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Industry 4.0 Enhanced Digital Product Passports and Circular Economy Dataspaces for Sustainable Bio-Based Industries

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Bio-based industries are central to Europe's shift toward a resource-efficient and competitive economy, yet they remain vulnerable to climate change and resource scarcity. These industries also hold strong potential for decarbonisation and circularity by closing material loops and regenerating ecosystems. To fully harness this potential, stronger digital infrastructures are required.

bioSpaCE addresses this challenge by advancing the digital transformation of bio-based manufacturing, with a focus on process transparency, resource efficiency, and resilience through solutions for material tracing and flow modelling.

bi0SpaCE Pilot Partners:

bi0SpaCE project outcomes will be demonstrated and validated with four complementary industrial partners.

Fiskeby
Paperboard production

GreenLab
Eco-Industrial Parks

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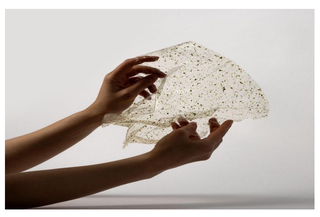
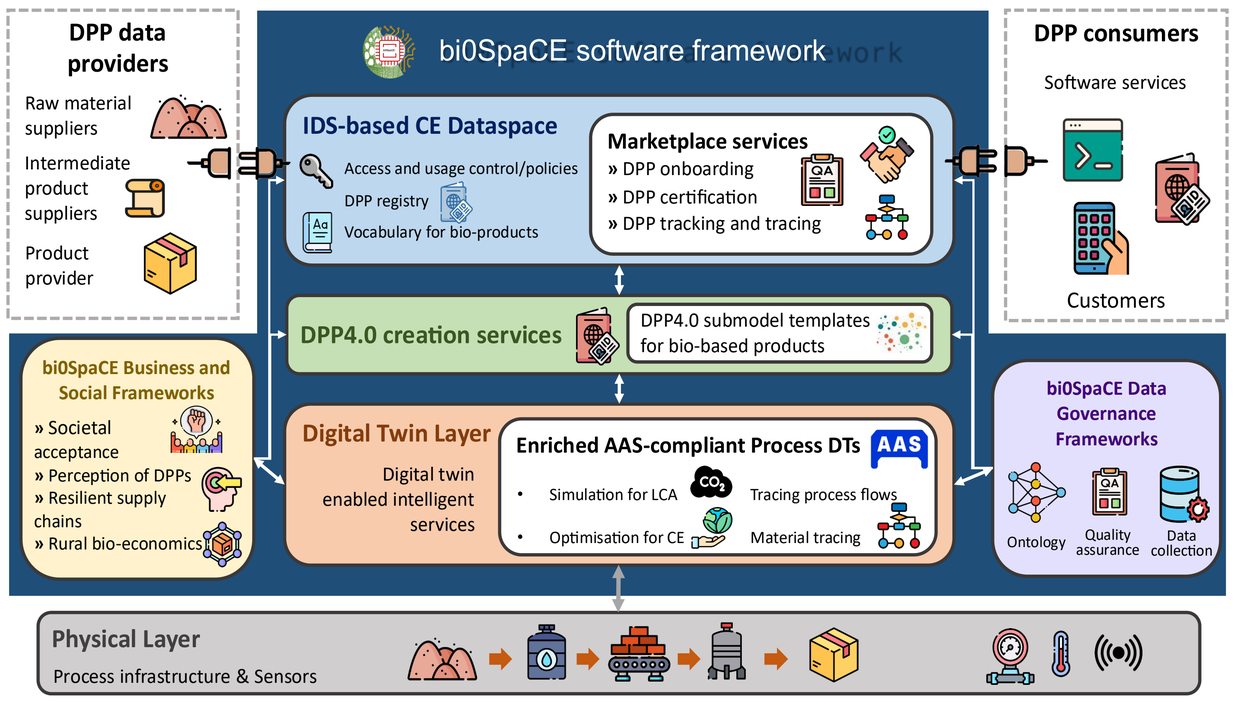
Food & Cosmetics

NORIWARE
Bio-based Packaging



The bi0SpaCE conceptual architecture



Physical Layer: process infrastructure and sensors providing data to Digital Twin Layer.

Digital Twin (DT) Layer: enables process DTs augmented with circular economy (CE) services such as simulation, life-cycle assessment (LCA), optimisation and end-to-end material and process traceability.

Digital Product Passport (DPP) Layer: defines the structure and content of DPPs, enriched with data from process twins and governance frameworks.

Dataspace Layer: enables semantic search and trusted sharing of DPPs with consumers through policy-based access, usage control, and user-facing applications.

The bi0SpaCE Vision:

Bio-based industries are highly digitalised, using Industry 4.0 solutions for accurate tracking of resources and emissions while delivering sustainable and circular bio-based products. A dynamic marketplace for these products is enabled through decentralised digital product passports, supporting transparency and circularity.

The bi0SpaCE Mission:

bi0SpaCE advances the creation of circular bio-based products and value chains by providing open-access digital solutions for rapid deployment of circular economy practices. The project will deliver process digital twin models, Industry 4.0 enhanced DPPs and CE dataspaces for data sharing and optimization, ensuring efficiency, resilience, and sustainability.

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Partners: DTU, Fraunhofer IOSB, Aarhus University, CARTIF, Nissatech innovation centre, UNI un mondo fatto bene, Swiss Smart Factory, Fiskeby, GreenLab, naturae®, NORIWARE

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