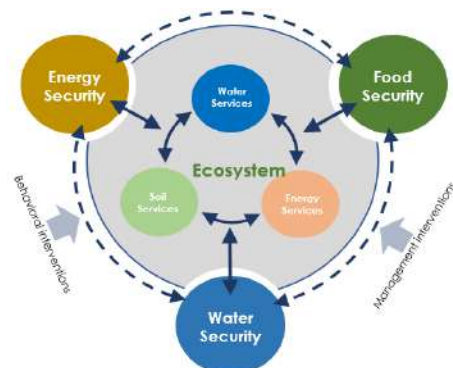




WEFE Nexus Bridging Framework: A methodological framework for WEFE Nexus implementation



WEFE Nexus Bridging Framework

The Water–Energy–Food–Ecosystems Nexus is an integrated approach to resource management that recognizes the complex and interdependent relationships between water, energy, food production, and ecosystems (WEFE). Rather than addressing these sectors in isolation, the Nexus perspective promotes coordinated planning to enhance resource efficiency, sustainability, and resilience.

Central to the WEFE Nexus approach is the identification and management of trade-offs and synergies across sectors—for example, how expanding irrigation may boost food production but increase water and energy demand, or how ecosystem restoration can simultaneously improve water quality and climate resilience. By explicitly considering these interactions, Nexus-informed planning helps avoid unintended consequences, supports balanced decision-making, and ensures that development strategies deliver long-term benefits across environmental, social, and economic dimensions.

Benefits of WEFE Nexus

The Water–Energy–Food–Ecosystems (WEFE) Nexus provides a transformative framework for tackling interconnected resource challenges in the face of climate change, demographic pressure, and environmental degradation.

By fostering integrated governance across traditionally siloed sectors, the Nexus promotes greater efficiency, resilience, and sustainability. Ecosystems are often neglected in conventional planning, despite their vital role in maintaining water quality, regulating climate, and underpinning agricultural and energy systems. This oversight leads to decisions that ignore long-term environmental costs. The WEFE approach addresses this gap by explicitly recognizing the value of ecosystems as integral components of socio-economic resilience, ensuring that their services and co-benefits are fully considered in policy and investment decisions.

Equally important is the Nexus’s emphasis on participation and inclusiveness. Engaging diverse stakeholders—from local communities and farmers to utilities, civil society, and decision-makers—ensures that solutions are adapted to specific environmental, social, and cultural contexts. The WEFE participatory model fosters dialogue across sectors and interest groups, supporting outcomes that balance diverse needs and minimize negative trade-offs. Ultimately, the Nexus approach leads to enhanced water and food security, expanded access to renewable energy, and better protection of ecosystems, while laying the groundwork for co-designed solutions informed by robust data and inclusive governance.

Key findings of BONEX

- The WEFE Nexus enables integrated planning by addressing interlinkages and trade-offs between water, energy, food, and ecosystems.
- Ecosystems must be treated as active components in resource governance, not as externalities.
- Local knowledge and inclusive participation are critical to ensure context-appropriate and equitable solutions.
- Implementation remains limited due to institutional silos, technical complexity, and lack of understanding, especially in non-Western contexts.
- The BONEX project applied and refined the WEFE framework in seven Mediterranean countries, leading to the creation of Nexus Bridging Plans (NBPs).
- NBPs offer actionable roadmaps, aligning stakeholder priorities with technical tools like REWEFE to support integrated decision-making.
- Policy recommendations call for improved coordination, joint budgeting, science-policy interfaces, capacity building, and gender mainstreaming.

Evolution of Nexus concept

The Water–Energy–Food–Ecosystems (WEFE) Nexus emerged from the growing need for integrated resource management to support sustainable development. Rooted in the principles of Integrated Water Resources Management (IWRM) from the 1990s, the Nexus approach gained international visibility following the 2008 World Economic Forum and was formally introduced at the 2011 Bonn Nexus Conference.

In response to escalating concerns over food insecurity, water scarcity, and rising energy costs, the conference marked a pivotal shift by reframing these issues as inherently interconnected. The original Water–Energy–Food (WEF) Nexus promoted a systems-based perspective, emphasizing how decisions in one sector can generate ripple effects—both risks and opportunities—in others, thereby advocating for more coherent, cross-sectoral policy solutions (1).

The WEF Nexus quickly resonated with researchers, international organizations, and development agencies, reflecting a broadening recognition that siloed sectoral governance is inadequate for tackling today's complex global challenges. As the climate crisis deepened and biodiversity loss accelerated, it became increasingly clear that the original three-sector focus was insufficient.

Ecosystems—historically treated as passive environmental settings—needed to be acknowledged as dynamic systems delivering critical services that underpin water availability, food production, and energy resilience. This recognition catalyzed the expansion to the WEFE Nexus, explicitly integrating ecosystems into the framework.

This expanded vision, particularly promoted in Europe through initiatives like the European Commission's Joint Research Centre Position Paper (2), underscores the ecological foundations of sustainable governance. It strengthens alignment with multiple Sustainable Development Goals (SDGs), reinforcing the urgency of integrated planning and systemic transformation. Despite its growing prominence in academic and policy discourse, the operationalization of the WEFE Nexus remains at an early stage. There is still a need for tested methodologies, practical tools, and real-world experiences to support its implementation.

Challenges of WEFE Nexus implementation

Despite the increased attention and conceptual development of WEFE Nexus approach, most countries continue to govern WEFE sectors in isolation. This fragmented management hinders the potential for integrated solutions and undermines the resilience of socio-environmental systems.

Originating primarily from Western policy and academic contexts, the WEFE Nexus offers a systems-based framework for coordinated resource governance. Yet, when applied through top-down approaches, it risks neglecting local realities, including socio-cultural dynamics, traditional knowledge, and diverse stakeholder perceptions—particularly in the Global South. In many non-Western regions, the Nexus concept may not resonate with or be fully understood by key actors and local communities, posing significant barriers to implementation. This underscores the need for inclusive, bottom-up approaches that recognize local knowledge systems and ensure community engagement throughout Nexus planning and decision-making.

A key challenge remains in closing the gap between theory and practice. Although the WEFE Nexus has advanced considerably as a conceptual framework, its practical implementation is still limited—hindered by institutional fragmentation, technical complexity, and political inertia. Moving from vision to action requires not only effective cross-sectoral coordination, but also robust governance structures that enable collaboration, support institutional learning, and promote the exchange of practical experiences in diverse contexts.

To respond to these challenges, the BONEX project developed and applied the WEFE Bridging Framework (WEFEF)—a pragmatic methodology for turning the Nexus concept into action.

By integrating multi-actor co-creation and dialogue through System Thinking Dynamics methods with tools like the Rapid Evaluation of Water-Energy-Food-Ecosystem Nexus (REWEFE), the framework supports context-sensitive, participatory assessments. The BONEX project launched a series of demonstration activities across the Mediterranean, applying and refining the WEFE Framework (WEFEF). These pilots generated concrete insights into how the Nexus approach can be implemented on the ground, offering valuable guidance for practitioners and policymakers aiming to translate Nexus principles into actionable strategies.

Nexus implementation under BONEX Case studies

The WEFEF framework was applied in seven case studies across the Mediterranean region—Portugal, Spain, Italy, Morocco, Tunisia, Jordan, and Lebanon. Each case involved extensive stakeholder engagement, integrating local knowledge with scientific analysis to co-design context-specific Nexus strategies. These diverse settings enabled an iterative process of applying and refining the framework under varying institutional, socio-economic, and environmental conditions. This practical experience generated valuable insights, ultimately informing the development of an updated version: WEFEF 2.0.

The main outcome of this process was the co-creation of Nexus Bridging Plans (NBPs)—strategic documents that serve as actionable roadmaps to operationalize the WEFE Nexus at the local and regional levels. NBPs articulate a shared vision among stakeholders and identify concrete measures, policy recommendations, and priority actions to improve cross-sectoral coordination and promote sustainability. They are designed to “bridge” the gap between Nexus thinking and real-world decision-making by aligning technical assessments with stakeholder needs, institutional capacities, and political realities.

Each NBP integrates qualitative and quantitative methods from the application of the WEFEF including REWEFE tool (Rapid Evaluation of Water-Energy-Food-Ecosystems), stakeholder dialogues, and co-creation workshops. As such, the plans reflect not only systemic analyses but also the contextualized priorities and trade-offs defined by actors on the ground. By providing a structured yet flexible pathway, NBPs support the transition from fragmented management to integrated Nexus governance and can inform future investment planning, policy alignment, and multi-stakeholder collaboration.

Drawing on the practical experience of implementing the WEFeF framework across seven Mediterranean case studies, and enriched by exchanges with other projects, initiatives, and experts—including the WEFE Nexus Conference in Rabat co-organised by BONEX and SURE-Nexus, and the insights gained from the Dresden Nexus Conference—we are well positioned to offer a set of policy recommendations to support the effective implementation of the Nexus approach in practice.



Conclusions and Policy recommendations

- Establish Cross-Sectoral Coordination Mechanisms:** Governments should create or strengthen coordination bodies dedicated to integrating water, energy, food, and ecosystem (WEFE) considerations into policymaking and planning. Ideally anchored at a high-level authority—such as the Prime Minister's office—these mechanisms should foster a shift from sectoral competition to cross-sectoral collaboration by aligning strategies, policies, and budgets. At subnational levels, local authorities are encouraged to form cross-sectoral platforms (e.g., Nexus task forces) to coordinate regional plans, pilot innovations, and jointly manage shared resources.
- Reform Budgeting Systems to Enable Integrated Projects:** Traditional budgeting structures reinforce sectoral silos, making it difficult to fund integrated initiatives. Governments should introduce joint budget lines or flexible financing envelopes that accommodate cross-sectoral Nexus projects. Funding instruments—such as pooled funds, green bonds, or public-private partnerships—should be aligned with Nexus principles and embedded in public investment frameworks to enable more coherent resource allocation.
- Strengthen Nexus Governance through National Strategies and Regional Cooperation:** Countries should develop national WEFE Nexus strategies aligned with SDG targets and climate commitments. These strategies should include clear implementation pathways, defined roles, timelines, budgets, and measurable indicators. At the regional level, platforms such as the Union for the Mediterranean (UfM), PRIMA, and Plan Bleu can facilitate transboundary cooperation through shared metrics and coordinated action on common challenges.
- Institutionalize Science-Policy Interfaces and Align with Socioeconomic Priorities:** To bridge the gap between evidence and policymaking,

governments should establish interdisciplinary advisory bodies that bring together scientists, policymakers, and practitioners. These bodies should regularly interact with planning and legislative institutions. To increase political buy-in, Nexus approaches must demonstrate tangible economic and social benefits—such as job creation, SME growth, and enhanced resilience. Quantifying trade-offs and synergies strengthens the case for policy and budgetary support.

- **Translate Nexus Concepts into Practical and Accessible Tools:** Complex Nexus concepts must be made accessible through user-friendly communication tools, such as tailored policy briefs, infographics, and locally relevant case studies. Governments should invest in decision-support tools that visualize trade-offs and synergies and enhance data collection and monitoring systems. Interoperable, shared data platforms—such as dashboards at basin or regional levels—can guide investment planning and evidence-based decision-making.

- **Promote Nature-Based Solutions, Smart Technologies, and Traditional Knowledge** Nexus planning should prioritize low-cost, adaptive interventions like constructed wetlands, agroforestry, and riparian restoration—especially in climate-vulnerable regions. Investment in smart technologies, such as solar-powered irrigation, AI-assisted systems, and soil moisture sensors, should be done collaboratively with local communities to ensure adoption and usability. Traditional and indigenous knowledge should be recognized, supported, and integrated into national innovation agendas.

- **Institutionalize Inclusive Co-Creation Processes:** Ensure meaningful participation of diverse local actors—from farmers and pastoralists to youth and community leaders—in designing and implementing Nexus strategies. Apply participatory tools such as scenario planning, stakeholder mapping, and Living Labs to foster co-ownership and ensure that local knowledge informs decision-making processes.

- **Invest in Cross-Disciplinary and Systems-Oriented Capacity Building:** Promote systems thinking through hands-on, peer-based learning initiatives, such as the Collaborative Learning Schools (CLS) piloted in the SustainFood project. Similar training programs should be expanded, particularly targeting local stakeholders, technical staff, and decision-makers to strengthen cross-sectoral collaboration and implementation capacity.

- **Mainstream Gender Equality in All Stages of Nexus Planning** Gender considerations must be embedded throughout Nexus project cycles—from design to implementation and monitoring. Use gender-sensitive tools, ensure equal access to resources and decision-making, and avoid tokenism by fostering meaningful, inclusive participation. Programs should conduct gender impact assessments, promote gender-balanced teams, and actively address structural inequalities affecting access and agency.

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BONEX project website: <https://bonex-prima.eu/>