



Plan-C

CIRCULARITY IN MACHINE INDUSTRY

Circular Solutions for the Future of the Machine Industry

The machine industry plays a key role in industrial development, but the sector is facing increasing challenges: rising raw material prices, energy-intensive production, stricter environmental requirements, vulnerable supply chains, and growing market demand for sustainable operation.

The **Plan-C – Moving PLastics and mAchine iNdustry towards Circularity** project was launched to support the circular transformation of the plastics and machine industries in the Danube Region. Through the cooperation of **14 partners from 9 countries**, the project supports companies, especially SMEs, in applying circular economy principles in practice.

The message of Plan-C is clear:

The life of a machine does not end when it stops working. In a circular system, the value of machines, components and materials can be preserved for as long as possible through repair, upgrading, refurbishment, remanufacturing, reuse and material recovery.

Why is Circularity Important in the Machine Industry?

From Linear Production to Circular Thinking

The traditional “take–make–dispose” model is no longer sustainable. In the machine industry, circularity means that the full lifecycle of a machine is considered from the very beginning: durability, reparability, disassembly, upgradability, component reuse and end-of-life recovery are built into the design and business model.

Key principles of circularity in the machine industry include:

- eco-design and durability
- modular machine design
- reparability and easy maintenance
- refurbishment, remanufacturing and component reuse
- use of recycled and traceable materials
- Product-as-a-Service / Machine-as-a-Service business models
- take-back systems and reverse logistics

What are the benefits for companies?

Circularity generates economic and environmental value alongside operational and strategic advantages. It opens new business opportunities by enabling innovative business models, improving resource efficiency, reducing costs, and supporting long term sustainability goals.

In addition, circularity enables companies to:

- reduce raw material and waste management costs
- extend the lifetime of machines and components
- reduce dependence on vulnerable supply chains
- create new revenue streams through service-based, leasing or performance-based models
- comply with ESG and sustainability expectations
- strengthen innovation, resilience and competitiveness.

What happened in the Plan-C project?

Co-creation, Practical Tools and Transnational Cooperation

The Plan-C project was built on co-creation, combining industry expertise and transnational cooperation to advance circularity in the machine industry. Plan-C project partners worked together with machine industry stakeholders to explore how circular economy principles can be applied across the full machine lifecycle.

It included design thinking workshops, regional stakeholder consultations, transnational peer learning activities and pilot-oriented development processes.

As part of this work, the partners identified the main challenges and opportunities related to circular transformation in the machine industry across the Danube Region. The project showed that countries and companies are at different levels of circular readiness, digital maturity, financing capacity and regulatory preparedness. At the same time, these differences create valuable opportunities for mutual learning and cross-border cooperation.

Circular Machine Lifecycle Phases

The Plan-C project analysed the machine lifecycle through eight interconnected phases

1. Design and Development
2. Material Sourcing
3. Manufacturing and Assembly
4. Distribution and Logistics
5. Use and Maintenance
6. End-of-Life Management
7. Refurbishment and Reuse
8. Waste Management

For each lifecycle phase, the project developed practical recommendations, circular strategies and company-level implementation options. One of the key project results is the **Guideline for Circularity in Machine Industry**, together with fact-sheets for the different lifecycle phases. These materials provide practical guidance for companies on how to start or further develop their circular transition.

Key Circular Development Directions

Circular transformation in the machine industry focuses on concrete actions across design, use and business models. The following priorities summarise the most important areas for implementation:

- Design for longevity and circularity, e.g. designing modular, repairable and disassemble machines
- Data-driven maintenance and performance monitoring, e.g. introducing preventive and predictive maintenance systems
- Sustainable material use, e.g. using recycled, traceable materials in machine production
- Circular service-oriented business models, e.g. leasing or Machine-as-a-Service

Practical Guidance from First Steps to Implementation

The Plan-C project results are not only theoretical documents. They provide easy to follow guidelines, handbooks and strategies as well as practical company and application examples to start or strengthen circular transformation of machine manufacturers.

Take a look to Plan-C library and learn more

- Piloting co-creative design-thinking workshops to transform machine industry towards circularity (Output 2.1)
- Guideline for circularity in machine industry and factsheets of life cycle phases showing how circular principles can be integrated into machine design, production, use, maintenance, refurbishment and end-of-life management. (Output 2.2)
- Transnational strategy regarding circularity in machine industry comprising a Handbook for circular machine industry and a joint plan (strategy) to boost circularity in the machine industry (Output 2.3)



Plan-C Library

Take the First Step towards a Circular Machine Industry

Partners



The future of the machine industry is not linear.

It is circular, resilient and built on long-term value creation.

Project No:

DRP0200194

Lead Partner:

Danube Region Programme

Project duration:

Business Upper Austria - OÖ Wirtschaftsagentur GmbH, Austria

Total Interreg Funds:

January 2024 – June 2026

Total Eligible Budget:

1.735.600 Euro

2.169.500. Euro

This project is supported by the Interreg Danube Region Programme co-funded by the European Union.



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This document was supported as part of Plan-C project, an Interreg Danube Region Programme co-funded by the European Union.