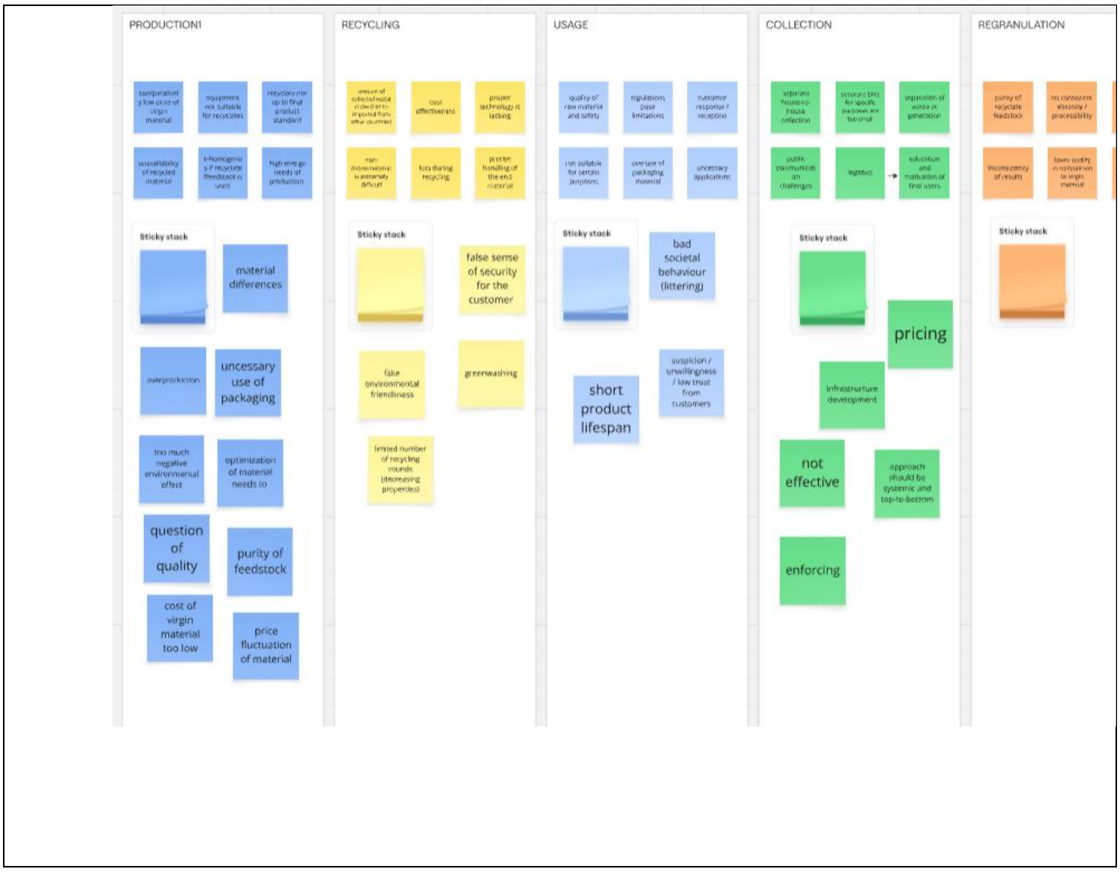
bad societal behaviour (littering instead of collection)

short product lifespan

suspicion / unwillingness / low trust from customers

Collection, separate house-to-house collection is needed separate bins for specific purposes are too small separation of waste at generation public communication challenges logistics education and motivation of final users pricing infrastructure development not effective approach should be systemic and top-to-bottom little enforcement **Regranulation**, purity of recyclate feedstock no consistent viscosity / processibility energy, water, resource intensity inconsistency of results lower quality in comparison to virgin material higher price **Recycling**, amount of collected waste is low (has to be imported from other countries) low cost effectiveness proper technology is lacking non-monomaterial is extremely difficult to recycle quantity loss during recycling precise handling of the end material false sense of security for the customer

greenwashing, fake environmental friendliness limited number of recycling rounds (decreasing properties)
Step 4. **Determining importance of track sections** Which sections are the most important to tackle? Do these sections have many problems that need to be solved or little problems that are very important? Include a graphic representation of the importance (photograph of flipchart or processed data)
- **Which sections are the most important to tackle?** - **Do these sections have many problems that need to be solved or little problems that are very important?** - **Include a graphic representation of the importance (photograph of flipchart or processed data)**


PRODUCTION1
RECYCLING
USAGE
COLLECTION
REGRANULATION
Sticky stack
material differences
unecssary use of packaging
question of quality
purity of feedstock
cost of virgin material too low
price fluctuation of material
Sticky stack
false sense of security for the customer
greenwashing
Sticky stack
bad societal behaviour (littering)
short product lifespan
Sticky stack
pricing
not effective
enforcing
Sticky stack

Fill out this part only after completing "Step 9" of the Workshop Concept:

Step 5. **How feasible are these solutions? How useful would overcoming this hurdle be?** **(score of 1-10 for each)** Which lifts have the highest score overall? Include a picture of the Feasibility/Usefulness scale (photograph or processed data)
Usage, Use of QC systems to ensure higher end-product quality Tax on overuse Educate customers Optimize packaging Improve customer acception Standardise materials across products carbon footprint label dedicated areas of reusing Better sourcing, selection, high-tech machines and technology **collection**, Provide additional bins during peak times (like holidays or events) Increase motivation among people Increase number of collection points Selected sectors with help Increase capacity, educate public, incentivise customers

Post education for moral mindset

More strict regulations for industry

Home sorting kits with clear instructions

Include in education

deposit system for even better collection, even in textiles

regranulation,

QC system

invention of dedicated technologies

improve handling and cleanness of the scrap material to avoid contamination on further process

adjust machine settings based on material behaviour

AI-powered self-learning process control system

Stimlate economic activity - consumption of virgin material will also help increase availability of recycled ones

increase effectiveness of wase sorting to be able to create homogenous feedstock

incentivise environment-friendly solutions

Energy and water needs should be covered with renewables

Regular calibration of machines

recycling,

Develop partnership with local government

Rethink the applications for recycled materials

Create regulation that supports the use of recyclates in products, give financial incentive to the industry to increase recycling rate

automated system to reduce human error

dedicated technology invention and awareness among society

product simplification, try for monomaterials where possible Better control of collection -> better recycled material ->higher tust of end user->higher price Financial aid for recyclers by polluter pays system
Scale of feasibility/usefulness: No. 1: Motivate converters to use recycled materials by subsidies, tax reliefs, etc. No. all the rest (equal score) - reward and penalty for citizens - standardise materials across products - Tax on overuse, Educate customers, Optimize packaging - carbon footprint label - Better sourcing, selection, high-tech machines and technology - refillable or reusable packaging - collection infrastructure development - regulations with help - think before regulate

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Strategy development with transformation roadmaps with plastics processors

All interregional groups are responsible for evaluating and completing this check list, which contains individual parameters that should be evaluated and recorded during workshop D.3.2.1. In some cases, short statements are sufficient; in other cases, please provide an evaluation comment, upload files, photo documentation, etc.

Involved Partners:	TUKE, SPK, UTB, Plastr
Participants:	33 participants
Date of proceeding:	10.10.2025
Place of proceeding:	Hotel Kontakt, Stará Lesná 180, 059 52, Slovakia

Proposed Workshop topic:
Hurdles & Lifts - Plastics Processors identify hurdles in in the circularity of their products. - Each Participant then seeks a way to “lift” machine producers over their hurdles.
Short description of the workshop, possible images, photos, etc.:
The workshop was centered on determining key struggles of plastics processors as well as ways for them to help machine producers become more circular. Description: The workshop, organized with **two target groups** – machine manufacturers and plastic processors, included the following procedures/steps: **The target group** consisted of participants from the university sector, from production (small and medium-sized companies), and research representatives. In terms of age composition and male and female representatives, it was balanced,

which has a great impact on defining and solving obstacles. The participants came from both the Czech Republic and the Slovak Republic. The official language of the workshop was Slovak; the participants presented and discussed in their national languages.

In the introduction, the project content, project outputs and results, the workshop objective, and the timeframe were presented.

All participants **introduced themselves** (name, job position, organization, and were supposed to identify themselves with some part of the product cycle (within the circular economy).

It was necessary to have enough **didactic materials ready** for the workshop (flip papers, markers, colored sticky notes). The essence of the Roadmap method and the possibilities of its use were presented. Both groups reviewed key EU documents on the circular economy, and at the same time, some key points from the Circular Economy Action Plan in the Slovak Republic were selected.

Subsequently, methodological procedures were carried out: defining areas - sections within the product cycle (especially for plastics and especially for machines), 5 areas were determined for each cycle, and prioritization was carried out. Subsequently, obstacles in the given sections and proposed solutions were determined. The groups moved 2 times - when defining obstacles (they were supplemented by the second group - the second view) and when solving obstacles (the view of the second group was supplemented). The structure was also presented within the workshop Action Plan *(general)* and methodological connection of individual parts of the Action Plan with the outputs of the Roadmaps method. Therefore, the groups continued with further activities - added to individual solutions for usefulness and feasibility.

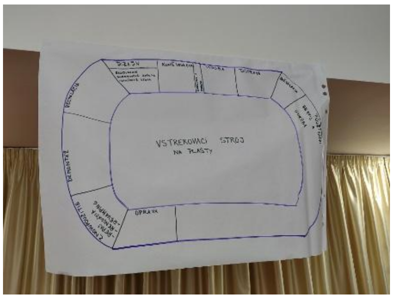
Subsequently, the groups changed again, and points from 1-3 were assigned for the time frame (need for speed of implementation). To implement the solutions, the group also proposed evaluation criteria for the proposed solution to be implemented.

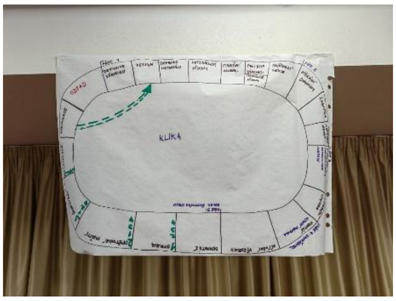
At the end of the workshop, a summary was made for each group (plastics processors and machine manufacturers), and a map was presented - the path of transferring outputs to the Action Plan and tasks to be solved in accordance with the action plan.

All workshop participants provided **oral feedback on the workshop** - methodology, outputs and the meaning of using the Roud map method for planning in accordance with the action plan.

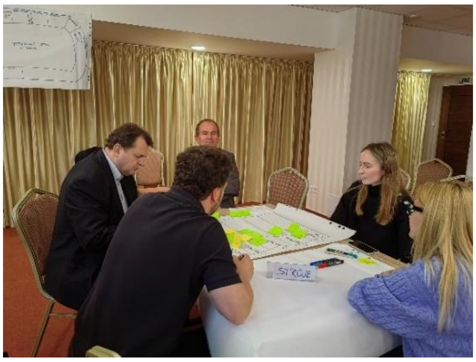
All procedures were **implemented in each group on 2 flipchart papers.**

The workshop **lasted 4.5 hours,** including a break.

 machine manufacturers group

 plastic processors group

Worskhop 10.10.2025 -Slovakia



machine manufactures plastic processors

<u>Results and discussion of the Workshop step-by-step:</u>

Step 1.

Identifying 5 track sections for plastics producers

What sections during a products lifetime are the most important for circularity?

The group selected the **5 most important sections** (areas) within the cycle, drew a table on another flipchart paper, and listed only the 5 most important sections (areas) within their product cycle in the left part (see).

In the next step, the importance of the sections of the route was determined. Each participant could assign 6 points to all sections. (They could assign points to any sections, divide them into several sections or assign all points to one section if they considered it particularly important.)

The sections were then ranked by importance, according to the total number of points. Each participant added the points themselves. They did not have to discuss them with their colleagues in advance, but they can discuss them later. It is advisable for each participant to take a marker and assign their points for the individual sections. The points are then added up.

Section	Importance
Design (material, technology)	11
Raw material sourcing	 5
Production process	 8
Product use (consumer)	 5
End of life (EOL)	 7

Step 2.

Identifying hurdles on the track

What keeps a product / process from becoming circular?

What problems arise during the transformation towards circularity?

1.Consideration of environmental impacts

2.Shortage of specialists

3.Poor quality raw materials

4. Insufficient (missing) vocational knowledge

5.Technological parameters and logistics 6. Legislation 7. Collection of products at EOL 8. Speed of innovation implementation 9. Financial complexity of new materials 10. Financial complexity of relevant research 11. Emission footprint 12. Limited use
Step 3. **Assigning problems to track sections** At which point in a product's lifetime does each hurdle occur? What are the consequences of each hurdle?

- **At which point in a product's lifetime does each hurdle occur?**
- **What are the consequences of each hurdle?**

Design (material, technology)	Production process
1.Consideration of environmental impacts 2. Shortage of specialists	1. Poor quality raw materials 2. Insufficient (missing) vocational knowledge 3. Technological parameters and logistics

End of life (EOL)	Raw material sourcing
1. Legislation 2. Collection of products at EOL 3. Speed of innovation implementation	1. Financial complexity of new materials 2. Financial complexity of relevant research 3. Emission footprint

Product use (consumer)
Limited use

The consequences of the obstacles were not precisely defined. In the following steps, the time horizons - the urgency of the solution - were defined.

Step 4.

Determining importance of track sections

Which sections are the most important to tackle?

Do these sections have many problems that need to be solved or little problems that are very important?

Include a graphic representation of the importance (photograph of flipchart or processed data)

In the previous steps (1-3) as well as in the summary description of the entire workshop, it is stated that within the plastics processing cycle, key areas/sections (5) were initially selected. All the problems that the group participants named could be assigned to the key 5 parts/sections of the "path" = the circularity cycle. In step 4, the obstacles and sections that were identified as the most important were selected.

Design (material, technology)	Production process
1.Consideration of environmental impacts 2. Shortage of specialists	1. Poor quality raw materials 2. Insufficient (missing) vocational knowledge 3. Technological parameters and logistics

End of life (EOL)
1. Legislation 2. Collection of products at EOL

3. Speed of innovation implementation

Step 5.

Considering the hurdles of machine producers

What are their most important hurdles?

Which hurdles can we as plastics processors help them overcome? And how?

The most important hurdles regarding plastics processors and machine manufacturers were: in the **design (material and technology) and production process sections.**

Design (material, technology)	**Production process**
defined hurdles	defined hurdles
1. Consideration of environmental impacts 2. Shortage of specialists	1. Poor quality raw materials 2. Insufficient (missing) vocational knowledge 3. Technological parameters and logistics
proposed solutions	proposed solutions
- Rationalization of the production process - Determination of the proportion of recycled material - Design for Recycling (D4R)	- optimization and rationalization - bio-based and eco-friendly resources

At the same time, **common and very important problems (hurdles) were defined**, which should be solved together.

1) EU legislation

2) Quality and sufficiency of human resources

proposed solutions

1) active participation in the comment procedure for European legislation
2) support for the dual education system in secondary schools,

   support for the active participation of students in solving company tasks,

   provision of various forms of education for professional employees (technicians, designers) within the framework of lifelong learning.

Step 6.

How feasible are these solutions? How useful would overcoming this hurdle be?

(score of 1-10 for each)

Which lifts have the highest score overall?

Include a picture of the Feasibility/Usefulness scale (photograph or processed data)

The group participants were asked to define the usefulness and feasibility of each proposed solution. A shorter scale was chosen, **from 0 to 5**. The participants from each group took colored post-its and assigned a record to each solution, where **the first number indicated feasibility and the second number indicated usefulness** (on a scale from 0-5).

In the record, it then looked like e.g. 4:5 (where 4 was the feasibility of the solution and 5 indicated usefulness)

<u>The following proposed solutions achieved the **best ratio** of feasibility and utility for plastics processors (converters):</u>

- Dual education and training within the production process 5:5
- Rationalization of the production process 4:5
- Reducing the energy intensity of the production process 4:5

- Modernization of technologies and materials 4:5

<u>The following proposed solutions received the **lowest scores** in terms of feasibility:</u>

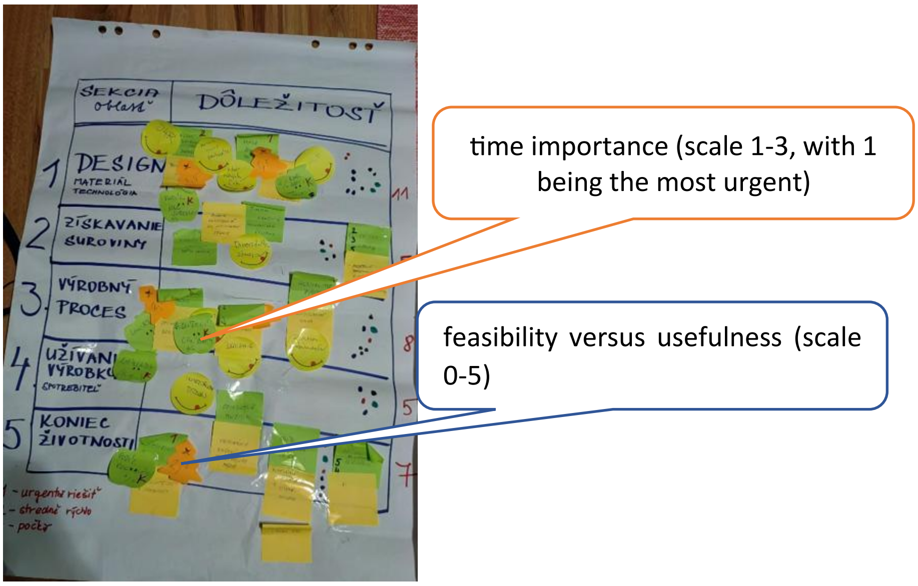
- Use of bio-based and eco-friendly resources 2:5
- Simplification of legislation within the framework of EOL (End of life) 2:5
- Subsidies oriented towards applied research 2:5
- Universal product design 2:5

<u>From the perspective of the **urgency of solving the problems**, the following solutions were selected as urgent:</u>

1) dual education, motivation of experts, and recruitment of specialists in the field of design (materials and technologies) = problem **lack of specialists**

2) optimization and rationalization, bio-based and eco-friendly resources = problem **technological parameters and logistics**

3) solution of legislation within the EOL framework (clarity and simplicity) = problem **legislation**



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Strategy development with transformation roadmaps with plastics processers

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Involved Partners:	Romanian Cluster Association – CLUSTERO, Bucharest, Romania - "Petru Poni" Institute of Macromolecular Chemistry – ICMPP, Iași, Romania - SORINTEX Textile Romania - Moldova
Participants:	13 Participants
Date of proceeding:	13.11.2025
Place of proceeding:	Chisinau, Republic of Moldova

Proposed Workshop topic: WORKSHOP: Circular Economy in the Plastics Industry Strategic Development Workshop powered by Plan-C project
Hurdles & Lifts Participants identified several major barriers **(Hurdles)** hindering circularity in the plastics sector, including: • Insufficient collection of plastic waste across urban and rural areas. • Lack of effective separation systems for plastics and mixed waste.

- Limited access to funding for purchasing modern recycling or processing equipment.
- Difficulty in reusing certain types of plastics due to complex or composite material structures.
- Absence of clear national regulations governing plastic recycling and reuse.
- Insufficient infrastructure for waste collection stations.
- Low cost-efficiency ratio of new products made from recycled plastics.
- High levels of plastic imports and uncontrolled inflow of waste materials.
- Low level of digitalisation in waste management and recycling processes.
- Low public awareness and lack of environmental responsibility among consumers and producers.

Identified **LIFTS**

To address these challenges, participants proposed several potential solutions and enabling measures:

- Favourable legislation supporting the collection, separation, and recycling of plastics.
- Reuse of industrial waste from textiles and construction as raw materials for other industries.
- Transfer of plastic waste for use as an alternative thermal energy source in facilities equipped with non-polluting incineration systems.
- Advanced sorting and processing technologies that allow higher material recovery rates.
- Digitalisation of the recycling chain, including tracking systems for waste collection and processing.
- Public-private partnerships to develop regional recycling infrastructure and innovation hubs.

• Educational and awareness campaigns promoting circular consumption and production patterns. • Cluster-based cooperation models to facilitate cross-sectoral projects and innovation transfer. • Access to EU and national funding instruments to support green technology investment. • Development of eco-design principles encouraging manufacturers to design recyclable and reusable plastic products.
Short description of the workshop, possible images, photos, etc.:
The **Strategic Development Workshop on Circular Economy in the Plastics Industry** was held in **Chișinău, Republic of Moldova**, on **13 November 2025**, within the framework of the **Plan-C project**. The event was organised with the active involvement of the following partners: • **Romanian Cluster Association – CLUSTERO**, Bucharest, Romania • **"Petru Poni" Institute of Macromolecular Chemistry – ICMPP**, Iași, Romania • **SORINTEX Textile Cluser**, Moldova The workshop gathered representatives from the private sector, research and innovation institutions, and business support organisations from Romania and Moldova. Participants jointly explored key challenges and opportunities for strengthening circular economy practices within the plastics industry. The discussions were structured around **five track sections** relevant for plastics producers: 1. **Waste Collection** – addressing gaps in waste collection systems and local infrastructure.

2. **Waste Sorting** – improving technologies and practices for effective material separation.
3. **Reintegration of Recycled Plastics** – promoting the use of secondary raw materials in production cycles.
4. **Product Design** – integrating eco-design principles to facilitate recycling and reduce waste.
5. **Use / Reuse** – supporting sustainable consumption and reuse-oriented business models.

Through an interactive and collaborative approach, participants identified both common **hurdles** and potential **lifts** to foster innovation, resource efficiency, and sustainability. The workshop strengthened cross-border cooperation between Romania and Moldova and contributed to the development of shared strategies for advancing a **circular and competitive plastics industry** in the region.

Results and discussion of the Workshop step-by-step:

Step 1. **Identifying 5 track sections for plastics producers** What sections during a products lifetime are the most important for circularity?
Identifying 5 track sections for plastics producers - Waste Collection – ensuring proper systems and logistics for collecting post-consumer and industrial plastic waste. - Waste Sorting – implementing efficient technologies and processes for material separation by type, composition, and recyclability. - Reintegration of Recycled Plastics – promoting the reintroduction of recycled materials into production chains as high-quality secondary raw materials. - Product Design – integrating eco-design and modularity principles that enable easier recycling, repair, and reuse of plastic products. - Use / Reuse – extending product life cycles through consumer awareness, reuse models, and innovative circular business practices. **What sections during a products lifetime are the most important for circularity?** Circularity must be addressed throughout a product's entire lifetime, from design to end-of-life. However, participants agreed that the design phase plays the most crucial role, as it determines the materials used, the product's durability, and how easily it can be repaired, reused, or recycled.

The use phase is also essential, as responsible consumption and maintenance help extend product lifespan and reduce waste generation. Finally, the end-of-life stage, which includes waste collection, sorting, and reintegration of recycled materials, is critical for closing the loop and ensuring that resources re-enter the production cycle.

Overall, design and end-of-life management were identified as the most important stages for achieving true circularity in the plastics industry.

Step 2.

Identifying hurdles on the track

What keeps a product / process from becoming circular?

What problems arise during the transformation towards circularity?

- **What keeps a product / process from becoming circular?**

A product or process often fails to become circular due to poor design choices, such as the use of mixed or non-recyclable materials and the lack of planning for reuse or disassembly. Other limiting factors include insufficient waste collection and sorting infrastructure, high costs of recycling compared to producing virgin materials, and limited market demand for recycled products. Additionally, the absence of supportive legislation and low awareness among producers and consumers further hinder circularity.

- **What problems arise during the transformation towards circularity?**

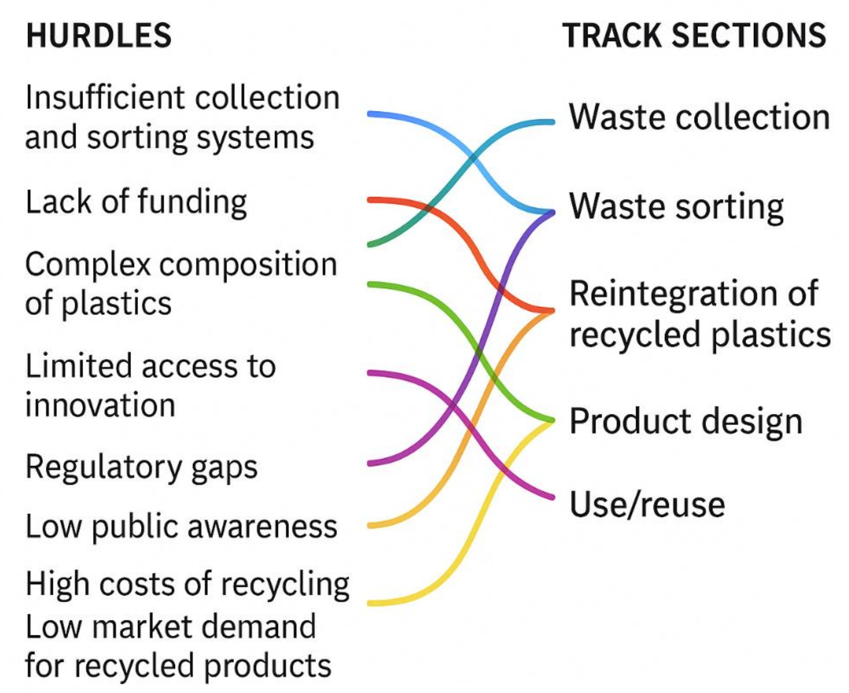
The shift towards circularity faces multiple challenges, including technological barriers, as many industries lack access to efficient recycling or recovery technologies. Financial constraints also play a major role, as investments in new equipment and systems can be costly. Moreover, the transition requires changes in business models, supply chains, and consumer behaviour, which take time and coordination. Finally, regulatory uncertainty and the lack of clear standards often slow down implementation and discourage companies from adopting circular practices.

Step 3.

Assigning problems to track sections

At which point in a product's lifetime does each hurdle occur?

What are the consequences of each hurdle?



- **At which point in a product's lifetime does each hurdle occur?**

Most hurdles appear at multiple stages of a product's lifetime. Design-related issues, such as the complex composition of plastics or lack of recyclability, occur at the very beginning — during the product design and material selection phase. Collection and sorting problems arise at the end-of-life stage, when waste management systems are insufficient or inefficient. Lack of funding and

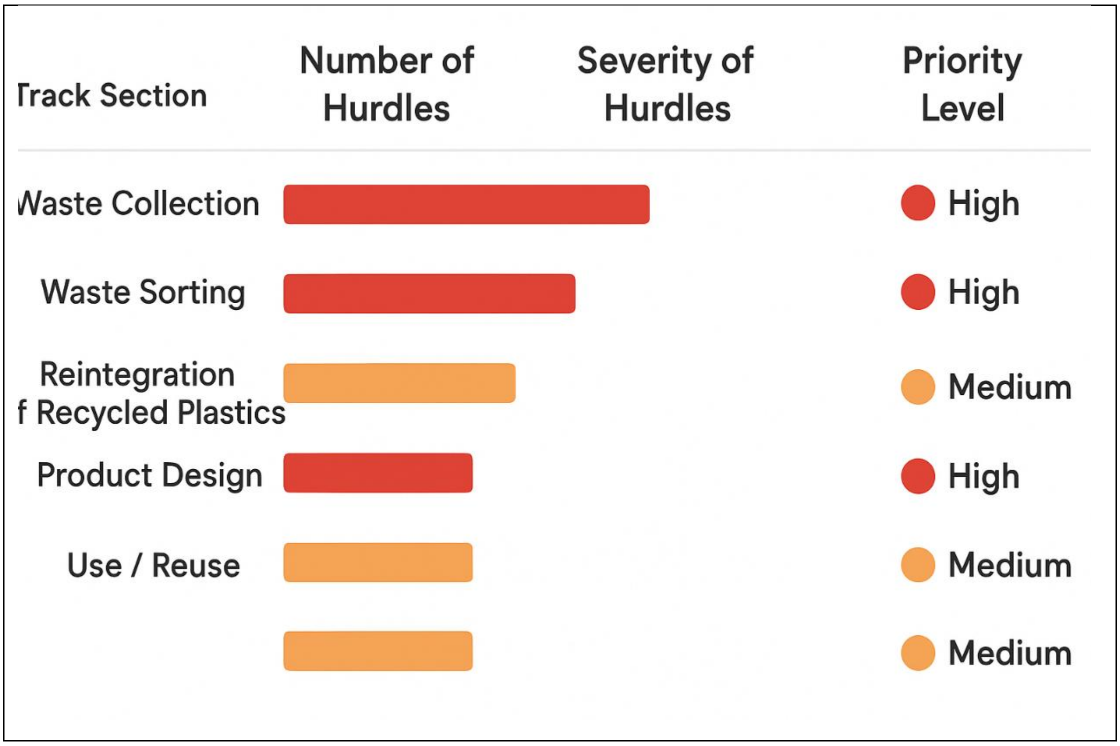
limited access to innovation mainly affect the production and recycling phases, where investment in new technologies is essential. Regulatory gaps and low public awareness influence the entire product lifecycle, as they shape the framework and behaviour needed for effective circularity. - **What are the consequences of each hurdle?** Each hurdle has both direct and indirect consequences on circularity. Poor design leads to non-recyclable products and increased waste, while weak collection and sorting systems cause loss of valuable materials and environmental pollution. Lack of funding and innovation limits the scaling of recycling technologies, keeping production dependent on virgin materials. Regulatory uncertainty and low awareness reduce motivation and participation across industries and consumers. Altogether, these barriers slow down the transition towards a circular economy, resulting in higher resource consumption, greater environmental impact, and missed economic opportunities for sustainable growth.
Step 4. **Determining importance of track sections** Which sections are the most important to tackle? Do these sections have many problems that need to be solved or little problems that are very important? Include a graphic representation of the importance (photograph of flipchart or processed data)
- **Which sections are the most important to tackle?** During the workshop, participants identified that **Waste Collection** and **Waste Sorting** are the most critical sections to address for enabling circularity in the plastics industry. Without effective collection and sorting, downstream

processes such as recycling and reintegration of recycled plastics cannot function efficiently. **Product Design** is also highly important, as materials that are difficult to recycle or poorly designed for reuse generate significant challenges throughout the product lifecycle.

- **Do these sections have many problems that need to be solved or little problems that are very important?**

The most important sections tend to have **both numerous and significant hurdles**. For example, Waste Collection faces multiple problems: lack of collection stations, low public awareness, and inefficient logistics. Similarly, Waste Sorting is hindered by inadequate separation technologies and insufficient funding for equipment. Product Design, while having fewer problems numerically, contains **critical barriers** such as complex plastic compositions that directly block recyclability. Thus, some sections are burdened by many moderate problems, while others have fewer but highly impactful issues.

- **Include a graphic representation of the importance (photograph of flipchart or processed data)**


Track Section
Number of Hurdles
Severity of Hurdles
Priority Level
Waste Collection
High
Waste Sorting
High
Reintegration
f Recycled Plastics
Medium
Product Design
High
Use / Reuse
Medium
Medium

Fill out this part only after completing "Step 9" of the Workshop Concept:

Step 5. **Considering the hurdles of machine producers** What are their most important hurdles? Which hurdles can we as plastics processors help them overcome? And how?
- **What are their most important hurdles?** Machine producers face several key challenges, including low energy efficiency, limited information about the types of plastics processed, a shortage of specialists for repair and maintenance, lack of spare parts, and insufficient infrastructure for component reuse. - **Which hurdles can we as plastics processors help them overcome? And how?** Plastics processors can help address these hurdles by providing detailed information on the types of plastics in their streams, sharing operational insights to enhance energy efficiency, and collaborating on training programs to develop skilled technicians. They can also support spare parts availability through coordinated demand or shared inventories and promote circular approaches for machine components, such as refurbishment or reuse. These measures strengthen collaboration, improve machinery performance, and advance a more circular plastics ecosystem.
Step 6. **How feasible are these solutions? How useful would overcoming this hurdle be?** **(score of 1-10 for each)**

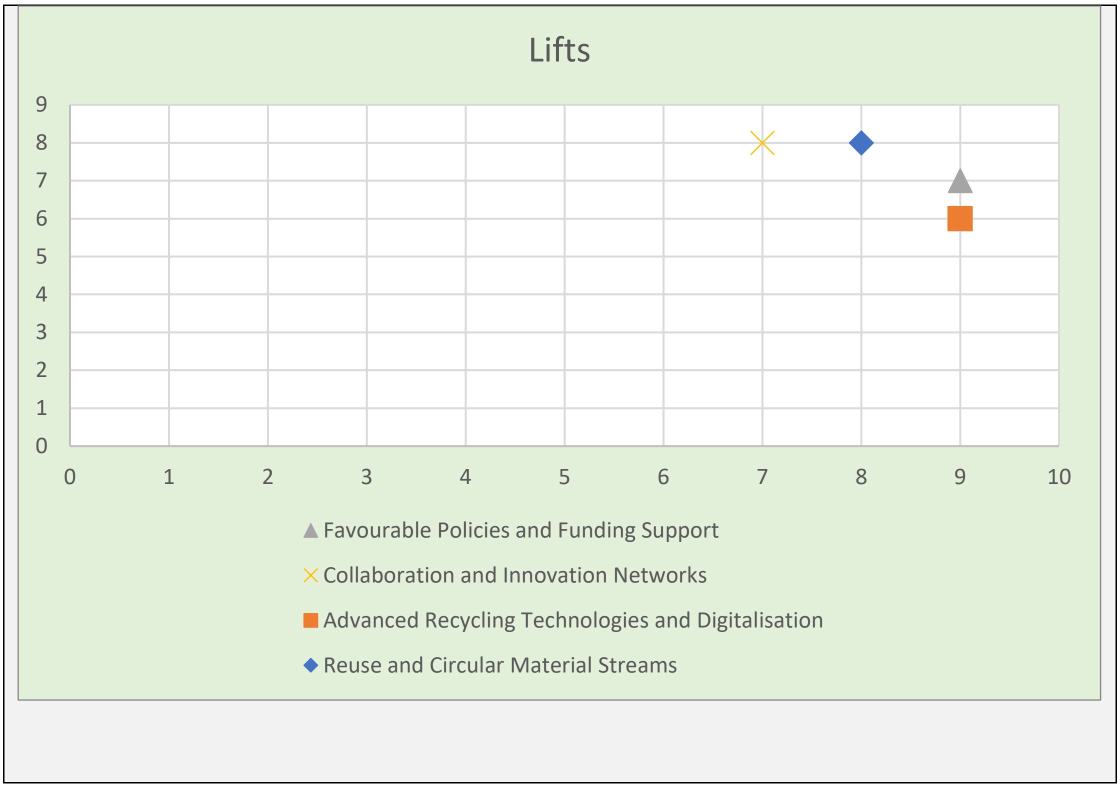
Which lifts have the highest score overall?

Include a picture of the Feasibility/Usefulness scale (photograph or processed data)

- **Which lifts have the highest score overall?**

Lift	Feasibility	Usefulness
Favourable Policies and Funding Support	7	9
Reuse and Circular Material Streams	8	8
Advanced Recycling Technologies and Digitalisation	6	9
Collaboration and Innovation Networks	8	7
Education, Awareness, and Eco-Design	9	8

- **Include a picture of the Feasibility/Usefulness scale (photograph or processed data)**


Lifts
9
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8
9
10
Favourable Policies and Funding Support
Collaboration and Innovation Networks
Advanced Recycling Technologies and Digitalisation
Reuse and Circular Material Streams