BONEX
Boosting Nexus Framework Implementation in the Mediterranean

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA programme supported by the European Union.

FACTSHEET | DEMOSTRATION PILOT JORDAN

Wadi Mujib (Jordan)

Context of the demonstration project

According to the National Water Strategy 2023-2040, Jordan has only 61 m³ of renewable water per capita annually, making it one of the world's most water-stressed countries.

Climate change worsens this crisis, as rainfall declines by 1.2mm yearly and temperatures rise by 0.03°C annually, leading to prolonged droughts that threaten agriculture and intensify environmental challenges.

At the same time, Jordan's heavy energy dependence and soaring prices strain households, industries, and businesses, reducing competitiveness and investment.

Reliance on costly imports deepens fiscal deficits, making sustainable energy solutions urgent for economic growth. Meanwhile, a rapidly growing young population heightens pressure on food security and job creation, with unemployment remaining a critical concern (21.4% in 2024).

Against this backdrop, the BONEX pilot in Jordan is located in Dhiban—a rural poverty hotspot marked by activism and social discontent (Colfax, 2019)—highlighting the need for a holistic approach to the WEFE nexus towards resilient solutions.

Description of the technology demonstrated in the DP

The BONEX Demonstration Project in Jordan implements a pilot with two hydroponic greenhouses (418.5 m² each) powered by solar PV compared to traditional greenhouses. The hydroponic system uses drip irrigation with locally sourced volcanic tuff as a soilless substrate, operating in a closed-loop water system sourced from Al Wala Valley. A smart fertigation system optimizes water and nutrient use, saving 25-38% water while increasing crop yields by 25-106%. Four crop cycles with three different crop types (cucumbers, peas, red cabbage) demonstrated superior performance, especially under extreme heat (40-49.9°C), where hydroponics suffered only 24% crop damage vs. near-total loss in traditional systems. The solar PV system has a capacity to produce 4 kW and generates over 1 KW/day surplus, ensuring energy neutrality. Managed by a youth cooperative (13 men, 10 women), the project enhances socio-economic sustainability by integrating gender-inclusive technology and capacity building. It serves as a scalable model for water-efficient, climate-resilient agriculture in Jordan, aligning with WEFE Nexus principles by addressing water scarcity, energy needs, and food security in degraded, resource-scarce regions. The initiative also engages with the WEFE4MED Knowledge Hub for policy integration and stakeholder collaboration.

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WEFE Nexus dimensions

Reflecting on the impact of BONEX intervention in Jordan, the following WEFE dimensions can be highlighted:

- **Water:** Implemented closed-loop hydroponics using filtered spring water, achieving 25-38% savings vs traditional irrigation.
- **Energy:** Solar-powered system generated >1KW/day surplus, making operations energy-neutral.
- **Food:** Increased productivity (25-106%) with climate-resilient cash crops (cucumbers, peas, cabbage).
- **Ecosystems:** Used local volcanic tuff substrate and smart fertigation to minimize environmental impact.

The system reduced the CO2 emissions by 66.7 kg CO_2 eq. and 13.2 kg CO_2 eq. compared to fuel-powered and grid-powered hydroponics.

- **Socioeconomic:** Empowered a youth cooperative (23 members, 43% women) through training and employment.

Main policy recommendations

Jordan needs effective governance and policies that foster integrated planning and action. A critical step is empowering the existing National WEFE Nexus Council to harmonize strategies across water, energy, agriculture, and environmental sectors.This council should lead the development of long term holistic strategies to address the nexus. Such strategy should capitalize on successful existing projects, like the BONEX Wadi Al Wala demonstration site, and reflect on upscaling pathways.

Policy reforms should incentivize efficiency through adjusted subsidies, while financial tools (green grants, low-interest loans) support small farmers and cooperatives.To boost small-scale farming profitability, simplify land permits, improve market access, and promote innovations like shared logistics, cooperative models, and vertical supply chain integration.

In parallel, investing in data platforms, like the REWEF tool, will enable evidence-based planning. Strengthen multi-stakeholder partnerships (government, NGOs, private sector, donors) for inclusive, scalable solutions and launching capacity-building and public awareness campaigns should drive adoption of sustainable practices.

Gender dimension

The BONEX DP incorporated gender equality through its design and implementation. The project engaged a youth cooperative of 23 members (10 women, 13 men), achieving 43% female participation—significant in Jordan's male-dominated agriculture sector.

Women agricultural engineers received training and employment, improving technical and financial empowerment. Hydroponic technology was chosen as a gender-sensitive solution, reducing physical labor demands while creating skilled roles accessible to women.

The cooperative ensured equal participation in decision-making and profit-sharing. Monitoring confirmed women's active involvement in crop production and solar PV maintenance. Targeted capacity-building strengthened women's expertise in modern farming and entrepreneurship.

By challenging traditional gender roles, the project demonstrated how WEFE Nexus interventions can promote equity in rural Mediterranean areas.

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