

REPLAY: A Digital Twin for the Regional and Cross-Border Plastics Circular Economy



Keywords: Regional Circular Economy, Plastics Recycling, Digital Twin, Artificial Intelligence (AI), Digital Product Pass, Cross-Border Circular Economy

Challenges

- **Loss of Material:** Post-industrial plastic waste, particularly from small and medium-sized enterprises (SMEs), is frequently lost from the material cycle and instead thermally recovered due to the absence of standardized and economically viable recycling systems.
- **Fragmented cross-border data and logistics:** A diverse data landscape with incompatible formats hinders efficient information sharing and exchange between companies.
- **Economic Uncertainty:** For circular systems to be profitable, they need a "critical mass" of material. However, there is a lack of models to calculate this minimum threshold, which obstructs investment and proper planning.

Vision

To create a proven, economically viable model for regional and cross-border circular economies. We are transforming industrial plastic waste from a disposal problem into a high-quality, tradable commodity through a smart digital platform.

Research Approach

- **Develop a decentralized data platform** with a shared ontology to enable seamless information exchange between companies, including support for international data standards and cross-border information flows.
- **Implement a Digital Twin** to simulate, analyze, and optimize regional and cross-border material flows, logistics, and determine the "critical mass" for profitability.
- **Leverage Artificial Intelligence (AI)** for automated forecasting of supply and demand, optimization of recycling processes, and adaptive logistics.
- **Establish a Digital Product Pass** to document material properties and processing history, ensuring quality and traceability of recycled plastics.
- **Validate the approach** through a prototypical implementation and a real-world demonstrator in the Mainfranken region to prove its practical viability and at least one other European country.

Call for International Partners: Help Us Scale this Idea!



Consortium

- **Academic Partners:** TH Würzburg-Schweinfurt, TH Nürnberg, TH Ingolstadt (all based in Germany).
- **Industrial Partners:** ZF Friedrichshafen AG, Erich Rothe GmbH & Co. KG, OWI Formteile aus Holz und Kunststoff GmbH & Co. KG, R.PLAST Kunststoffaufbereitungs- u. Handels-GmbH, Infosim GmbH & Co. KG, Geis Industrie-Service GmbH, Region Mainfranken GmbH & Transform, IFG Ingolstadt AöR.

We are seeking partners to establish the next regional and cross-border ecosystem, focusing on the creation of local marketplaces along various industrial value chains. While our expertise is rooted in plastic recycling, the concept is applicable to other sectors.

We are looking for:

- An **industrial cluster**, a **regional development agency**, or a **university** with strong industry ties located **outside of Germany**, interested in establishing a local circular economy platform.
- A **technology provider** interested in contributing to and expanding the platform, for example, with skills in Digital Product Pass (DPP), data ecosystems, AI, or Digital Twins.

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