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Creation of a Vision for Transnational Collaboration of Plastics Processors and Machine Producers

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Responsible Partner: TUKE

Content

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Introduction

Introduction to the Plan-C Project

Moving PLastics and mAchine iNdustry towards Circularity (Plan-C) is an international project focusing on the Danube Region. The project consortium consists of 14 project partners from 9 countries (AT, BiH, CZ, DE, HU, MD, RO, RS, SK) whose regions are part of the Danube Region. As the project name suggests, the main objective of the project is to support the transformation of the plastics value chain in the Danube Region towards a circular economy through transnational cooperation. In addition to the core consortium of project partners, a number of other actors are involved, ranging from associated strategic partners to stakeholders representing plastics processors and manufacturers of plastics processing machinery.

The joint effort is to develop a vision of a transformed plastics value chain designed for the circular economy and to demonstrate the benefits of plastics reuse/recycling and maintenance, redistribution, refurbishment/remanufacturing and recycling of plastics and machinery. The final Transnational Action Plan for anchoring the circular economy in a holistic plastics value chain addresses SMEs, large enterprises, public sector organisations, sector agencies and public authorities.

Objective and Scope of Creation of a Vision for Transnational Collaboration of Plastics Processors and Machine Producers

The plastics industry is undergoing changes driven by increasing demands for innovation, digitalisation, efficiency and sustainability. In this context, there is a need to create a common transnational vision for cooperation between plastics processors and machine manufacturers, which makes the basis for synergistic partnerships across borders, strengthens the competitiveness of the sector and determines the direction of future development on a global scale.

The main objective of the vision is strategic and long-term cooperation between actors in the plastics value chain. This cooperation is to ensure:

- Increasing technological compatibility and innovation
- Connecting knowledge between the production target and plastics processors to create smarter, more efficient and more flexible production solutions
- Joint research in areas such as automation, digitalisation and additive manufacturing
- Promoting sustainability and the circular economy
- Collaborating on the development and deployment of recycling technologies biodegradable materials and energy-efficient machines
- Sharing know-how in the field of environmental innovation and reducing the carbon footprint.

Cooperation between plastics processors and machine producers is not a new concept. Most of these relationships have so far operated within the framework of bilateral contracts or local partnerships. Given the complexity of the challenges facing the historic industry, it is necessary to create a systemic, transnational vision that would coordinate joint efforts across borders.

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This vision for the transnational collaboration of plastic processors and machine producers should be based on the following main pillars:

1. Technological integration and innovation
2. Support for the circular economy
3. Unification of standards and harmonisation of processes
4. Cooperation in the creation of technical, quality and environmental standards valid across countries
5. Mutual recognition of certifications and audits in supply chains
6. Establishment of international platforms and centres of excellence
7. Support for education and training programs, exchange internships and dual education
8. Joint research and knowledge transfer between companies, universities and research institutions

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Creation of a Vision for Transnational Collaboration of Plastics Processors and Machine Producers

Project partners answered five questions regarding the vision for the transnational collaboration of plastic processors and machine producers.

1. How can plastics processors & producers contribute to creating a circular machine industry?
2. How can the machine industry support the circularity of plastics processors and producers?
3. How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimising machines?
4. How can plastics processing machine manufacturers be encouraged to design and optimise machines for easy and fast processing of recycled materials?
5. How can plastics processing machine manufacturers be encouraged to design and optimise machines for easy and fast production of recycled materials?

The full set of answers collected from the Plan-C partner regions can be found in the annex section.

Plastic processors and machine manufacturers form an interconnected ecosystem. Processors need technologies that enable efficient and sustainable use of both primary and recycled plastics. Machine manufacturers, in turn, need feedback from processors to develop equipment that reflects the real needs of the industry. In the Danube Region, where countries are at different levels of industrial development, transnational cooperation is key to supporting innovation and the transition to a circular economy.

Strategic objectives are:

- Supporting the circular economy
- Developing machines adapted to the processing of recyclates
- Integrating eco-design and standardization into plastic products
- Reducing energy consumption and waste in processing processes
- Joint innovation and research
- Implementing joint R&D projects
- Creating test centers and pilot lines
- Exchanging know-how between industry and academia
- Unifying standards and quality
- Defining regional standards for the quality of recyclates,
- Certification of machines suitable for the processing of secondary raw materials
- Harmonizing legislation between the countries of the Danube Region.
- Building human capital
- Educational programs for technicians, engineers and managers
- Transnational internships and exchange programs
- Creating innovation clusters and cooperation networks

- Use of policy and financial instruments support through EU programmes (Horizon, Interreg)
- Involvement of public-private partnerships, financial incentives for businesses investing in circular solutions.

To scale up the vision for transnational collaboration of plastics processors and machine producers in the Danube Region the solution needs to be systemic.

The demand-side (plastics processors/producers) asks for stable quality and quantity flows of recyclable materials and available recycled material.

Supply-side incentives and standards for machinery manufacturers are needed to ensure that machines reliably process recycled materials or produce recycled raw materials. Therefore, coordinated public policy and financial support (standards, procurement, R&D, extended producer responsibility, tax/credit signals) should build the frame for sustainable production.

Machine producers react quickly when there are clear regulations (ecodesign/product requirements), predictable market demand and a share of R&D costs or demonstration projects. The regulatory environment at the EU level (Circular Economy Action Plan; Ecodesign for Sustainable Products) needs to provide a framework that can be adopted and adapted by the countries in the Danube Region.

Below a summary of each individual vision (the responses to the questions mentioned above) provided by the project partners and a combined summary of all project regions. A joint vision, encompassing all project partners' regions, was then developed at the end.

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Visions from Nine Regions

AT |Austria

Strengths:

- Strong focus on circular economy, existing plastic and environmental clusters
- State the art recycling and/or technology
- SMEs (Small and Medium-sized Enterprises) and OEMs (Original Equipment Manufacturers) have strong export of recycling machines and technologies.

Vision:

1. Technical Collaboration

- Co-develop machinery tailored for recyclate variability and contamination.
- Joint R&D initiatives to create adaptable, modular, and efficient recycling technologies.
- Pilot testing and feedback loops between processors and machine developers.

2. Process Integration

- Design closed-loop systems and modular production lines for virgin and recycled materials.
- Implement traceability tools to monitor material flow and origin.
- Enable in-line recycling and regrind integration for seamless material reuse.

3. Digitalization and Data Sharing

- Build shared databases on recyclate properties and performance.
- Develop digital twins and AI-driven systems for predictive maintenance and adaptive processing.
- Use digital platforms to track machine performance and material flow.

4. Market and Policy Alignment

- Advocate for circular-compatible machinery standards and procurement criteria.
- Align with EU and national circular economy strategies (e.g., ESPR, Green Deal).
- Promote circular business models such as Product-as-a-Service (PaaS) and Machine-as-a-Service (MaaS).

5. Knowledge Transfer and Capacity Building

- Co-create training programs and guidelines for operating circular-compatible machines.
- Share best practices, case studies, and technical documentation.
- Establish experience exchange platforms and FAQs for problem-solving.

6. Strategic Engagement and Recognition

- Foster cross-sector partnerships and innovation clusters.
- Create platforms for pilot testing and co-development.
- Promote visibility through awards, certifications, and sustainability rankings.

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BiH|Bosnia and Herzegovina

Strength:

- Waste management performance is improving, but circular economy systems are underdeveloped.

Vision:

1. Technical Collaboration

- Processors share recyclate data to improve machine design.
- Joint development with recyclers enhances processing systems.
- Test batches help build more robust machines.

2. Process Integration

- Products designed for recyclability support circular use.
- Modular machines reduce waste and investment.
- Machines that handle variable-quality recyclates ease the shift from virgin plastics.

3. Digitalization and Data Sharing

- Machines track energy and material performance for better quality control.
- Real-time data improves machine settings and efficiency.

4. Market and Policy Alignment

- Public tenders for “recyclate-ready” machines influence manufacturers.
- National and EU labels promote circular equipment.

5. Knowledge Transfer and Capacity Building

- Demonstrators show recyclate efficiency, building trust.
- Pilot projects and innovation vouchers reduce risk.

6. Strategic Engagement and Recognition

- Local collaboration customizes machines for recyclates.
- Better access to parts extends machine life.
- Joint investment programs support circular technology.

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CZ|Czech Republic

Strengths:

- Develop mechanical engineering industry, there is a demand for innovations in plastics.
- National Circular Czech strategy and waste plans
- Active industry players developing closed-loop packaging

Vision:

1. Technical Collaboration

- Processors and manufacturers jointly identify critical machine components and assess circular impacts.
- Collaboration ensures machines support decarbonization through optimized design.

2. Process Integration

- Machines must allow reuse or remanufacturing of wear parts.
- Service contracts should prioritize reconstruction over replacement.

3. Digitalization and Data Sharing

- Specifications must include energy efficiency data with design justification.
- Transparent data supports lifecycle carbon footprint reduction.

4. Market and Policy Alignment

- Manufacturers should commit to post-use machine engagement.
- Circular service models align with sustainability policies.

5. Knowledge Transfer and Capacity Building

- Manufacturers must explain servicing methods that favor reuse.
- Clear documentation supports processor understanding and adoption.

6. Strategic Engagement and Recognition

- Continuous exchange between processors and manufacturers drives tailored solutions.
- Service contracts should include remanufacturing options to extend machine life.

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DE|Germany, Baden-Württemberg

Strengths:

- Leaders in circular policies and technologies. Strong industrial base, but lower plastic recycling rate.
- Opportunities for innovation in the automotive sector.
- Leading OEMs and strong industry associations, ready to standardise and scale modular retrofit solutions.

Vision:

1. Technical Collaboration

- INNONET Kunststoff connects processors, machine makers, and researchers for joint R&D and recycling-focused dialogue.
- Working groups enable direct feedback on recycling-optimized machinery.

2. Process Integration

- Processors share recyclate properties and process needs (e.g., quick-change systems) with manufacturers.
- Pilot projects (e.g., Plastics InnoCentre) test machine setups tailored to recycled materials.

3. Digitalization and Data Sharing

- Clear technical requirements (e.g., viscosity, density variations) help optimize machine design.
- Data from pilot cases supports machine adaptation for recyclate processing.

4. Market and Policy Alignment

- Programs like REKOWI fund joint circular economy projects between processors and machine makers.
- Events like KONGRESS BW foster collaboration across industry, policy, and science.

5. Knowledge Transfer and Capacity Building

- Pilot cases demonstrate practical recycling solutions and build know-how.
- Platforms promote exchange of best practices and technical insights.

6. Strategic Engagement and Recognition

- WIN-Charta boosts processor credibility and encourages machinery partners to align with sustainability goals.
- Regional initiatives incentivize long-term commitment to circular practices.

HU|Hungary

Strengths:

- Strong industrial base, but lower plastic recycling rate.
- Opportunities for innovation in the automotive sector.

Vision:

1. Technical Collaboration

- Processors share data on recycled and bio-based material challenges to help manufacturers adapt machine designs.
- Joint pilot projects test modular solutions for better adaptability and longer equipment lifespan.

2. Process Integration

- Machines should handle diverse recycled inputs with minimal adjustment.
- Modular systems and inline quality control improve processing consistency and reduce downtime.

3. Digitalization and Data Sharing

- Predictive diagnostics, contamination monitoring, and energy tracking optimize recyclate processing.
- Data-driven systems support efficient, low-carbon machine operation.

4. Market and Policy Alignment

- Policy incentives (e.g., tax benefits, grants) encourage circular-ready machine designs.
- Demonstrated market demand from processors using post-consumer waste drives innovation.

5. Knowledge Transfer and Capacity Building

- Collaborative R&D with academia and industry showcases the value of modularity and energy efficiency.
- Technical requirements from processors guide machinery development for recycled materials.

6. Strategic Engagement and Recognition

- Manufacturers should support feedstock preparation (e.g., shredding, washing, sorting) with advanced technologies.
- Financial support for pilot projects reduces risk and accelerates circular machinery adoption.

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MD|Moldova

Strengths:

- Smaller market
- Priority is building collection systems and simple recycling capacity
- Support modular, low-cost machines and local entrepreneurship

Vision:

1. Technical Collaboration

- Processors inform machine makers of new requirements (e.g. contamination tolerance, modularity) through co-creation and feedback.
- SORINTEX can partner with manufacturers to develop equipment aligned with circular practices like remanufacturing and closed-loop systems.

2. Process Integration

- Adoption of post-consumer and post-industrial recyclates drives demand for adaptable machinery.
- Retrofitting legacy equipment supports circularity and reduces capital costs.

3. Digitalization and Data Sharing

- Material passports and digital traceability tools align both sectors with sustainability goals.
- Smart diagnostics and contamination monitoring improve recyclate processing efficiency.

4. Market and Policy Alignment

- Policy incentives (e.g. tax benefits, co-financing) encourage circular-ready machine designs.
- Demonstrated demand from processors using recycled materials motivates innovation.

5. Knowledge Transfer and Capacity Building

- Moldova's academic partnerships (e.g. Technical University) support pilot projects and training.
- International collaboration enables technology transfer and skill development.

6. Strategic Engagement and Recognition

- SORINTEX can lead circular model pilots focused on reusability and repairability.
- Supporting refurbishment over replacement strengthens long-term sustainability.

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RO|Romania

Strengths:

- Developing recycling infrastructure
- Low plastic recycling rates historically but active NGOs/enterprises
- Opportunity for medium-scale recycling lines upgraded with EU support.

Vision:

1. Technical Collaboration

- Romanian plastics processors and SMEs can co-create circular-ready machinery by sharing feedback and piloting solutions.
- Companies like EURODAC Automation design machines with recyclable components and advanced recovery technologies.

2. Process Integration

- Circularity across the value chain includes responsible sourcing, eco-design, and reintegration of recycled plastics.
- Machine refurbishment and modular upgrades reduce waste and extend equipment life.

3. Digitalization and Data Sharing

- Digital tools optimize material flows and support traceability and lifecycle monitoring.
- Material passports and smart diagnostics enhance circular business models.

4. Market and Policy Alignment

- EU funding and cross-border cooperation accelerate circular innovation and modernization.
- Reducing dependence on imports strengthens Romania's machinery sector.

5. Knowledge Transfer and Capacity Building

- Collaboration with research institutions supports training and technology development.
- Transnational partnerships enable tailored, energy-efficient solutions for SMEs.

6. Strategic Engagement and Recognition

- Engaging end-user industries (e.g. packaging, automotive) helps close the loop in plastics reuse.
- Romania's integrated approach boosts regional competitiveness and sustainability leadership.

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RS|Republic of Serbia

Strengths:

- Local OEMs and suppliers exist
- Focus on upgrading process quality and integrating digital process control to handle recyclates
- Growing demand for machine modernization

Vision:

1. Technical Collaboration

- Serbian plastics processors can co-develop material standards and test recycled plastics with machine producers.
- Collaboration helps tailor machinery to handle recycled feedstocks effectively.

2. Process Integration

- Improving collection and sorting enables a steady supply of clean, standardized recyclates.
- Eco-design of plastic components supports reuse and recovery at machine end-of-life.

3. Digitalization and Data Sharing

- Smart systems for monitoring material flow, energy use, and quality enhance recyclate processing.
- Digital tools improve efficiency and reduce downtime in machine operations.

4. Market and Policy Alignment

- Low recycling rates highlight the need for investment and policy support to boost circularity.
- Long-term partnerships and modular solutions reduce costs for smaller processors.

5. Knowledge Transfer and Capacity Building

- Technical training and shared R&D projects strengthen processor capabilities.
- Machine producers support processors with adaptable equipment and expertise.

6. Strategic Engagement and Recognition

- Serbia's potential lies in leveraging post-consumer waste through circular machinery.
- Supporting refurbishment and modularity extends equipment life and reduces capital needs.

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SK|Slovak Republic

Strength:

- Central European manufacturing base — opportunity to join cross-border pilot clusters (CZ, AT, SK) for packaging and automotive recyclates.

Vision:

1. Technical Collaboration

- Slovak plastics processors can co-develop recyclable materials and components with machine producers.
- Partnerships help tailor machines for recycled inputs and end-of-life recovery.

2. Process Integration

- Eco-design and use of recycled plastics reduce reliance on virgin materials.
- Machines designed for closed-loop flows minimize waste and improve efficiency.

3. Digitalization and Data Sharing

- Smart systems monitor material flow and energy use, enhancing recyclate processing.
- Digital traceability supports efficient recycling and lifecycle management.

4. Market and Policy Alignment

- Slovakia's low circularity rates highlight the need for stronger policy support.
- Aligning with EU strategies boosts adoption of circular practices.

5. Knowledge Transfer and Capacity Building

- Collaboration with resin producers and researchers fosters innovation in recyclable plastics.
- Joint development improves supply chain resilience and creates new revenue streams.

6. Strategic Engagement and Recognition

- Machine producers can lead circular transformation by designing adaptable equipment.
- Slovakia's emerging strategy offers a foundation for long-term sustainability leadership.

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Combined Summary of Nine Regional Visions

1. Technical Collaboration

Plastics processors and machine manufacturers must co-develop solutions tailored to recycled and bio-based materials. This includes sharing data on material behavior, piloting modular machinery, and designing components for recyclability. Regional networks and platforms (e.g. INNONET Kunststoff, SORINTEX partnerships) foster innovation through joint R&D and feedback loops.

2. Process Integration

Circularity must be embedded across the value chain—from eco-design and responsible sourcing to modular machinery and end-of-life recovery. Processors play a key role by improving sorting and recycling practices, while machine producers must offer adaptable equipment that handles diverse feedstocks and supports reuse, refurbishment, and remanufacturing.

3. Digitalization and Data Sharing

Digital tools such as smart diagnostics, material passports, and energy tracking systems enhance traceability, efficiency, and lifecycle monitoring. Real-time data sharing between processors and machine builders enables better machine calibration and supports predictive maintenance.

4. Market and Policy Alignment

Policy incentives (e.g. tax benefits, grants, co-financing) and public procurement standards can accelerate the adoption of circular-ready machinery. EU strategies and national frameworks (e.g. Slovakia's 2022 circular strategy, REKOWI in Baden-Württemberg) provide a foundation for aligning industry practices with sustainability goals.

5. Knowledge Transfer and Capacity Building

Cross-sector collaboration with academia, recyclers, and service providers builds technical capacity and fosters innovation. Pilot projects, training programs, and regional events (e.g. KONGRESS BW) support SMEs and strengthen local ecosystems for circularity.

6. Strategic Engagement and Recognition

Processors and machine producers must engage in long-term partnerships to co-create solutions, retrofit legacy equipment, and expand circular business models. Recognition through sustainability charters (e.g. WIN-Charta) and regional leadership initiatives enhances credibility and drives market transformation.

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Joint Vision for Transnational Collaboration of Plastics Processors and Machine Producers

Development of transnational collaboration between plastics processors and machine producers within the Danube Region will require a strategic, coordinated, and evidence-based approach to ensure the long-term sustainability, competitiveness, and circularity of the plastics value chain.

Building upon the foundations established through the Plan-C initiative, several key directions should be pursued to consolidate and expand the progress achieved thus far. Future efforts should focus on deepening cross-border collaboration between plastics processors, machinery manufacturers, research institutions, and public authorities.

Establishing permanent transnational innovation platforms and networks would enable continuous knowledge exchange and joint development of advanced technologies. Shared pilot facilities and demonstration centers should be created to validate innovations under real industrial conditions. At the same time, cross-border clusters can facilitate the scaling of circular technologies, automation solutions, and digitalised production systems across the region.

A crucial step towards systemic circularity is the harmonisation of standards, policies, and regulatory frameworks across the Danube countries. Developing regional standards for recyclates quality, machine certification, and environmental performance will facilitate the integration of secondary raw materials and the interoperability of production systems. In addition, governments should adopt public procurement and fiscal policies that prioritise circular-ready technologies and incentivise enterprises to invest in sustainable practices.

Continued investment in joint research and innovation is essential for maintaining technological competitiveness.

Establishing open data frameworks on recyclates characteristics and processing parameters would accelerate innovation and transparency. Leveraging European funding instruments such as Horizon Europe and Interreg can further support cross-border pilot projects, technology transfer, and the commercialisation of circular solutions.

Human capital development remains a cornerstone of the transition towards a circular and digital industrial ecosystem. Future actions should emphasise specialised education and training programs focused on circular manufacturing, automation, and sustainable production. Dual education schemes and transnational internship programs for engineers, technicians, and managers can strengthen workforce mobility and expertise exchange across the region. Furthermore, upskilling initiatives are required to prepare the existing workforce for the demands of the green and digital transitions.

The creation of stable market demand for circular-ready machinery and recycled materials will be a decisive factor in ensuring the long-term viability of circular business models.
Public and private procurement policies should prioritise products with recycled content and energy-efficient machinery. The implementation of financial and institutional mechanisms is fundamental to enabling the industrial transformation envisioned by the Plan-C project. Institutional cooperation among industry associations, policymakers, and academic institutions

must be strengthened to coordinate strategic initiatives, support policy coherence, and ensure the sustainability of collaborative efforts beyond the project's lifetime.

Conclusion

The Plan-C partner regions' vision is to establish a robust, multinational network of partners from the plastics processing and machinery sector, accelerating technological innovation by connecting the expertise of machinery manufacturers with the practical needs of plastics processors to create more efficient, intelligent, and energy-efficient processes. Plan-C envisions the support for the circular economy by jointly developing technologies and processes. These enable maximum recycling of plastics and the use of recycled materials in new products.

It is necessary to unify standards and reduce environmental footprint by harmonising processes and developing joint solutions to reduce emissions, energy consumption and waste throughout the value chain.

The increase in competitiveness can be supported through open cooperation and the sharing of data, trends, and technical solutions, which contribute to faster adaptation to changing markets and legislation.

The priority is to build an educated and flexible workforce by investing in the professional growth of people across sectors and countries so that they are prepared to face the challenges of modern industrial production.

Creating a shared vision between plastic processors and machine producers on a transnational level brings some strategic, technological and environmental benefits. This cooperation makes the basis for the systematic development of the entire industry and its transformation towards sustainability, efficiency and innovation.

The outlined future directions represent steps for a strategic roadmap for fostering a resilient, innovative, and circular plastics ecosystem within the Danube Region. By reinforcing transnational cooperation, harmonising regulatory frameworks, investing in innovation, and developing human capital, the partnership between plastics processors and machine producers can serve as a model of sustainable industrial transformation in Europe. Continuous collaboration, supported by coherent policy and financial instruments, will be essential for maintaining momentum and achieving a truly circular and competitive plastics value chain.

Annex

AT |Austria

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Technical Collaboration • Share insights on the behaviour of recycled plastics during processing (Plastics processors, Plastics producers, Machine manufacturers for processing equipment) • Identify practical challenges in using recyclates, such as contamination and variability (Plastics processors, Machine manufacturers for processing equipment and for sorting equipment) • Co-develop machine features that improve recyclate handling and adaptability (Machine manufacturers for sorting equipment, Plastics producers) • Engage in joint R&D projects focused on recyclate-optimized machinery (Machine manufacturers for processing equipment, Plastics producers, Research institutions, Universities) • Provide facilities and expertise for pilot testing of new machine • designs (Plastics processors, Machine manufacturers for processing equipment) Process Integration Collaboration • Collaborate on implementing closed-loop systems for internal recycling (each stakeholder) • Design modular production lines that accommodate both virgin and recycled materials (Machine manufacturers for processing equipment, Plastics processors) • Develop traceability tools to monitor material flow and origin (Plastics producers, Machine developers, Data specialists) Data and Digitalization Collaboration • Build shared databases on recyclate properties and performance (Research institutions, Plastics producers, Industry associations, Machine manufacturers) • Support the development of digital twins and simulation tools for process optimization (Machine manufacturers, Software developers, Plastics processors) • Promote AI-driven systems for adaptive machine settings and predictive maintenance (Machine manufacturers, Automation specialists, Plastics processors, IT teams) Market and Policy Collaboration • Align procurement strategies to prioritize circular-compatible machinery (Procurement teams, Sustainability officers, Company

	leadership) • Advocate jointly for standards and policies that support circular machine design (Industry associations, Regulatory bodies, Company leadership, NGOs) • Develop training programs together for effective handling of recycled materials (Universities, Industry associations, Plastics processors, Machine manufacturers)
How can the machine industry support the circularity of plastics processors and producers?	• Design and Engineering • Develop machines optimized for processing recycled plastics, including handling variability in material quality • Integrate modular and adaptable components to allow easy upgrades and retrofitting for circular processes • Design equipment that minimizes material loss and enables efficient reprocessing • Process optimisation • Implement advanced sensor systems for real-time monitoring of recycled material properties • Enable precise control of temperature, pressure, and mixing to accommodate recycled inputs • Support closed-loop production setups through machine integration and automation • Share data for (predictive) maintenance • Adapt circular business models • Offer refurbishment programs and sell products as good as new • Offer shared ownership models – Product as a service (PaaS) / Machine as a service (MaaS) • Upgrading and retrofitting machines • Recycling and Material Recovery: Develop systems for the effective recycling of machine components and recovery of valuable materials at the end of the machine's life. • Waste management • Integrated waste separation systems • In-line recycling: Reprocess production scrap directly back into the process. • Regrind integration: Machines that can blend virgin and recycled materials without compromising quality • Digital Integration • Provide digital platforms for tracking material flow and machine performance • Collaborate on digital twins and simulation tools to optimize recycling processes • Enable AI-driven predictive maintenance and process adaptation for recycled materials • Knowledge Transfer • Offer training programs on operating machines with recycled materials • Share best practices and case studies on circular machine applications

	• Co-develop guidelines and manuals for circular-compatible machine operation • Strategic Engagement • Participate in standardization efforts for circular-compatible machinery • Align product development with circular economy goals and sustainability regulations • Support joint innovation platforms and funding applications for circular technologies
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	• Market Incentives • Highlight growing demand for machines capable of processing recycled materials. • Promote competitive advantages through circular innovation (e.g. access to new markets, sustainability certifications, growing • demand). • Offer financial incentives or subsidies for circular-compatible machine development. • Regulatory and Policy Support • Introduce standards and regulations that require or reward circular design features. • Align public procurement criteria with circularity goals. • Support participation in national and EU-level circular economy initiatives. • Ecodesign for Sustainable Products Regulation (ESPR) and Circular Economy Action Plan. • Collaboration and Co-Development • Facilitate partnerships with plastics processors and producers to co-design machines based on real-world needs. • Encourage joint R&D projects with research institutions and innovation clusters. • Create platforms for cross-sector knowledge exchange and pilot testing. • Technical Enablement • Provide access to recyclate data and processing requirements to inform machine design. • Support modularity and retrofitting to extend machine lifecycles and adapt to recycled inputs. • Integrate digital tools (e.g. sensors, AI, simulation) to optimize performance with recycled materials. • Recognition and Visibility • Establish awards or certifications for circular machine innovations. • Promote success stories and case studies through industry associations and media. • Encourage participation in sustainability rankings and benchmarking initiatives.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	• Market-Driven Incentives • Demonstrate growing demand from plastics processors for machines compatible with recycled materials. • Highlight business opportunities in emerging circular markets and sustainability-driven procurement. • Promote competitive differentiation through circular innovation and eco-design. • Regulatory and Policy Levers • Introduce standards that require or reward recyclate-compatible machine features. • Offer tax incentives, grants, or subsidies for circular machine development. • Align with EU Green Deal, Ecodesign Directive, and national circular economy strategies. • Collaborative Development • Facilitate co-creation with plastics processors to define machine requirements for recyclates. • Support joint innovation projects with research institutions and industry clusters (innovation hubs) • Encourage participation in pilot programs and testbeds for circular machine technologies. • Technical Enablement • Machine operators provide data and processing parameters to inform machine design. • Promote modularity, retrofitting, and lifecycle extension in • machine architecture. • Integrate advanced control systems for handling material variability and contamination. • Knowledge and Capacity Building • Offer training programs on circular design principles and recyclate processing. • Share case studies and best practices from successful circular machine applications. • Develop guidelines and toolkits for designing machines optimized for recycled materials.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	• Market Incentives • Emphasize the growing demand from plastics processors for machines that handle recycled materials efficiently. • Highlight cost savings and productivity gains from machines optimized for recyclates. • Promote access to new markets and customers focused on sustainability and circularity. • Regulatory and Policy Support • Introduce performance standards for recyclate-compatible machinery. • Offer public funding, tax incentives, or grants for circular machine innovation. • Align with circular economy targets in national and EU-level policy frameworks. • Collaborative Development • Facilitate co-design with recyclate producers and plastics processors to define machine requirements. • Support joint R&D projects and pilot programs focused on recyclate processing technologies. • Encourage participation in industry platforms and innovation networks. • Maintenance partnerships • Technical Enablement • Provide access to recyclate data and processing parameters to inform machine design experts. • Promote modular machine architecture for flexibility and retrofitting (business case). • Integrate advanced control systems to handle material variability and contamination. • In-line quality measurements of recycled input materials and automatic adaptation of the production line • Knowledge Sharing and Capacity Building • Share case studies and technical documentation on successful implementations. • Experience exchange platform • FAQ for problem solving

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BiH | Bosnia and Herzegovina

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	• By providing information on the types and quality of recycled materials they use (e.g. flow, temperature sensitivity), processors help machine manufacturers design equipment that works better with recyclates. • Processors in BiH are increasingly open to piloting new types of recycled plastics, which supports innovation on the machine side. • By designing their own plastic products to be easier to recycle or reprocess, they create a stable loop where machinery can be reused and optimized for circularity. • Processors can work directly with machine producers on improving or customizing equipment for local recycled material conditions.
How can the machine industry support the circularity of plastics processors and producers?	• Machines that handle variable-quality recycled materials make it easier for processors to shift away from virgin plastics. • Instead of forcing full replacements, modular machines reduce waste and investment pressure. • Equipment that tracks energy use and material performance can help processors control quality when using recycled inputs. • In countries like BiH, better access to parts and servicing extends machine life and reduces downtime, which is essential for circularity.
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	• Public tenders or industrial buyers asking specifically for machines that are "recyclate-ready" will shift manufacturer priorities. • National strategies can reward circular equipment via labels, recognition, or co- financing. • Innovation vouchers or joint demonstration projects reduce the financial risk of trying out circular features.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	• Demonstrators that show machines running efficiently with recycled plastic help convince manufacturers of the business case. • Real-time data on recycled material behaviour helps improve machine parameters like pressure, torque, or screw geometry. • Manufacturers could be offered test batches of post-consumer or post- industrial recyclates to develop more robust machines. • EU- or region-wide labels for machines that process recyclates.
How can plastics processing	• Machine builders working together with recyclers or processors can co-develop better systems for cleaning, sorting, and

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machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	processing recyclates. • If processors are shifting to recycled plastics but need better equipment, this creates a strong business case. Programs that support joint innovation or shared investment in recycled-material production technologies reduce risk for manufacturers.

CZ|Czech Republic

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Processors must work with suppliers (manufacturers) to identify critical points in technologies and together they must determine, evaluate and calculate the impact effects of circular measures on machines so that they meet decarbonization effects.
How can the machine industry support the circularity of plastics processors and producers?	In basic specifications and offers for machinery and technologies, machine manufacturers must specifically specify and justify individual critical parts and the composition of machines - such as: energy consumption in relation to the optimal solution; justification of the correct approach to the design of machine parts that are subject to rapid wear; last but not least, machine manufacturers must offer effective service, parts reconditioning (not replacement) and, among other things, the possibility of re-using these machines in the event of their shortened service life.
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	1. They will offer remanufacturing or reuse in the case of servicing wear parts. 2. In the machine/technology specifications, the manufacturer will describe and justify the use and efficiency of individual parts that consume energy; he will describe why his design (meaning the use of parts) is the optimal solution with a positive impact on the carbon footprint over the life of the technology. 3. The machine manufacturer will always offer specific service activities that will describe the method of servicing, with the preference always being given to procedures and principles that implement REUSE, reconstruction and/or reuse of individual parts. The same applies to the "mandatory" participation of the machine manufacturer in its (the machine's) use after the end of operation by the plastics processor.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	This will always be a matter of specific development and subsequent specifications - this must be based on an exchange of information between the machine manufacturer and the customer (processor). Furthermore, the machine manufacturer should always offer remanufacturing and repairs of wear parts in the Service Contract.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	The same

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DE|Germany, Baden-Württemberg

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Use Networks & Platforms • INNONET Kunststoff – the key plastics network in the region, bringing together toolmakers, machine manufacturers, processors, and research. It enables collaboration, R&D, and open dialogue on recycling needs. Such platforms allow processors to directly communicate requirements for recycling-optimized machinery (e.g., through dedicated working groups). Provide Clear Requirements & Pilot Cases • Share practical inputs with machinery makers: • Properties of recyclates (viscosity, impurities, density variations). • Stable process parameters for high throughput. • Quick-change systems for frequent material switches. Joint pilot projects (e.g., at the Plastics InnoCentre in Horb) can demonstrate machine setups optimized for recyclates. Leverage Funding & Innovation Programs • REKOWI – a Baden-Württemberg program that funds resource-efficient, circular economy projects. Machinery manufacturers and processors can co-apply. • KONGRESS BW – an annual event for resource efficiency & circular economy that connects companies, politics, and science. Commit to Sustainability • Initiatives like the WIN-Charta (sustainability charter for SMEs in Baden-Württemberg) give processors credibility and set incentives for machinery partners to align with circular practices.

How can the machine industry support the circularity of plastics processors and producers?	Design Machines for Recycling
	• Machines should be flexible and robust to handle recyclates with varying quality. Key features include:
	  ○ Optimized screw and feeding designs.
	  ○ Automation for parameter adjustment based on material properties.
	  ○ Quick cleaning/changeover systems.
	
	Enable Transparency Across the Value Chain
	• Integrate digital solutions like R-Cycle for material traceability.
	• Provide OPC UA / EUROMAP 77 interfaces to enable smart, data-driven process control.
	
	Offer Product-as-a-Service Models
	• Shift from selling machines to offering:
	  ○ Shared usage or leasing.
	  ○ Regular upgrades, retrofits, and maintenance.
	  ○ End-of-life take-back for remanufacturing.
	• This reduces resource use and ensures machinery remains part of a circular economy.

How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	Visibility & Recognition • Participate in initiatives such as "100 Companies for Resource Efficiency" (Baden-Württemberg program). • Present circular machine solutions at KONGRESS BW for visibility and reputation. Collaborative Development • Work with processors in networks like INNONET Kunststoff to jointly define recycling-specific machinery needs. • Use neutral test environments such as the Plastics InnoCentre for demonstration projects. Funding & Financial Support • Apply for REKOWI funding to reduce the financial burden of developing recycling-ready machines. • Access EU-level programs that reward resource-efficient industrial machinery. Standardization & Regulation Alignment • Engage in European standards development (e.g., EUROMAP, CEN/CENELEC material efficiency standards). • Early involvement ensures machinery design meets future legal and customer requirements.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	Stakeholders
	• Contribution to a Circular Machine industry
	
	Plastics Processors / Producers
	• Clearly communicate recycling needs
	• Engage in networks
	
	Machinery Manufacturers
	• Design flexible, recycling-ready machines
	• Integrate traceability & digitalization
	• Offer Product-as-a-Service
	• Join standardization efforts
	
	Joint Platforms
	• INNONET Kunststoff
	  ○ industry dialogue
	• Plastics InnoCentre
	  ○ pilot projects
	• KONGRESS BW & "100 Companies"
	  ○ visibility & best practice
	• WIN
	• Charta
	  ○ shared sustainability goals

How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	Concrete Steps for Baden-Württemberg 1. Start a dialogue: processors bring recycling demands into INNONET working groups. 2. Develop pilots: test circular machine setups at Plastics InnoCentre. 3. Apply for funding: REKOWI or EU calls to finance machine adaptation. 4. Join standards: ensure compatibility with EUROMAP & digital traceability frameworks. 5. Adopt new business models: test Product-as-a-Service for plastics machinery. This approach combines regional networks, state funding, technological innovation, and sustainability frameworks to create a robust circular machine industry in Baden-Württemberg.

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HU|Hungary

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Plastics processors and producers can support a circular machine industry by sharing feedback and data on challenges with recycled and bio-based materials, helping machinery manufacturers adapt designs and integrate the necessary inline quality control systems for processing such feedstocks. Through joint pilot projects, they can also test modular solutions that extend equipment lifespan and improve adaptability.
How can the machine industry support the circularity of plastics processors and producers?	The machine industry can support plastics processors by designing flexible, modular equipment capable of handling a wide range of recycled and bio-based inputs with minimal adjustment. Integrating predictive diagnostics, contamination monitoring, and energy tracking further optimises the processing of recyclates, improving efficiency, reducing downtime, and extending equipment lifespan.
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	Plastics processing machine manufacturers can be encouraged through targeted policy incentives, such as tax benefits or co-financing for circular-ready designs, and by demonstrating market demand from processors using post-consumer waste stream materials. Collaborative R&D projects with academia and industry can showcase the business value of modularity, predictive maintenance, and energy-efficient systems, motivating manufacturers to integrate these features from the design stage.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	They can be encouraged through direct collaboration with plastics processors to define technical requirements for handling recycled materials efficiently, including inline quality control systems and contamination monitoring. Financial incentives—such as EU or national grants, tax benefits, or subsidised pilot projects—can further reduce the investment risk and accelerate the development of such machinery.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	They can be encouraged by supporting the development of machinery that enables consistent and efficient preparation of recycled feedstock through shredding, washing, and sorting processes. Integrating advanced separation technologies and contamination removal systems ensures that the output meets stable quality specifications, providing a reliable and uniform waste stream for regranulate production

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MD|Moldova

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Plastics processors and producers play a foundational role in catalysing a circular machine industry by generating demand for circular-ready machinery, promoting design-for-recyclability standards, and participating in co-creation partnerships with machinery manufacturers. By shifting to post-consumer and post-industrial recyclates and adopting eco-design principles, processors inform the machinery sector of new technical requirements—such as processing variability, contamination tolerance, and modularity. SORINTEX, for instance, can leverage Moldova's increasing network of recycling facilities and partnerships with academic institutions (like the Technical University of Moldova) to pilot circular business models that emphasize reusability and repairability of both plastics products and the machinery itself. Plastics producers can also encourage machine refurbishment over replacement and promote material passports and digital traceability tools to align both sectors toward long-term sustainability goals.
How can the machine industry support the circularity of plastics processors and producers?	The machine industry enables circularity in plastics processing by designing adaptable, modular equipment that can handle varied recycled feedstocks, incorporate smart diagnostics, and reduce energy and resource usage through efficient design. In Moldova's case, where there is high dependence on imported technologies and limited infrastructure, partnerships with international machine producers are critical for technology transfer and training initiatives. SORINTEX can engage with manufacturers to co-develop equipment that not only meets the immediate needs of recycled materials processing but is also compatible with emerging circular practices such as closed-loop systems, remanufacturing, and predictive maintenance. Importantly, retrofitting legacy equipment—a realistic approach given Moldova's current infrastructure—can dramatically improve performance and reduce capital expenditures compared to new purchases.

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How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	Manufacturers can be incentivized through a mix of market demand, regulatory instruments, and financial de-risking mechanisms. Key levers include: • Extended Producer Responsibility (EPR) policies that promote equipment take-back and remanufacturing obligations. • Green public procurement standards that favor machinery with lower environmental footprints. • Tax incentives or leasing models for modular, upgradeable machines, which reduce the financial barrier for SMEs like those in Moldova. SORINTEX can act as a facilitator by co-organizing regional pilots or demonstration sites—possibly supported by EU or donor funding—to showcase the performance of optimized circular machinery. Moreover, Moldova's strategic alignment with EU circular economy goals can be used to access financing and align local manufacturers with European standards, including digital product passports and CE-compliant design
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	Processing refers to how machinery handles already recycled materials—for example, shredded PET or regranulated polypropylene—transforming them into intermediate or final products (e.g., films, bottles, components). To encourage machine manufacturers to optimize for this phase, the focus must be on material handling robustness, operational flexibility, and contamination resilience. Manufacturers can be incentivized through: • Technical standards that mandate compatibility with recycled polymers (e.g., ISO/TR 10300 or EN 15343); • Procurement policies from large processors that explicitly require machines able to manage variability in input materials (e.g., moisture content, MFI fluctuations); • Public grants and tax breaks for R&D that improves feeding, filtering, and dosing mechanisms for low-purity recyclates; • Collaborative testing environments (e.g., pilot lines or demo labs) where local Moldovan processors and foreign machinery developers co-test recycled inputs under real production scenarios. Integrating predictive maintenance systems and AI-driven material recognition can improve the processing speed and reduce downtime, which processors are increasingly demanding.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	Production here refers to machinery that enables the creation or regeneration of recycled materials themselves—such as regranulators, extruders for pelletizing recycled plastic, shredders, or wash lines—essentially, equipment that turns waste into reusable feedstock. To encourage manufacturers to focus on this production phase, strategies should target: • Innovation funding programs (EU Horizon, national circular economy funds) that prioritize recycling equipment with higher throughput and lower energy intensity; • Digital Product Passports (DPPs) and material traceability standards that favour technologies enabling traceable, certifiable recycled output; • Partnerships with municipal or industrial waste handlers, to co-develop regionally adapted recycling solutions—especially relevant for Moldova where infrastructure is emerging; • Pay-per-use business models that allow processors and recyclers to access advanced recycling production lines without heavy upfront capital costs; • Cross-industry platforms (e.g., involving agriculture, construction, packaging) that define the types of recycled materials in demand, guiding machinery development toward producing exactly those grades and specifications. • The optimization of recyclate production machinery must align with Moldova's strategic objectives for reducing raw material dependence and exporting high-quality secondary materials.

RO|Romania

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	• Plastics processors and producers in Romania, particularly SMEs, can significantly contribute to a circular machine industry by integrating circularity principles across the entire value chain. This includes selecting and sourcing materials responsibly, designing products for longevity and recyclability, processing plastics efficiently, and facilitating collection, sorting, and reintegration of recycled plastics into new products. • By actively collaborating with machine manufacturers, recyclate producers, service providers, and research institutions, Romanian companies can provide feedback on equipment capable of processing recycled materials, pilot circular solutions, and promote the use of sustainable materials. For example, companies like EURODAC Automation design machines with replaceable and recyclable components and implement advanced technologies for material analysis and recovery. • Furthermore, collaboration with consumers and adoption of digital tools optimize material flows, reduce waste, and improve resource utilization. Such an integrated approach not only supports innovation and trust in recycled materials but also strengthens local industry, reduces dependence on imported machinery, and opens new markets for sustainable products.
How can the machine industry support the circularity of plastics processors and producers?	• The Romanian machinery industry can play a key role in supporting the circularity of plastics processors and producers by integrating innovation, collaboration, and adaptability across the entire value chain. • Through transnational partnerships—especially within the Danube region—Romanian machine producers can co-develop modular, energy-efficient equipment tailored to SMEs, enabling the processing of recycled feedstock and reducing dependency on imported technologies. • Innovations in sorting, recycling, and circular design allow machines to be easily upgraded or repurposed, minimizing waste and extending product lifecycles. Digital technologies developed locally enhance traceability and lifecycle monitoring, supporting circular business models. • By engaging with service providers, research institutions, and end-user industries (e.g. packaging, automotive • , construction), the machinery sector helps close the loop between plastic production and reuse. Access to EU funding for cross-border cooperation further accelerates modernization and sustainability. • This integrated approach strengthens Romania's position in the circular economy, fosters regional competitiveness, and contributes to a resource-efficient future.

How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	• To encourage plastics processing machine manufacturers in Romania to engage in circular practices for designing and optimizing equipment, a multi-layered strategy is required—combining financial incentives, regulatory frameworks, institutional support, and transnational collaboration. • Given the limited number of domestic manufacturers, EU and national programs should prioritize funding for modular, upgradeable, and energy-efficient machinery designed for easy disassembly, refurbishment, and integration of recycled materials. These features not only extend equipment lifespan but also facilitate circular business models such as leasing and service-based contracts. • Institutions such as the "Ernest Lupan" Institute for Circular Economy and Environmental Research (IRCEM, https://ircem.ro/) in Cluj-Napoca have developed clear design guidelines and best practices through dedicated working groups, focusing on material selection, modularity, and closed-loop systems. Meanwhile, the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)—a public body under the Romanian Ministry of Education—provides funding for advanced recycling technologies and supports the formation of industrial consortia that drive innovation in circular machinery design. • These institutional efforts should be aligned with the needs of recyclate producers, processors, and downstream industries such as automotive, construction, and packaging, which generate stable demand for circular technologies. Collaboration across the Danube region enhances knowledge transfer and market alignment, while public–private partnerships and joint R&D initiatives reduce risk and accelerate adoption. • Education and awareness campaigns, led by R&D institutes, agencies, and NGOs, are essential to foster a circular mindset among manufacturers and end-users. Training programs and knowledge-sharing platforms help embed circularity as a core principle in machine design and optimization. • This integrated approach strengthens Romania's position within the circular plastics value chain and supports the development of a sustainable, competitive, and innovation-driven machinery sector.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	• Plastics processing machine manufacturers in Romania can be encouraged to design and optimize machines for easy and fast processing of recycled materials through a combination of financial incentives, regulatory frameworks, and collaborative innovation. • EU and national funding programs can reduce the cost of R&D and support cross-border pilot projects where machines are tested under real operational conditions, allowing adaptation to the variability of recycled feedstock. Stable demand from downstream industries such as automotive, packaging, and construction reinforces market confidence and long-term investment. • Integrating smart manufacturing technologies —such as IoT and AI-powered sorting systems—enables machines to automatically adjust to material properties, improving efficiency and reducing waste. Standardized protocols for machine performance and recycling processes ensure consistency and facilitate the adoption of best practices across the industry. • Clusters and industrial consortia can foster collaboration between machine manufacturers, recyclers, material producers, and research institutions, creating platforms for knowledge exchange and co-development of circular technologies. • Recognition programs and public awareness campaigns can further motivate companies to lead in sustainable machine design, while public–private partnerships help mitigate innovation risks and accelerate the transition to a circular plastics economy.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	• Plastics processing machine manufacturers can be encouraged to design and optimize equipment for the efficient production of recycled materials through a combination of infrastructure development, market stimulation, regulatory support, and collaborative innovation. • Strengthening Romania's recycling infrastructure and ensuring stable demand for high-quality recycled materials — especially from industries such as packaging, construction, and automotive — creates a viable business case for machine innovation. Business models based on leasing, refurbishment, and service contracts reduce investment risks and extend equipment lifespans. • Transnational collaboration within the Danube region enables manufacturers to co-develop and test machines under real conditions, adapting to challenges such as inconsistent feedstock quality, limited collection systems, and low acceptance of refurbished components. • Standardizing materials and recycling protocols ensures consistency and facilitates the adoption of best practices. Promoting successful examples of optimized recycling machinery—highlighting improvements in recycling rates and environmental impact—can inspire broader industry engagement.

	• Public–private partnerships, EU funding, and cluster-driven innovation platforms can accelerate the development of advanced recycling technologies, positioning Romania as a key contributor to the circular plastics economy.

RS | Republic of Serbia

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Plastics processors and producers can play a crucial role in enabling a circular machine industry by ensuring a steady supply of high-quality recycled materials and by shifting towards sustainable input streams. Serbia already generates a significant amount of post-consumer plastic waste, but recycling rates remain low compared to EU averages. By improving collection, sorting, and recycling practices, processors can provide clean and standardised recycled polymers that meet the technical requirements of machine producers. Moreover, plastics processors can collaborate with machine producers to test the performance of recycled plastics in industrial applications and co-develop material standards tailored to circular solutions. They can also invest in the eco-design of plastic components to facilitate disassembly, reuse, and material recovery at the end of machine life.
How can the machine industry support the circularity of plastics processors and producers?	The machine industry can support plastics processors and producers by developing equipment optimised for processing recycled plastics, which often differ from native materials in consistency and stability. For example, extruders, injection moulding, and blow-moulding machines adapted for recycled feedstocks can reduce material losses and improve product quality. The machine industry can also integrate smart digital systems that monitor material flow, energy use, and quality parameters, making recycled plastic processing more efficient. Machine producers can enter into long-term partnerships with plastics processors, supporting them with technical training, shared R&D projects, and modular machine solutions that extend equipment lifetimes and reduce costs for smaller processors.
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	Encouragement can be achieved through a mix of regulatory, market, and innovation incentives. Serbia is in the process of aligning with EU circular economy directives, which is a strong driver for manufacturers. Public policies, such as tax incentives for circular design, subsidies for eco-innovation, and green procurement standards, can stimulate manufacturers' engagement. On the market side, increasing consumer and B2B demand for sustainable products in Serbia and the Western Balkans creates pressure for machine makers to adopt circular practices. Additionally, collaboration platforms between research institutions, plastics processors, and machine producers can provide shared knowledge and reduce R&D risks. Access to EU and regional funding programs for green transition also serves as a direct incentive.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast	To encourage such optimization, stakeholders can promote pilot demonstration projects that showcase the commercial and environmental benefits of machines adapted for recycled plastics. Establishing testbeds where manufacturers and processors jointly experiment with recycled feedstocks can reduce uncertainty and accelerate market adoption. Defining standards and certification schemes for machines that efficiently process recycled materials would provide recognition and increase competitiveness in EU and regional markets. Financial support through

processing of recycled materials?	innovation grants, coupled with knowledge and technology transfer from EU partners already experienced in circular machinery, will further encourage manufacturers to prioritise such designs.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	This requires aligning industrial innovation with market demand. Serbian machine manufacturers can be encouraged by showing the growing business case for recycled material processing, especially in the packaging, automotive, and construction industries. Export opportunities to EU markets, where demand for recycled plastics is high, provide additional motivation. Policymakers in Serbia can introduce eco-design requirements and standards that reward machines capable of producing high-quality recyclates. Promoting cross-border collaboration within the Danube and Balkan regions can create knowledge spillovers and scale effects, making it more attractive for Serbian manufacturers to specialise in circular-ready machines.

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SK|Slovak Republic

Question	Answer
How can plastics processors and producers contribute to creating a circular machine industry?	Slovakia has a circular (secondary) material consumption rate of only ~6.4% (versus the EU average of 12.8%) and very low material productivity (~1.34€/kg instead of the average of 2.09€/kg). The definitive national circular economy strategy was created only in 2022. Plastics manufacturers and processors can contribute, for example, in the area of designing products and components for simple separation, recycling and use of recyclates - using the principles of the EU strategy for plastic packaging and eco-design. Furthermore, by introducing recycled materials, i.e. using more recycled plastic as an input material in the production of engineering parts, we can reduce dependence on primary raw materials. Plastics processors can collaborate with machine producers to develop innovative materials and recycling solutions. This includes creating plastic components made from recycled content or designing new plastics that are easier to recycle at the machine's end-of-life. These partnerships can create new revenue streams and improve the resilience of both industries' supply chains.
How can the machine industry support the circularity of plastics processors and producers?	The machine industry in Slovakia can play a key role in supporting a clean economy, especially in cooperation with plastic processors and manufacturers. Instead (make-use-dispose), it can help create linear closed material flows, reducing waste, costs and dependence on primary raw materials. Machine producers can design equipment that can process a wider variety of recycled plastics. Simultaneously, resin producers can create new plastic formulations that are specifically designed to be easily sorted and recycled at the end of a product's life. When a plastic is designed to be machine-recyclable, it makes the process more efficient and cost-effective for everyone.
How can plastics processing machine manufacturers be encouraged to engage in circular practices for designing or optimizing machines?	Plastics processing machine manufacturers play a strategic role in the transition to a circular economy, as their equipment determines how efficiently and sustainably plastics are produced, processed and recycled. A combination of incentives, legislative frameworks, collaboration and innovation can encourage them to design and optimise machinery with a focus on circular principles. Support for the development of recycling and reprocessing technologies is provided in subsidies and grants for the development of machines designed for plastic recycling (e.g. crushers, granulators, decontamination lines)—tax breaks for companies that develop or modernise equipment supporting the circular processing of plastics.

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How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast processing of recycled materials?	The key to achieving this goal is to motivate manufacturers of plastics processing machines to optimise their equipment for these new requirements. Important are the financial incentives for the development of innovative technologies. Provide state subsidies and EU funds for research and development of machines. Instead of selling a machine, manufacturers lease it and charge based on usage. Since the manufacturer retains ownership, they are incentivized to design for longevity, durability, and easy maintenance to maximize their long-term profit. Offering services to take back and refurbish older machines or upgrade components with new technology creates a new revenue stream and a more resilient business model. Establishing programs to buy back or take back end-of-life machines provides a steady supply of materials for new machine production, reducing reliance on virgin metals and parts. Machine manufacturers can collaborate directly with plastic resin producers to develop equipment tailored to new, more recyclable plastic formulations. Incorporating digital technologies and sensors can optimize machine performance with recycled materials, allowing for real-time adjustments and ensuring consistent product quality despite feedstock variability. Collaborative research and development projects between machine manufacturers, academic institutions, and recycling companies can lead to breakthroughs in processing technology that make recycling more efficient and economically viable.
How can plastics processing machine manufacturers be encouraged to design and optimize machines for easy and fast production of recycled materials?	Increasing the use of recycled plastics in industrial production is one of the main goals of the circular economy. Plastics processing machinery manufacturers can make a significant contribution to achieving this goal – especially if they design their technologies to enable easy production and offer high-quality output from recycled materials. Subsidies and calls from public funds (e.g. the Recovery Plan, programs of the Ministry of Economy of the Slovak Republic or EU funds Tax benefits for expenses related to research, development or modernisation of production lines for recycled plastic. • Support for research and development • Creation of research and testing centres for the development and verification of the functionality of machines for recycled materials on an industrial scale • Education and professional support for machine manufacturers Machine producers can form direct partnerships with recycling companies and resin producers to understand their specific pain points and co-develop solutions. This collaboration ensures that the machines being developed actually solve real-world problems. Manufacturers can set up pilot programs or demonstration centers where they showcase their new, circular-focused equipment. This allows potential customers to see the machines in action, processing their own waste materials, and witness the quality and speed firsthand. This hands-on experience can be a powerful sales tool. Highlighting successful case studies of companies that have

	invested in their specialized machinery for recycled materials and are now producing high-quality products will build confidence and demonstrate the profitability of a circular business model.