# *Circular business models for the valorization of the resources of the agri-food industry*

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Objective 12 of the 2030 Agenda aims to ensure sustainable production and consumption models, emphasizing waste reduction and valorization of residues. The PNRR-funded project UMARI focuses on the sustainable valorization of agri-food wastes and processing by-products as renewable sources of bioactive compounds and functional ingredients. Biotechnology and sustainable solid–liquid extraction processes have been employed to recover antioxidants, fibers, fatty acids, and phytochemicals from plant-derived matrices (e.g. tomato, citrus), to be integrated into formulations for diverse applications, including fortified foods, dermocosmetic products, bioactives for agriculture.

UMARI engages a short value chain fully located in the Calabria region, and promotes an industrial symbiosis approach where small-scale agri-food enterprises cooperate to create new circular business models, while minimizing waste and environmental impact. In alignment with the eco-design principles, UMARI also developed two innovative digital platforms:

- A blockchain-based traceability platform enhances transparency across the supply chain in the agri-food sector. By immutably recording all production, processing, and distribution phases, it enables real-time access to certified information about raw material origins, processing, and quality certifications. The innovation core is the digital product passport accompanying each item, ensuring authenticity and traceability. Producers benefit from brand protection and market positioning, while consumers gain simple verification tools accessible via apps or QR codes.
- A predictive shelf life and Period After Opening (PAO) platform for food and cosmetics, streamlines and automates what were previously fragmented, error-prone manual processes. Through validated models and storage condition simulations, the platform reliably predicts product lifespan and degradation parameters. Interactive dashboards make the data accessible and actionable, supporting advanced R&D activities.

UMARI exploited the enabling technologies to link biological valorization with local resource management, contributing to the development of scalable, replicable solutions for bio-based industries, fostering innovation across the agri-food, nutraceutical, and cosmetic sectors.

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