CGIAR Food Frontiers and Security Program

Building resilient food systems for the most vulnerable —fragile, urban, and island contexts

CGIAR FOOD FRONTIERS AND SECURITY

IWMI International Water Management Institute

Beyond Waste: Circular Economy Pathways for Resilient Island Food Systems

Transforming waste, wastewater and nutrients into value for climate-resilient island systems

Circular economy is not just about waste—it is about redesigning systems to generate value across interconnected resource flows.

Fortifier pellets made from human waste. Josiane Nikiema / IWMI

Island systems face growing pressure from climate change, resource scarcity, food systems and waste accumulation. Circular economy (CE) approaches offer a pathway to transform these constraints into opportunities—by closing resource loops across water, food, energy and materials.

Drawing on the international Water Management Institute (IWMI)'s global experience, this brief outlines how circular solutions can strengthen resilience, reduce waste, and unlock value in island contexts. It presents a practical framework and examples to guide investment and action.

Why Circular Economy Matters for Island Food Systems

Islands operate under unique constraints that shape their food, water, and waste systems. Limited natural resources, geographic isolation, and high exposure to climate variability create fragile and often inefficient systems. Increasing population and changing consumption patterns further intensify pressure on already strained infrastructure, particularly in waste and wastewater management.

Circular economy approaches enable a shift from linear "take–use–dispose" systems to regenerative systems that retain value. They can:

- Recover water, nutrients, and energy from waste streams
- Reduce environmental degradation and pollution
- Improve efficiency and productivity of food systems
- Create local economic opportunities and livelihoods
- Strengthen resilience to climate and resource shocks

Linear systems generate waste. Circular systems close loops—turning waste into resources that sustain food, water and energy systems.

The Opportunity: Moving "Beyond Waste"

- Recover resources (water, nutrients, energy)
- Reduce environmental pressure
- Improve food system efficiency
- Create local economic opportunities
- Strengthen climate resilience

Closing Resource Loops: IWMI's Approach

IWMI's approach combines science, innovation and partnerships to translate circular economy concepts into practical solutions:

- Research – Understanding system dynamics and identifying opportunities
- Co-design – Working with partners, governments and communities
- Pilot – Testing context-specific solutions in real-world settings
- Scale – Supporting pathways for adoption, investment, and policy integration

IWMI applies a systems-based approach to circular economy by focusing on interconnected resource loops across water, nutrients, energy, and materials. By identifying inefficiencies and losses within these systems, circular solutions can be designed to recover value, reduce waste, and improve overall system performance.

IWMI's Resource Loop Framework

A technical and policy-oriented analysis of circular economy opportunities in Island contexts, on waste generation, resource flows and management systems, highlighting key challenges such as low collection efficiency, high organic waste content, weak infrastructure and environmental and public health risks.

Energy innovations that deliver bioenergy from waste: reducing diesel dependence, lowering costs and emissions and strengthening energy security while linking sanitation, food and energy systems.

Nutrient innovations that deliver soil restoration from waste: reducing fertilizer dependence, improving soil health and strengthening local agriculture and livelihoods while closing nutrient loops.

Water innovations that deliver safe reuse and efficiency: addressing scarcity, reducing pollution and strengthening climate resilience and public health through decentralized and nature-based solutions.

Material innovations that deliver circular solutions: reducing plastic pollution, easing landfill pressure and creating local green enterprises while supporting cleaner coastlines and circular tourism.

IWMI's Commitment to Integrated Circular Economy Transformation

CE innovations and business models

100+ Circular business models for water, energy, nutrient, and protein recovery developed

20+ Circular businesses supported

3 Commercial PPPs facilitated

Learning and Innovation Hubs

4 Circular Economy Hubs in Ghana, Kenya, India, Vietnam

4 Accelerator programs

6 Universities use our CE modules

Capacity building in CE

3,600 Refugees and host communities, humanitarian actors

6,000 Women, youth entrepreneurs, farmers, public sector actors

10,000 Students using our online course

12,000 School children engaged in CE practices

Policy Influence and Decision Support

WHO, FAO & UNEP supported on developing **water reuse and RRR guidelines**

5 National Policies revised

Decision support tools like WasteWise & Water REPEAT

Mitigating water risks, managing water sustainably, and overcoming global inequalities

Assessment & Diagnosis

Evidence-based decision-making by assessing waste flows, resource recovery potential and environmental conditions across water, food and energy systems.

Development & Innovation

Translating diagnostic insights into scalable circular innovations across water, food and energy systems, combining technologies, nature-based solutions and digital/modeling tools

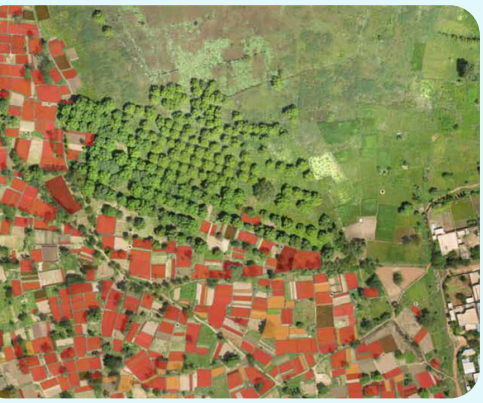
Implementation & Scaling

Advancing operationalization and scaling of circular economy solutions by bridging research, innovation and real-world application.

Enabling Environment

Strengthening enabling environments for circular economy transitions by supporting policy development, institutional capacity and skills.

Assessment & Diagnosis



Quantitative Assessment of Urban Food and Waste Flows in West African Cities

ICET conducted multi-city assessments across West Africa to map urban food flows and waste streams, generating evidence to recover nutrients from waste and close food–waste–sanitation loops for scalable circular economy solutions. First findings synthesized in the Urban Food Systems Atlas to support donor investment, urban planning, and integrated food–waste–sanitation strategies in West African cities.

WasteWise – A Multi-Criteria Decision Support Tool for Circular Bioeconomy Planning

WasteWise helps planners, policymakers, and entrepreneurs identify and prioritize viable resource recovery and reuse (RRR) business models. By integrating spatial and contextual data into an interactive dashboard, it evaluates options across technical, economic, environmental, and social dimensions—enabling scenario testing, reducing investment risk, and supporting scalable, evidence-based solutions.

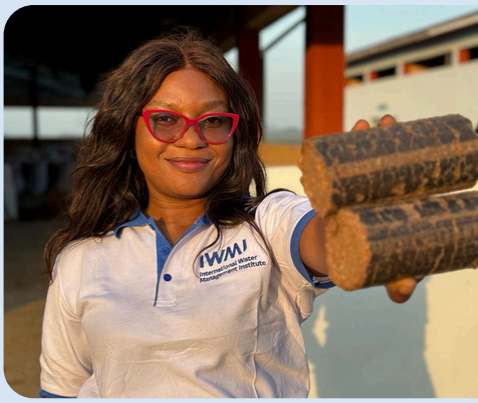
Solution Development & Innovation

From waste to food – Fortifer fertilizer

Over 15 years, ICET and partners developed fecal sludge–based fertilizers like Fortifer, increasing yields by 20–50% while maintaining soil health. Through WaFo and CapVal, IWMI supports commercialization via public–private partnerships, regulatory engagement, and investment to scale safe, circular sanitation and agriculture solutions.

Implementation & scaling

Circular Bioeconomy Innovation Hub



The Circular Bioeconomy Innovation Hub that connects enterprises, researchers, policymakers, and investors to accelerate circular solutions. Through Living Labs, it enables real-world testing, business development, and collaboration—supporting waste valorization, reuse, and bioenergy innovations to scale from pilots to investable, resilient, nature-positive systems.

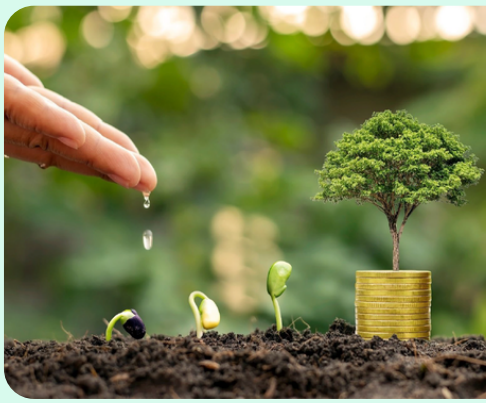
Implementation & scaling

ReWaterMENA – Advancing Water Reuse in MENA

Under the ReWaterMENA program, IWMI advances water reuse across the Middle East and North Africa through digital innovation and regional capacity building. Combining AI-driven decision tools with stakeholder engagement and business model support, it enables scalable, safe wastewater reuse across agriculture, industry, and environmental systems.

Enabling environment

Assessing the Investment Climate for Circular Bioeconomy Transitions in the Global South



Fifteen Global South countries were assessed for policy, institutional and financial factors that shape investment in circular bioeconomy solutions. The study highlights bottlenecks and provides a practical framework to guide policy reform, de-risk investments, and scale wastewater reuse, nutrient recovery, and energy solutions.

> *Circular solutions connect systems—turning waste streams into productive resources across water and food systems."*

From Concept to Action in Island Contexts

Circular economy approaches offer a practical and scalable pathway for island food systems to turn constraints into opportunities. By closing resource loops across water, nutrients, energy, and materials, islands can reduce dependency on imports, improve system efficiency, and build resilience to climate and economic shocks.

Targeted action is needed to strengthen waste-to-resource systems, expand safe water reuse, promote nutrient recycling, and integrate decentralized energy solutions. At the same time, enabling policies, institutional coordination, and innovative financing mechanisms are critical to move from pilots to sustained, system-wide adoption.

There is strong potential to accelerate impact through integrated investments, innovation platforms, and partnerships that align local priorities with regional strategies. With proven experience, systems expertise, and strong stakeholder networks, IWMI is well positioned to support this transition.

Partner with IWMI to co-develop circular solutions that transform waste into value and build resilient, sustainable island food systems.

For more information, contact:

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CGIAR Food Frontiers and Security Program

The CGIAR Food Frontiers and Security Program focuses on strengthening fragile, urban, and island food systems by catalyzing innovative policies, investments, and local capacities to improve food and water security, nutrition, and climate resilience for the world's most vulnerable communities.
https://www.cgiar.org/cgiar-research-portfolio-2025-2030/food-frontiers-and-security