

Circular Economy in Frontier Agriculture: Waste to Value in Mediterranean Food Systems

Problem/Challenge

Traditional agricultural practices in the Mediterranean often generate significant waste and suffer from inefficient resource management, leading to environmental pollution and lost economic value. Addressing these challenges is crucial for building resilient food systems and achieving the interconnected goals of the Water-Energy-Food-Ecosystem (WEFE) Nexus.

Our Solution/Key Finding

The FrontAg Nexus project demonstrates how frontier agricultural systems are pivotal to a **circular economy** model, transforming waste into valuable resources. Through practices like vermicomposting, insect farming (e.g., Black Soldier Fly larvae converting organic waste), and closed-loop aquaponics, nutrient and organic waste streams from agriculture and food processing can be effectively valorised, minimizing environmental impact.

Benefits & Impact

Adopting these circular practices leads to substantial benefits, including reduced waste disposal costs and environmental pollution. It creates valuable co-products such as protein-rich animal feed, bio-fertilizers, and high-quality compost. This enhances overall resource efficiency, lowers reliance on external inputs, and contributes directly to a more sustainable and resilient WEFE Nexus by fostering resource regeneration and ecosystem health.

Practical Recommendations

Farmers and SMEs should assess their waste streams (e.g., crop residues, food processing by-products) for potential conversion into resources through vermicomposting, insect rearing, or nutrient recycling in aquaponics.

Applicability Box

Theme: Circular Economy, Waste Valorisation & Resource Regeneration

Keywords: Circular Economy, Waste-to-Value, Nutrient Recycling, Vermicomposting, Insect Farming, Aquaponics, Mediterranean

Context: Agri-food waste management, sustainable farming, livestock feed production, organic fertilizer markets.

Required Resources: Access to organic waste streams, processing infrastructure (e.g., bioreactors, insect rearing facilities), technical knowledge of circular processes.

Scalability: Concepts are adaptable from farm-scale composting to industrial-scale insect protein production.

Readiness Levels: Varies by specific technology (e.g., vermicomposting is high TRL, some insect farming applications are emerging), but the circular approach generally gains momentum in BRL and SRL through policy support and demonstrated economic benefits [1, 2].

Risk Management/Considerations: Ensuring product safety from recycled materials, managing regulatory compliance, identifying suitable waste streams, and addressing potential odour or pest issues.

Policymakers are urged to offer financial incentives (e.g., grants, tax breaks) for waste valorisation projects, invest in R&D for innovative circular technologies, and establish clear regulatory pathways for the safe application of recycled agricultural by-products.

References and Further Information

- [1] UM6P, "D1.2: Supply and value chain analysis of climate smart and water saving agri-food production systems," FrontAg Nexus Project Deliverable, Ben Guerir, 2024.
- [2] E. Appolloni, V. Cerasola, G. Pennisi, W. Biru, G. Buchenrieder, T. Uyar and Y. Yavuz, "D1.1: Systematic literature review (SLR) of frontier agriculture systems and empirical evidence in the Mediterranean Region," FrontAg Nexus Project Deliverable, Bologna, 2023.

About this practice abstract

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Authors: O. Gillor (Ben Gurion University of the Negev (BGU)); O. Boukil (El Bosten); B. Darkaoui (University of Mohamed VI Polytechnic (UM6P)); E. Appolloni; G. Pennisi; V. A. Cerasola (University of Bologna (UniBo)); W. Biru; G. Buchenrieder (Universität der Bundeswehr München (UniBW)); M. Reuter (aquaponik manufaktur (APM))

Contact: Bouchra Darkaoui (UM6P), bouchra.darkaoui@um6p.ma

Review: T. S. Uyar (Eurosolar)

FrontAg Nexus: The project was launched in May 2023 to promote sustainable agri-food practices by applying the Water-Energy-Food-Ecosystems (WEFE) Nexus approach. Focusing on six Mediterranean countries—Israel, Italy, Morocco, Tunisia, Turkey, and Jordan—the project addresses climate change, resource scarcity, and food insecurity through collaborative research and innovation.

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