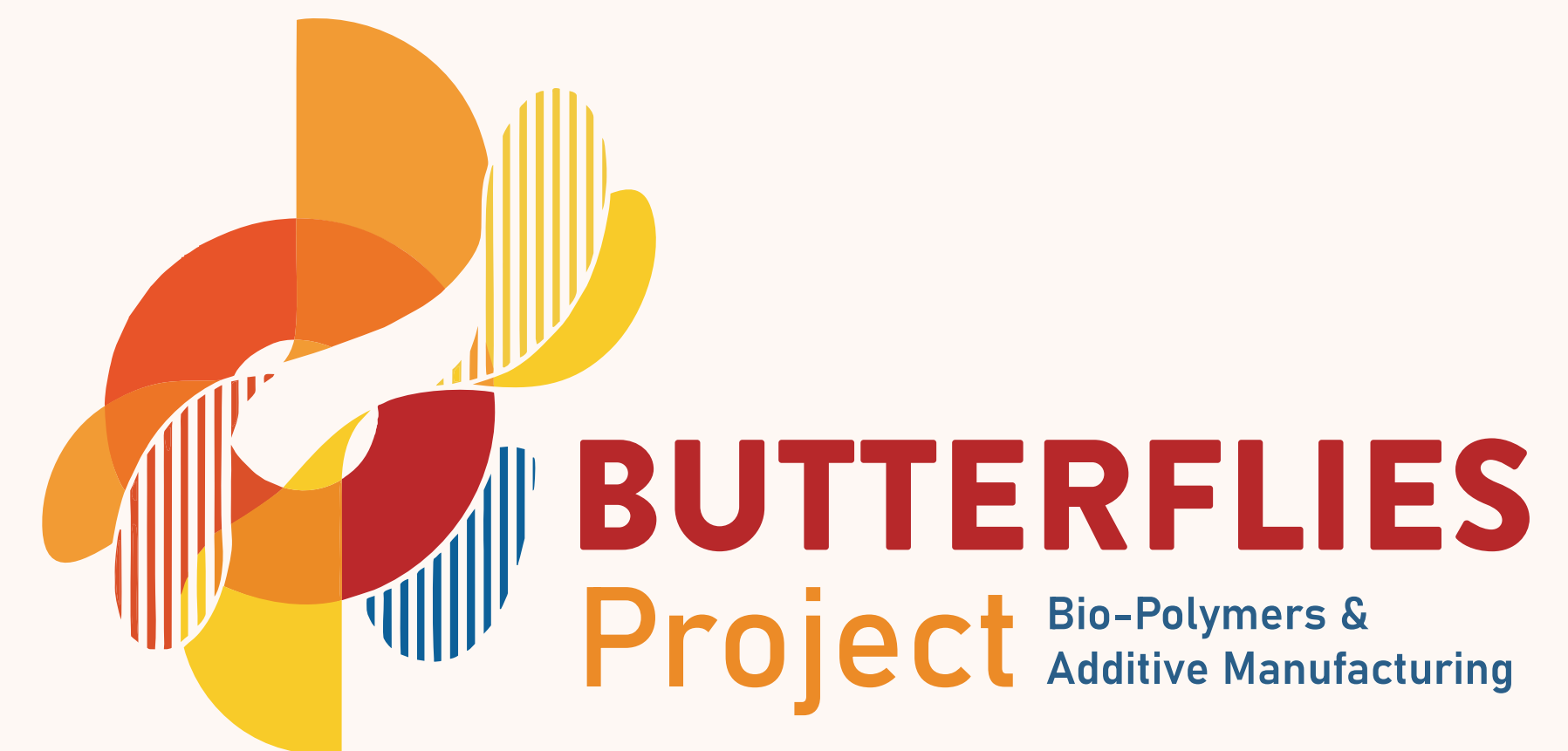


HYBRID MANUFACTURING FOR BIO-INTELLIGENT FUTURES



BUTTERFLIES develops sustainable additive manufacturing routes for chitin and chitosan by combining novel biomaterials, Binder Jetting, Two-Photon Polymerisation and an AI-enabled Digital Biosphere Platform.

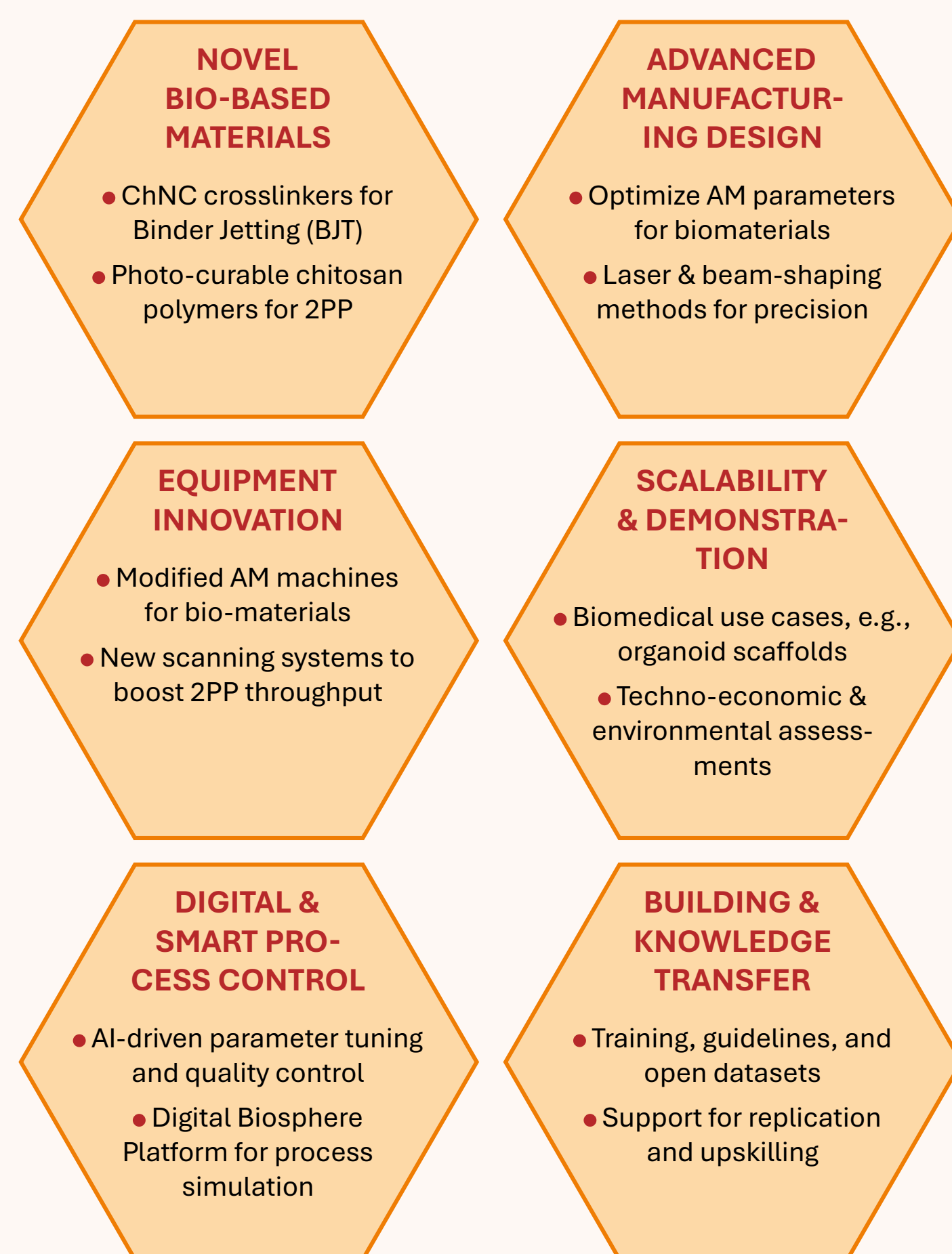
The Challenge

Chitin and chitosan are renewable, biodegradable and biocompatible polymers with significant potential for sustainable additive manufacturing. However, their industrial adoption remains limited by:

- insufficient printability and material stability;
- limited compatibility with existing AM equipment;
- low production speed and throughput;
- insufficient process monitoring and control;
- limited scalability and industrial validation.

BUTTERFLIES addresses these barriers by integrating material development, advanced manufacturing technologies, digital tools and application-driven validation.

Our Solution



Expected Impact

BUTTERFLIES will enable a new generation of sustainable, digitally controlled and application-ready additive manufacturing processes based on renewable biopolymers.

Scientific and Technological Impact

BUTTERFLIES introduces **novel bio-polymer formulations and printing processes**, thereby **pushing the boundaries** of what AM can achieve in terms of **resolution, sustainability, and material intelligence**. The project will demonstrate functional parts with **bio-based materials**, including **scaffolds for biomedical applications** with **embedded biological functionality**.

Environmental Impact

By **replacing petroleum-based binders and polymers** with **chitin and chitosan**, the project will directly **reduce carbon emissions** and **chemical waste** associated with **conventional AM**. It promotes **circular economy** principles, sourcing **raw materials** from **renewable** or **waste-derived streams** and facilitating their **end-of-life biodegradation**.

Economic and Industrial Impact

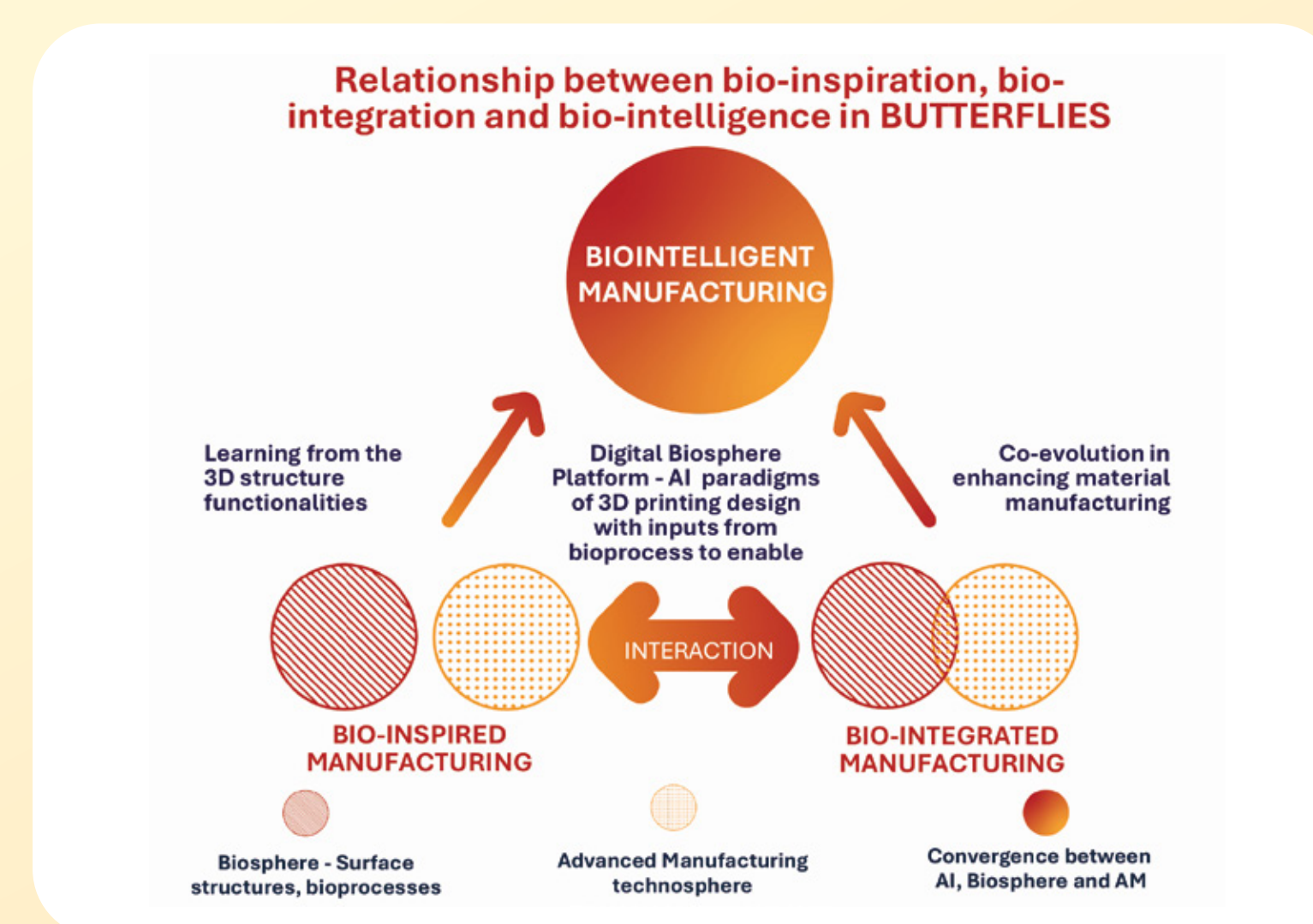
The project supports **new value chains in biomaterials and advanced manufacturing**, particularly in **high-value sectors** like **health tech** and **regenerative medicine**. It also opens up **future industrial applications** in **automotive, aerospace, and packaging**.

Social and Policy Impact

BUTTERFLIES promotes **gender balance, inclusivity, and skills development** across the consortium. It supports **EU policies on digital and green transitions**, aligning with **Horizon Europe** and **industry strategies** by encouraging **responsible innovation, standardisation, and sustainability-focused entrepreneurship**.

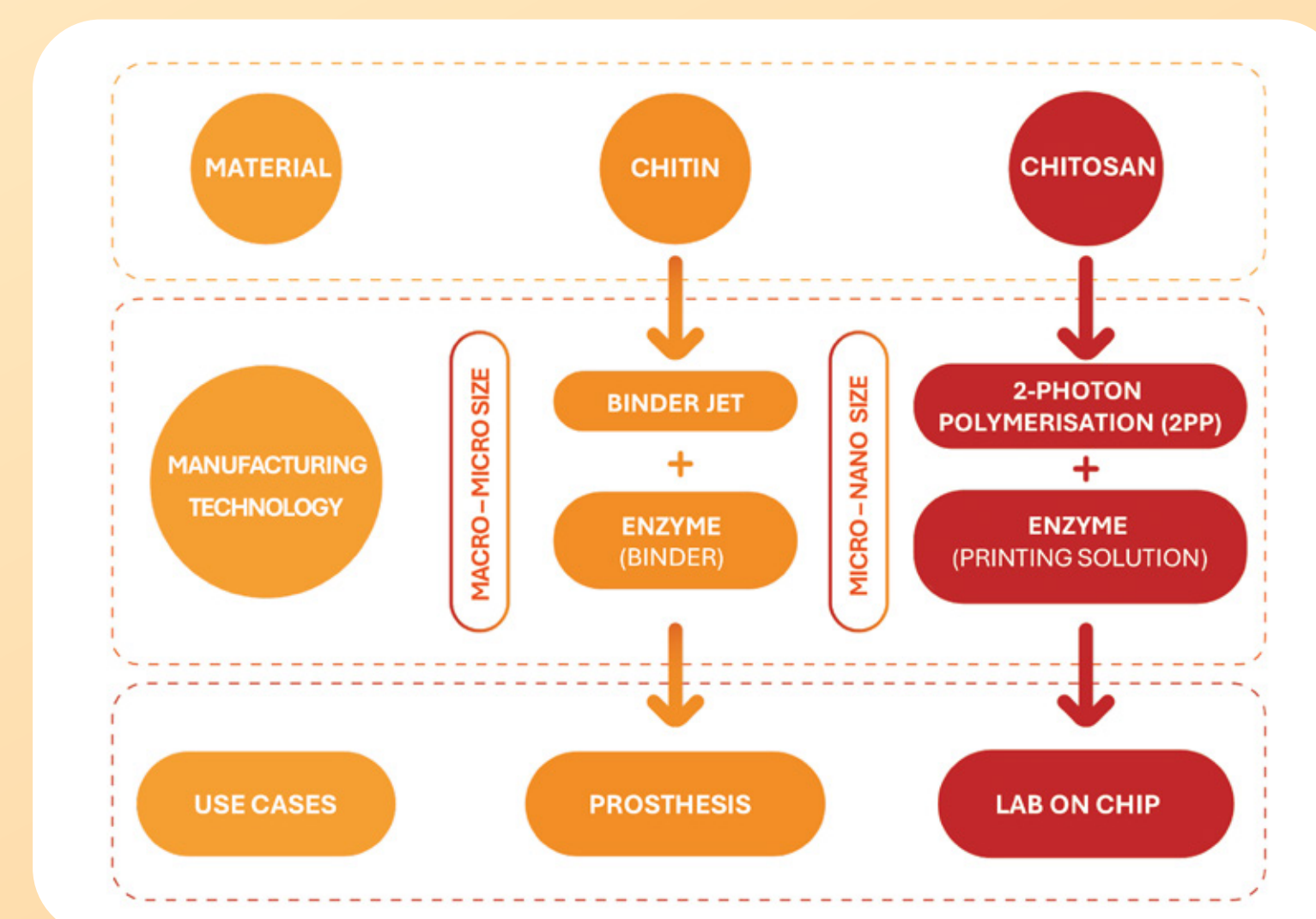
Concept and Approach

From the Biosphere to Bio-Intelligent Manufacturing



Two Complementary Technology Routes

BUTTERFLIES combines Binder Jetting at the macro-micro scale with Two-Photon Polymerisation at the micro-nano scale to create sustainable bio-based components for industrial and biomedical applications.



Use Cases and Targets

Use Case 1: Sustainable Binder Jetting

Objective

Develop chitin nanocrystal-based binders and an adapted Binder Jetting system for the production of customised biomedical and functional components.

Demonstrators



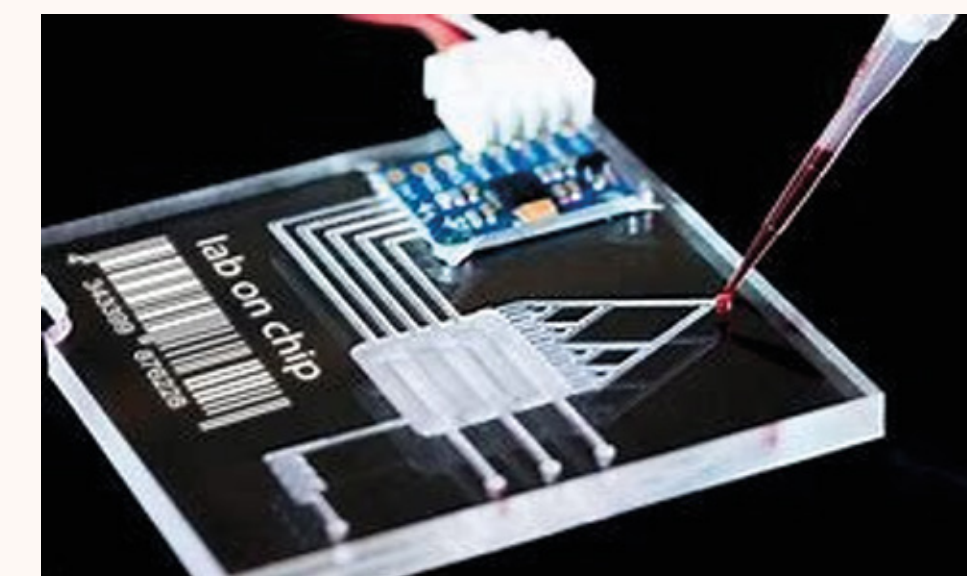
Indicator	Project target
ChNC concentration in binder	Up to 3 wt%
Adhesion improvement	20–50 %
Reduction in energy consumption	40 %
Improvement in mechanical properties	20 %
Reduction in carbon footprint	40 %
Reduction in post-processing	35 %
Increase in operational lifespan	50 %

Use Case 2: High-Resolution 2PP Bioprinting

Objective

Develop photocurable chitosan-based polymers and a high-throughput 2PP process for printing organoid scaffolds and advanced cell-culture platforms.

Demonstrators



Indicator	Project target
Increase in writing velocity	3x
Printing precision	Micrometre scale
Dimensional deformation during cell growth	Below 2 %
Improvement in scaffold mechanical strengt	20 %
Cell viability	Above 90 %
Reduction in carbon footprint	40 %
Validated organoid scaffold design	At least 3
Target organoid print rate	Below 1 second

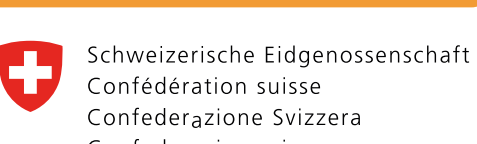
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ASSOCIATED PARTNER



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