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WORLD ECONOMIC FORUM

From Scarcity to Solutions:
Food-Water Innovation in Asia and the Middle East

WHITE PAPER

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Images: Getty Images

Contents

Foreword

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Global food and water systems are at a critical inflection point. Today, agri-food systems alone are responsible for 70% of freshwater use. By 2050, sustaining 9.7 billion people will require more resources even as climate change intensifies water scarcity, soil degradation and ecosystem collapse.[1] Solutions remain alarmingly fragmented, often treating food and water as if they are disconnected challenges.

This report redefines the paradigm by proposing long-term solutions and an investment case that bridges the food-water nexus. The new paradigm rests on two pillars:

Integrated solutions: We propose moving beyond isolated technology fixes to emphasize an ecosystem of action with enablers, such as policy coherence, blended finance and farmer-centric design.

Scaled-up water investments: China has achieved 90%+ grain self-sufficiency with 6% of the world's freshwater; the Middle East now dominates solar-powered desalination with 40% of global output. These are not case studies but successful blueprints that are scalable and applicable, especially in emerging markets. They reveal how constraints fuel ingenuity and investing in food systems requires investing in water.[2,3,4]

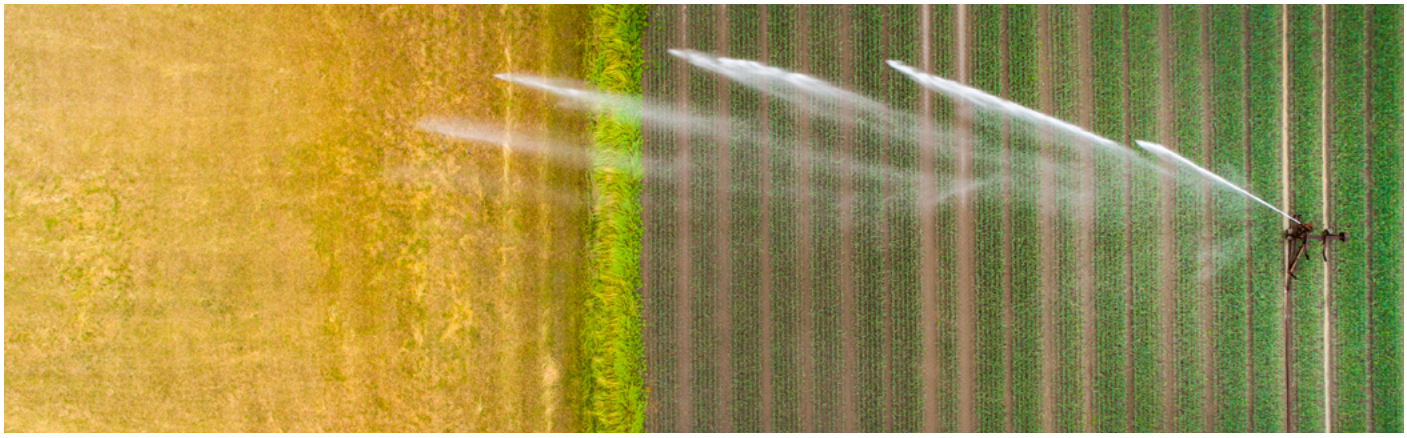
The World Economic Forum's Food Innovation Hubs reflect this integrated approach – connecting start-ups, corporates, farmers and policy-makers to pilot and accelerate solutions. This is just the beginning and the potential for scaling-up the networks is immense.

This white paper is a landscaping study that underscores the related opportunities in food and water and building a healthy ecosystem for transformation. First, collaboration to manage risk, designing for co-investment and adoption of solutions. Second, to position the food-water nexus as a critical impact multiplier to achieve growth through sustainable and resilient economies.

The future of food and water is not a choice but an imperative and an opportunity. We hope this report promotes greater understanding of how we can win together.

Executive summary

Soaring demand for freshwater propels the food-water nexus to the epicentre of global leadership imperatives.



China sustains

20%

of the global population with self-sufficient staple foods – despite having just 6% of the world's freshwater and 9% of its arable land.

The world's freshwater systems are buckling under unprecedented pressures: global freshwater demand is predicted to exceed supply by 40% by 2030, with the hydrological cycle[5] – nature's replenishment mechanism – increasingly disrupted by climate change, pollution and over-extraction.

By 2050, this imbalance will intensify as water demand is set to grow by 30% and food availability will need to increase by 60%.[6] Meanwhile agriculture – which already consumes 70% of freshwater withdrawals – faces shrinking rivers, erratic rainfall and depleted aquifers. This convergence of scarcity and urgent demand places the food-water nexus at the epicentre of global leadership imperatives, demanding immediate action to rebalance humanity's relationship with water.

Emerging economies provide inspiration

Emerging economies are suffering disproportionate burdens, as growing stresses in food and water systems intersect with rapid development needs. Yet they are also proving that innovation can turn constraints into catalysts. The combined food-water tech market in Asia Pacific and the Middle East is projected to reach $209 billion by 2030, accounting for nearly 45% of the global total. Despite inherent challenges, China and the Middle East offer a blueprint for scalable, market-driven solutions,[7] providing valuable inspiration for other developing countries navigating food-water transitions.

China – driving efficiency and self-reliance

- Despite having just 6% of the world's freshwater and 9% of its arable land, China sustains 20% of the global population with self-sufficient staple foods.[8]
- Breakthroughs in precision agriculture, blockchain traceability and closed-loop circularity have driven a 10x income rise for farmers since 2000.[9]
- An integrated system from policy to implementation emphasizes high-standard farmland development, R&D in bio-breeding and smart irrigation.
- These efforts secure the country's staple grain self-sufficiency and optimize agricultural water use efficiency, strengthening the sector's resilience and efficiency.

Middle East – testing solutions for arid climate futures

- In a region where 14 countries face extreme water stress, innovation has turned deserts into breadbaskets.[10]
- The Middle East accounts for 40% of global desalination output, with growing use of solar technologies and public-private partnership (PPP) models.[11]
- Breakthroughs in salt-tolerant crops and soil bio-engineering now enable sustainable yields in marginalized environments.

Holistic framework to transform food and water systems

An integrated green transition that balances economic growth, sustainability and resilience is emerging. New technologies and innovations have led to improved outcomes in food and water systems. This report proposes a holistic framework to transform food and water systems that comprises two dimensions:

Dimension #1

This features 12 high-impact innovations in technologies and business-models across three interconnected domains:

- **Agriculture and food:** solutions include genetic crop improvements and innovations in protein and nutrition.
- **Water:** solutions include digital water sourcing, advanced desalination and biological water treatment.
- **Cross-sector technologies:** these levers integrate precision agriculture, smart irrigation, soil improvement, sustainable packaging, green production and logistics, blockchain-enabled supply chain traceability, and food and water circularity.

Integration of these three domains spans the full value chain, from agricultural inputs and production to distribution, utilization and end-of-use recovery. Collectively, these technologies amplify impact when deployed within systemic frameworks.

Dimension #2

The success of technologies depends on the ecosystems that surround them. China and the Middle East reflect how policy coherence, blended finance, innovation and entrepreneur pipelines, collaborative clusters, private sector alignment and value chain adoption collectively have the potential to turn isolated innovations into systemic resilience.

The systemic and sustainable transformation of food and water systems requires five key enabling actions – referred to in this report as the "five-step blueprint":

1. Build a holistic policy framework.
2. Forge a robust financial ecosystem.
3. Cultivate food-water-centric strategic clusters.
4. Leverage the private sector to scale-up food-water technologies.
5. Upskill value chains and bolster consumer acceptance.

Call to action: a unified path forward

The work on systemic transformation has only just begun. Across emerging markets and especially in China and the Middle East, this five-step blueprint offers a pathway to dismantle silos, align stakeholders and embed innovation into the fabric of food-water systems.

Collaborative approaches are needed to bridge the disparate domains of policy, finance, skills training and grassroots implementation. Only through such public-private action at scale will it be possible to transition from fragmented pilots towards unlocking the full potential of food-water systems to act as engines of economic growth, sustainability and resilience.

1 A holistic framework to transform food-water systems

Creating more sustainable, interconnected food and water systems is critical to ensure the future of both humanity and nature. Emerging economies are leading the way.

Freshwater systems are buckling under soaring demand – especially from agriculture, which accounts for

70%

of the world's total freshwater withdrawals.

Food and water are as essential to life on earth as a functioning, healthy global economy. Worldwide, the food and water sector is a $14 trillion market with consistent overall annual growth of 6%.[12] Two-thirds of global jobs are water dependent.[13] However, freshwater systems are buckling under soaring demand – especially from agriculture, which accounts for 70% of the world's total freshwater withdrawals.[14]

Global freshwater demand is predicted to exceed supply by 40% by 2030,[15] with the hydrological cycle – nature's replenishment mechanism – increasingly disrupted by climate change, pollution and over-extraction. Events such as droughts and floods, combined with geopolitical tensions, are intensifying pressure on food prices which reached a record peak in 2022.[16] Looking ahead, by 2050, sustaining the world's 9.7 billion people will require a 30% increase in water resources and a 60% increase in food production.[17] Meanwhile, more than 40% of all species on earth depend on wetlands and rivers, either directly or indirectly, for their survival.[18]

1.1 Shared challenges, unequal burdens

Food and water systems worldwide face five critical and interconnected challenges (see Figure 1):

- Imbalances in food supply and water scarcity.
- Health problems stemming from dietary patterns as well as mass food production methods and water pollution.
- Greenhouse gas (GHG) emissions from current value chain practices.
- Degradation of ecosystems caused by land conversion, overexploitation and pollution.
- Vulnerabilities resulting from climate change.

These challenges, which are closely linked to energy systems, public health and urbanization, carry global impacts – but emerging economies bear the heaviest burden. For example, over 95% of people experiencing food scarcity live in emerging markets.[19] Globally, 25 countries are facing extremely high water stress, of which 16 are in the Middle East and North Africa.[20]

FIGURE 1 | **Food and water systems face five critical challenges**

Emerging markets bear the heaviest burdens from food- and water-related challenges

	Unequal supply	Health issues	GHG emissions	Natural impacts	Climate vulnerability
Food	2.3bn — people facing food scarcity — 95% are in emerging markets	0.7bn vs 1.0bn — 0.7 bn people globally face malnutrition — yet 1.0 bn are classified as obese	~30% — global GHG emissions attributable to food systems	~90% — direct deforestation in recent years attributable to agriculture	$3.8tn — global losses to crops & livestock due to natural disasters over last 30 years
Water	16/25 — most water-stressed countries in the world located in Middle East and North Africa	2.0bn — people using a drinking water source contaminated with faeces	~10% — global GHG emissions attributable to water systems	~78% — global ocean and freshwater eutrophication caused by agriculture	80mn — people at risk of hunger by 2050 due to climate vulnerability caused by water (e.g. flood, drought)

Sources: Food and Agriculture Organization of the United Nations (FAO); World Resources Institute (WRI); World Health Organization (WHO); Our World in Data; The Water Research Foundation; United Nations Office of the High Commissioner for Human Rights (OHCHR); BCG analysis.[21]

1.2 Holistic framework to transform food and water systems

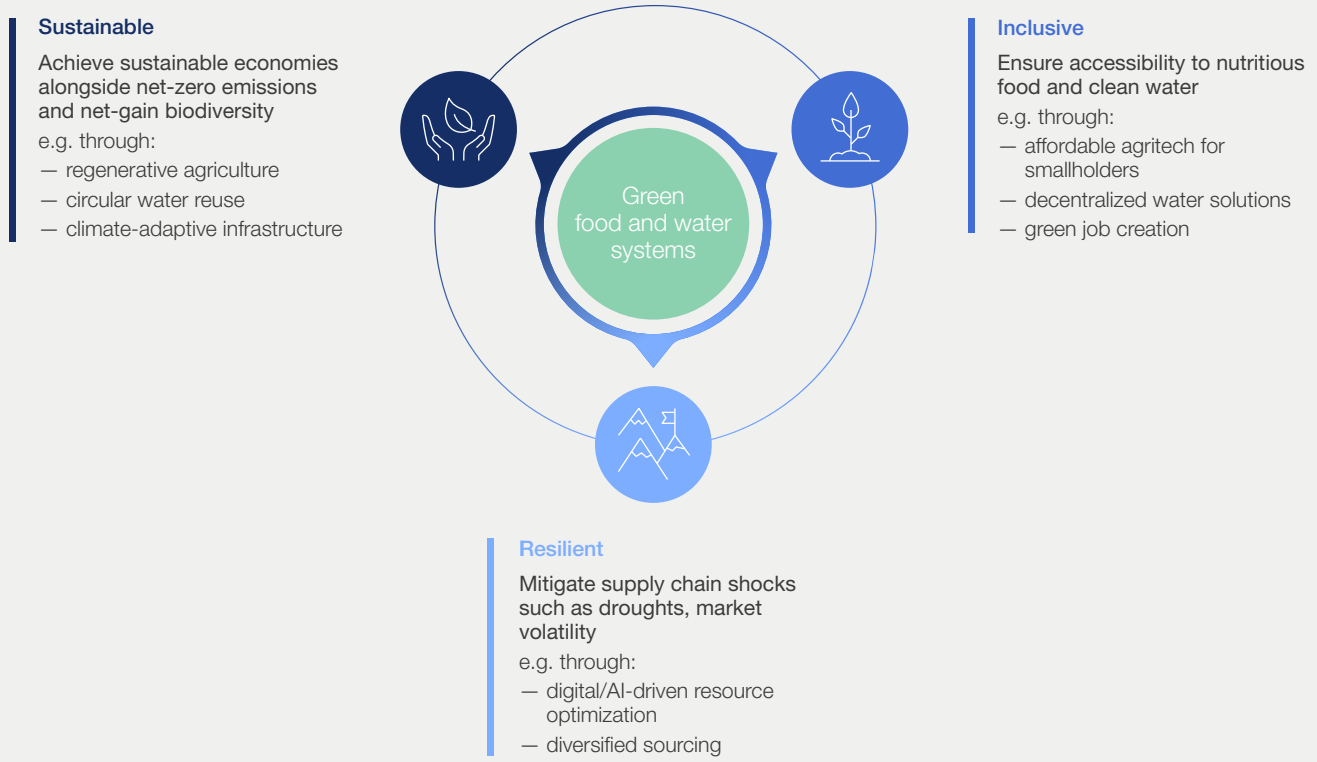
Taking action to address the challenges to food and water systems requires looking beyond each individual system. As shown in Figure 2, green food and water systems should be:

- **Sustainable:** able to support sustainable economies, reduce emissions and ensure net-gain biodiversity.
- **Inclusive:** delivering economic opportunities and access to nutritious food and clean water.
- **Resilient:** capable of mitigating supply chain shocks.

> **The convergence of water stress and rising food demand presents one of the most complex development challenges of our time. Addressing it requires systemic transformation across technologies and enabling ecosystems. Emerging economies are not just sites of vulnerability, but also of innovation, offering valuable lessons on how policy coherence, financial mechanisms and localized, value chain-driven solutions can jointly foster sustainable and resilient food-water systems.**
>
> Kevin Chen, Chair Professor, Zhejiang University

FIGURE 2 **Characteristics of green food and water systems**

Green transformation of global food and water systems is critical to overcome the challenges facing people and planet



Given the inextricable nexus between food and water systems, transformation calls for a holistic approach across two dimensions (see Figure 3):

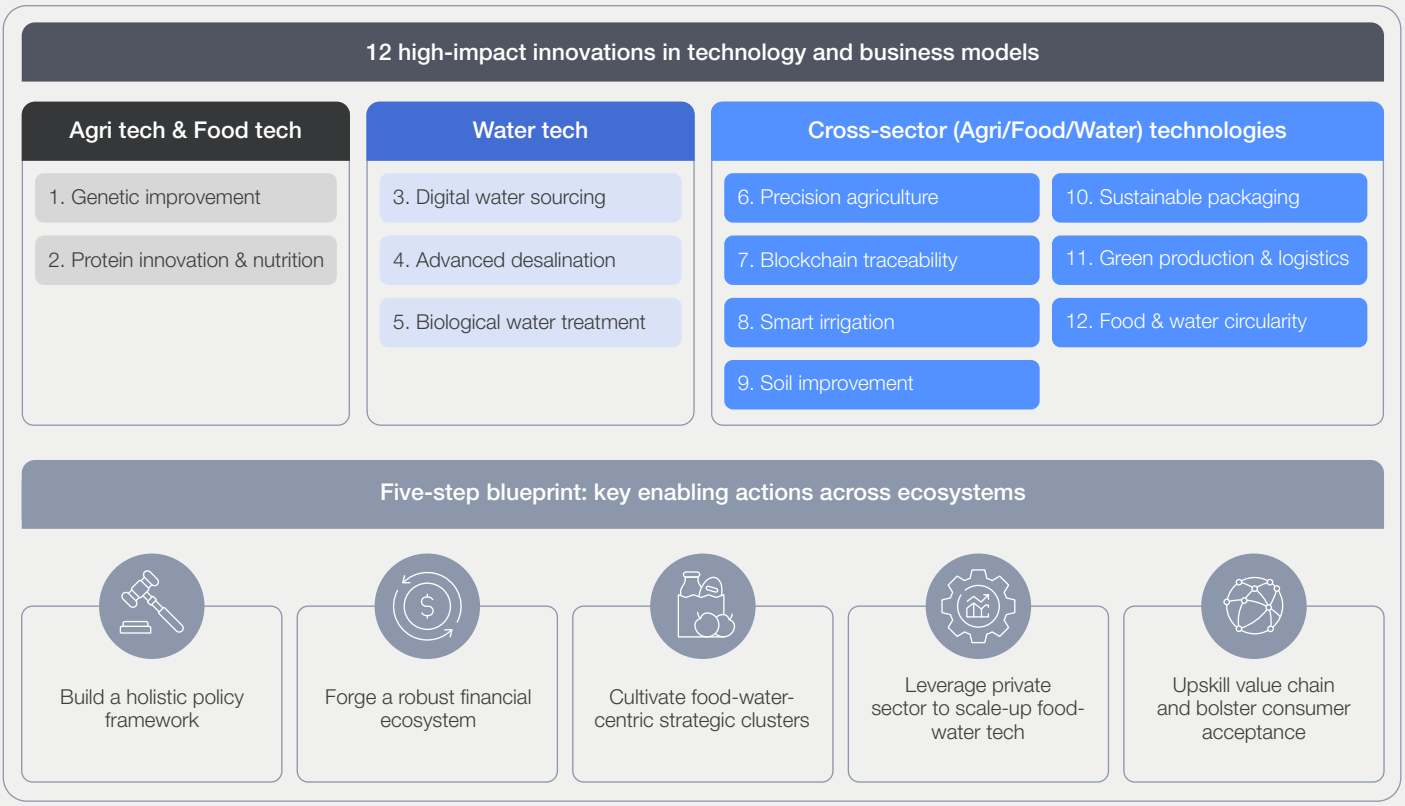
Dimension #1: This features 12 high-impact innovations in technology and business models across three interconnected domains: agriculture and food, water and cross-sector technologies.

Integration of these three domains spans the full value chain, from agricultural inputs and production to distribution, utilization and end-of-use recovery. Collectively, these technologies amplify impact when deployed within systemic frameworks.

Dimension #2: The success of technologies depends on the ecosystems that surround them. So this dimension encompasses five key actions – the "five-step blueprint" – to boost multi-stakeholder collaborations between actors from different ecosystems, such as government, finance, industry, technology and related value chains.

FIGURE 3 | **Holistic framework to transform food and water systems**

Transformation of global food and water systems requires innovations in technology and business models across multiple sectors, silos and ecosystems



Note: See Figure 7 for more detail on the five-step blueprint.

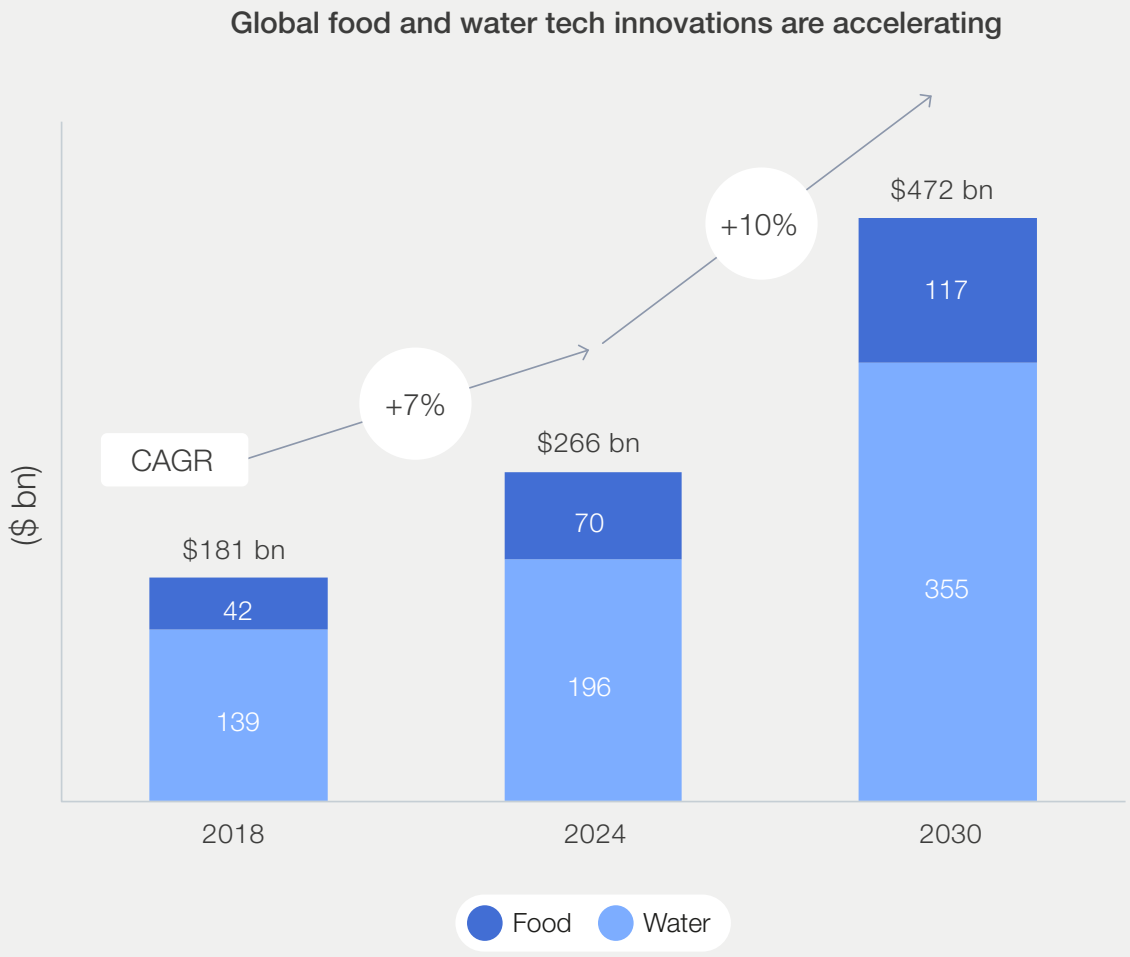
1.3 Innovation with practical implications for emerging economies

By 2030, the global market for food and water technology is projected to reach

~$470 billion

Food and water technology innovation has been accelerating. By 2030, the global market for food and water tech is projected to reach approximately $470 billion – an increase of 74% (or 10% year-on-year) compared to 2024's market size (see Figure 4).[22]

FIGURE 4 **Global food and water technology market size ($ billion)**



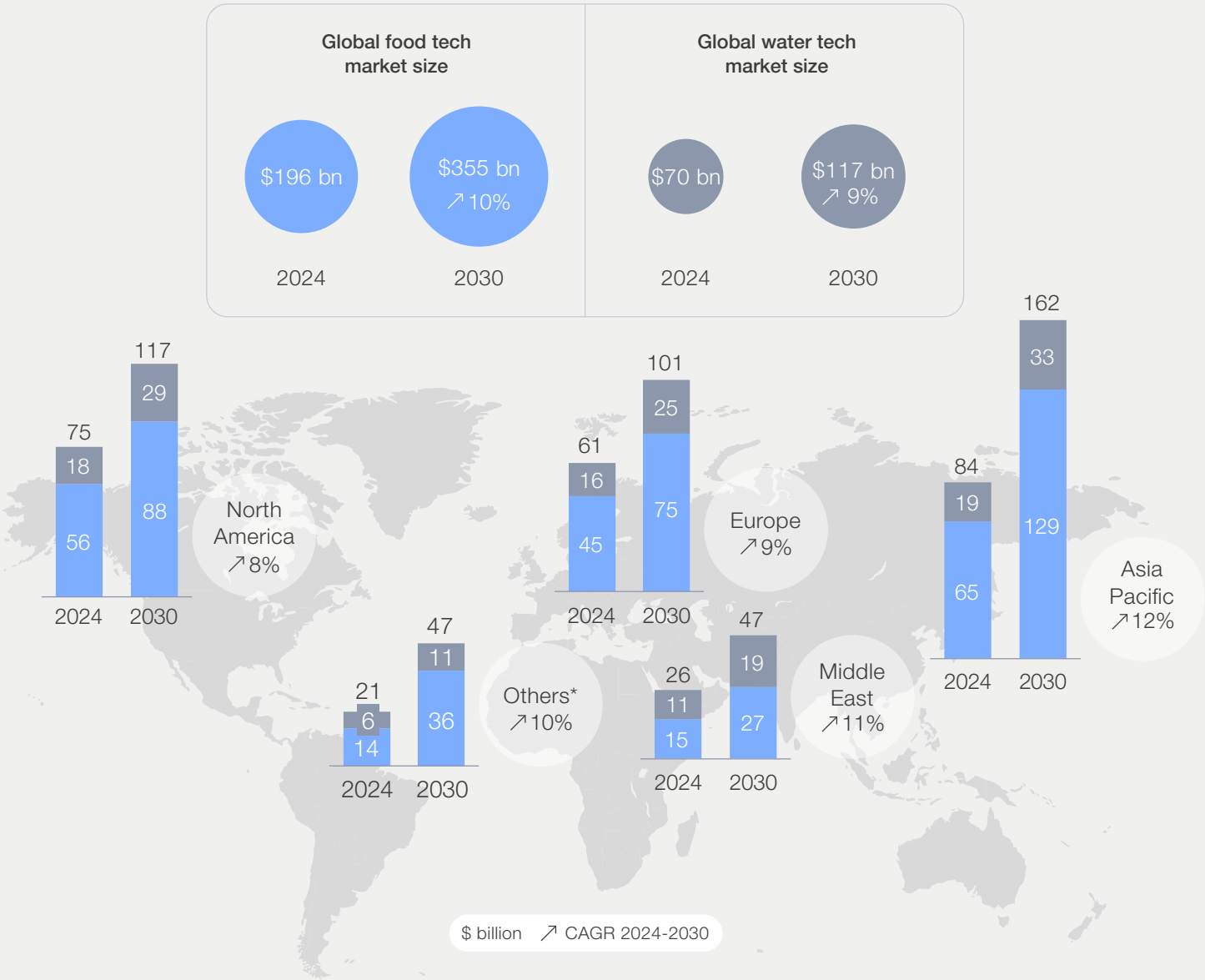
Note: CAGR = compound annual growth rate.

Source: BCG.

In regional terms, Asia Pacific is the world's largest market for green food and water technology, driven by scale and existing demand. Meanwhile, the Middle East is one of the world's most promising markets, supported by increasing investment and a growing focus on innovation. The two regions represent key growth markets and their combined growth will markedly outpace that of any other region by 2030, accounting for a total $209 billion or nearly 45% of the global food and water technology market (see Figure 5).

FIGURE 5 **Global food and water technology market size, by region (2024-2030)**

Asia Pacific and the Middle East are the most significant markets for global food and water technology, and are driving global growth



*Others includes Latin America and Africa

Note: All totals are rounded to the nearest $ billion.

Sources: Grand View Research, Bluefield Research, BCG.[23]

Emerging economies are playing an increasingly important role in the green food-water transition, with regions such as China and the Middle East showing notable progress in both market growth and innovation efforts. This report maps out the innovation landscape for green food-water systems in these two markets and aims to provide a primer on best practices and enabling actions to drive scale.

BOX 1 | A closer look at China

China has advanced efforts to address food-water system sustainability through integrated policy, technological innovation and multi-stakeholder collaboration. The country's progress provides an example of how to balance resource constraints with agricultural productivity, offering lessons for other emerging economies.

Challenges

China's agricultural sector operates under two primary constraints:

- **Resource scarcity:** China possesses just 6% of global freshwater resources and around 9% of global arable land.[24]
- **Structural composition:** Around 98% of China's 200 million agricultural entities are smallholdings.[25]

Outcomes

- **Self-reliance in core grain crops:** Domestic production on average meets 90%+ of demand for rice, wheat and corn.[26]
- **Global contribution:** China sustains almost 20% of the world's population, accounting for nearly 50% of global pork output and over 35% of aquatic products.[27,28,29]
- **Economic and social progress:** Average farmer incomes have increased 10x since 2000, reaching $3,200 in 2024, enhancing livelihoods and reducing rural poverty.[30]

BOX 2 | A closer look at the Middle East

The Middle East has developed strategies to address extreme water scarcity and limited arable land through technological and institutional initiatives, supported by collaborative efforts across public and private sectors.[31]

Challenges

The region operates under significant resource constraints:

- **Water scarcity:** 14 countries face extreme water stress, with per capita freshwater availability below half the global average.[32]
- **Arable land limitations:** Less than 5% of total land is suitable for agriculture, requiring productivity gains in arid environments.[33]

Institutional and technological initiatives

Key mechanisms to address these challenges include:

- **Public-private collaborations:** Partnerships between national ministries, authorities and water technology firms support the R&D activities of leading universities into solutions such as solar-powered desalination.
- **Specialized research institutions:** Dedicated research and innovation hubs (e.g. World Economic Forum's Food Innovation Hub UAE) focus on creating enabling ecosystems to develop and test technologies such as salt-tolerant crops and soil rehabilitation methods, making the region a test-bed for innovations.
- **Cross-border cooperation:** Emerging global water organizations, such as Saudi Arabia's Global Water Organization, facilitate knowledge exchange on water management practices.

Outcomes

- The region operates more than 400 desalination plants, accounting for approximately 40% of global desalinated water production.[34]
- Advances in bioengineering and soil enhancement have enabled agricultural activity in arid regions, contributing to economic diversification efforts.

> **Food systems are facing critical challenges – but of equal importance, the transition of food systems presents huge opportunities in protecting our natural resources and the environment, reducing GHG emissions, and providing livelihoods for millions of smallholders and vulnerable food insecure populations. Water is one of the most critical elements within the food system. Innovations in technology, policy, institutions, business practice and our behaviours are the only ways forward to achieve the desirable goals we all seek.**
>
> Shenggen Fan, Chair Professor and Dean, Academy of Global Food Economics and Policy (AGFEP), China Agricultural University (CAU)

2 Food-water innovation in action: lessons learned from industry practices

Industries tackle interconnected challenges through integrated use of technology and business model innovations.

Building on previous studies of emerging technologies for food system transformation,[35] this chapter provides a state-of-play analysis of 12 high-impact technology levers driving green food and water innovation in emerging economies (see Figure 6).[36] It examines how industries are applying these technologies to address interconnected challenges of resource scarcity, sustainability and resilience. Through case studies and market insights, this chapter highlights successful applications, systemic barriers to adoption and lessons learned from scaling-up solutions in fragmented ecosystems.

2.1 Where innovation meets impact: the 12 technologies transforming food-water systems

The 12 technology levers summarized in Figure 6 have been selected based on their strong market growth potential, critical significance for green food and water systems, and high applicability to emerging markets.

FIGURE 6 | **12 high-impact technology levers to transform food-water systems**

Agri & Food · Water · Cross-sector

12 tech levers	China & M/East mkt size 2030[1]	China & M/East CAGR '24-30 (vs global average)[2]	Why it matters	Most relevant emerging markets
GENETIC IMPROVEMENT — Drought-tolerant breeding — Pest-resistant breeding — GHG-friendly breeding	**$2.4bn**	**8.8%** (vs 7.7%)	— **Food security**: e.g. in China, since 1970s, Yuan Longping's hybrid rice has increased yields 9-fold. — **Sustainable agriculture**: helps crops adapt to environment, curbing chemical inputs.	— Regions with food import dependence and a focus on sustainable agriculture. — e.g. China, Middle East, Africa, South East Asia.
PROTEIN INNOVATION & NUTRITION — Plant-based proteins — Fermentation-based proteins — Cell-based proteins — Insect-based proteins — Algae-based proteins	**$2.8bn**	**9.4%** (vs 8.2%)	— **Resource conservation**: requires less land & water (3,200 litres (l)/kg for pea protein vs 15,000 l/kg for beef). — **Food security**: domestic alternative protein industry can reduce vulnerability to market swings. — **Health improvements**: innovations like sweet proteins can tackle obesity and diabetes.	— Urbanized, health-conscious areas, especially resource-constrained regions. — e.g. China, Middle East (UAE, KSA).[3]
DIGITAL WATER SOURCING — Data-driven water source selection — Real–time monitoring (e.g. leakage detection, water quality monitoring)	**$5.0bn**	**8.9%** (vs 8.8%)	— **Secure access to water**: data-based models can determine the best water source mix for a stable water supply in droughts. — **Water efficiency improvements**: sensor-based leakage detection can sharply reduce water loss.	— Arid/semi-arid regions with ageing water infrastructure. — e.g. Middle East (KSA), North Africa.
ADVANCED DESALINATION — Solar-powered reverse osmosis (SRO) — Reverse osmosis (RO) — Multi-stage flash distillation (MSF) — Multi-effect distillation (MED)	**$19.1bn**	**9.9%** (vs 9.5%)	— **Environmental protection**: SRO cuts desalination energy use by 75% vs traditional approaches. — **Carbon emissions reduction**: e.g. Saudi desalination may store 458 million tonnes of CO_2 by 2030. — **Groundwater depletion reduction**: e.g. Saudi water supply groundwater reliance drops to 8% by 2030 with desalination.	— Arid areas with water scarcity and abundant seawater resources. — e.g. Middle East (KSA, UAE).
BIOLOGICAL WATER TREATMENT — Aerobic treatment systems — Anaerobic systems	**$3.1bn**	**6.6%** (vs 6.0%)	— **Environmental protection**: comprehensive biological treatment in food-processing industry improves receiving river water quality. — **Water scarcity mitigation**: e.g. in M/East Gulf countries, 50%+ treated wastewater could be for agricultural irrigation with proper systems. — **Higher cost-efficiency**: lower treatment costs (vs chemicals); biogas as renewable energy.	— Regions with food-processing pollution, e.g. China, Brazil, India. — Water-stressed areas for reuse, e.g. South Africa.
PRECISION AGRICULTURE — Software & services — Digital tools – e.g. field IoT/AI, remote sensing & satellite imagery — Hardware – e.g. robotics & automized smart equipment	**$1.6bn**	**13.5%** (vs 12.6%)	— **Yield improvements**: 15-25% higher yields (vs average farms). — **Input savings**: 20-30% in water, 25% in fertilizers, 12% in seeds, 3% in crop protection.	— Major agri-regions seeking productivity gains and resource savings. — e.g. China, South East Asia.

 **SMART IRRIGATION** — Sensors — Controllers	**$3.7bn**	**21.0%** (vs 20.9%)	— **Water conservation**: e.g. in M/East, reduces water usage by 50% (vs conventional). — **Agricultural productivity**: e.g. in China, 10%-20% increase in crop yields. — **Environmental benefits**: prevents soil erosion and nutrient runoff (reducing pollution), lowers water use, cuts energy consumption.	— Arid/semi-arid zones, e.g. Middle East, North Africa. — Major agri-areas, e.g. China, India.
 **BIOENGINEERED SOIL IMPROVEMENT** — Bio-based soil conditioners — Biochar — Bioremediation	**$0.1bn**	**14.2%** (vs 13.7%)	— **Reducing reliance on chemicals**: e.g. 15-40% chemical fertilizer replacement in China & M/East. — **Soil health & productivity enhancement**: a. Biochar: increases soil organic carbon by 10-30% and water retention capacity by 15-25%. b. Bio-based soil conditioners: increase soil aggregate stability by 30-45%. c. Bioremediation: rapidly restores productivity in moderately degraded soils.	— Regions with soil degraded by industrial pollution. — e.g. China, Middle East, South East Asia, Brazil.
 **SUSTAINABLE PACKAGING** — Recyclable and recycled content packaging — Reusable packaging systems — Bio-degradables	**$61.5bn**	**7.6%** (vs 6.5%)	— **Plastics crisis & recycling**: e.g. China and M/East produce 40%+ of global plastics, with only 10-30% single-use-plastic recycling rates (vs 60% in leading countries).	— Large, eco-conscious consumer markets. — e.g. China, Middle East (UAE, KSA).
 **GREEN PRODUCTION AND LOGISTICS** — Improved efficiency — Switch to renewable energy — Alternative refrigerants — New energy fleets — Route optimization	**$15.3bn**	**24.4%** (vs 22.5%)	— **Carbon emissions reduction**: e.g. in China & M/East food & water systems, production & logistics account for 20-30% of total GHG emissions. — **Operational efficiency**: efficient routes slash energy & costs. — **Business benefits**: green-compliant businesses can avoid penalties and boost brand value.	— Regions with large-scale food & water manufacturing and logistics demand. — e.g. China, Brazil, India, Indonesia.
 **BLOCKCHAIN TRACEABILITY** — End-to-end traceability — Real-time data sharing	**$7.3bn**	**8.9%** (vs 8.8%)	— **Food & water safety**: enables rapid identification of contaminated items and minimizes food fraud. — **Efficiency gains**: e.g. China & M/East food & water supply chains can save up to $32 billion annually.	— Global food trade hubs. — e.g. China, Brazil, Argentina.
 **FOOD AND WATER CIRCULARITY** — Food recycling & re-use — Bio-remediated water purification — Water reclamation	**$5.6bn**	**9.7%** (vs 9.5%)	— **Waste minimization**: e.g. China & M/East waste 75 million tonnes of food/yr ~8% of global total. — **Resource utilization**: e.g. in China, Shanghai captures 78% of domestic food waste for biogas. — **Environmental protection**: reduces pollution and carbon emissions.	— Regions with megacities, e.g. China, India. — Arid/semi-arid regions, e.g. Middle East, North Africa.

Notes:

1) "mkt size 2030" represents the combined market size of all tech levers in China and the Middle East (M/East) by 2030.
2) "CAGR '24-30" denotes the compound annual growth rate (CAGR) of the aggregated China and Middle East markets for each tech lever from 2024 to 2030. The % values in brackets represent the corresponding global market average CAGRs for the same tech levers and period.
3) UAE = United Arab Emirates, KSA = Kingdom of Saudi Arabia.

Sources: Grand View Research, UBS Investment Bank, BIS Research, Statista, FAO, BCG.[37]

2.2 Innovation at the crossroads: industry applications and lessons learned

This chapter presents case studies from 13 enterprises across China and the Middle East, highlighting how industries are leveraging technology to address challenges at the water-food nexus, illustrating practical approaches to innovation and implementation. The integrated application of multiple technologies is also showing promising potential. However, adoption and scale require addressing systemic barriers, including the challenges detailed below.

Fragmented innovation ecosystem

A fragmented innovation ecosystem – marked by disjointed regulations, scarce long-term funding and volatile start-up pipelines – remains a critical barrier to scaling-up green solutions. For example, overlapping mandates between agricultural and environmental agencies can complicate approvals for smart irrigation projects.

> **Driving innovation in the food and water sectors is not only an urgent need, but also our responsibility. At Organic and Beyond, we understand that expanding organic agriculture relies not only on sustainable production models, but also on building trust-based partnerships with farmers and demand-driven collaboration with enterprises. We deeply understand that true sustainability can only be achieved through a systems approach to ecosystem restoration. From soil and water stewardship to biodiversity protection and carbon reduction, we prioritize ecological balance in every project.**
>
> Zhang Xiaodong, Chairman and Chief Executive Officer, Beijing Organic and Beyond Corporation

> A fragmented innovation ecosystem of disjointed regulations, scarce long-term funding and volatile start-up pipelines creates a critical barrier to scaling-up green solutions.

> Farmers lack incentives to reduce chemical usage or adopt water-saving technologies, due to low water prices, the high cost of innovation and a lack of sanctions or incentive schemes.

Meanwhile, companies struggle to source and integrate innovations due to disconnected R&D hubs, corporate procurement channels and farmer networks.

Start-ups face a double bind: inconsistent R&D funding stifles prototyping, while market access barriers (e.g. corporates prioritizing proven vendors) limit commercialization pathways. This fragmentation forces companies to navigate a labyrinth of siloed partnerships, inflated costs and risks for technologies requiring cross-sector alignment – from precision irrigation to food and water circularity.

Furthermore, technological innovation often goes together with business model innovation — the two are mutually reinforcing. For instance, the combination of soil improvement, smart irrigation and precision farming forms the foundation of regenerative agricultural practices. While companies such as Nestlé have developed comprehensive regenerative agriculture frameworks across emerging markets, the fragmented innovation ecosystem slows adoption.

Infrastructure deficits

Even promising technologies falter without infrastructure support. For example, smart irrigation adoption in arid Middle Eastern regions is hindered by unstable electricity grids; while China's last-mile, small infield irrigation systems, developed in the 1970s, require an upgrade as they cause inefficiency and water wastage.

Such gaps reflect underinvestment in cross-sector infrastructure (e.g. renewable energy grids, digital connectivity) that underpins tech scalability. In addition, digital infrastructure and data availability remain limited. Fragmented, inconsistent and siloed data – particularly on soil health, input use or emissions – hinders evidence-based decision-making and technology deployment.

Economic misalignment

Modular technologies, such as bio-engineered soil or solar-powered desalination, require upfront investments that smallholders and SMEs cannot shoulder alone. Farmers lack incentives to reduce chemical usage or adopt water-saving technologies (e.g. drip irrigation), due to low water prices, the high cost of innovation and a lack of sanctions or incentive schemes.

Skills shortages

The transition to advanced systems requires technical expertise that is often lacking not only among farmers but across the entire food value chain. From operating internet of things (IoT)-enabled irrigation systems to managing data-driven logistics and sustainable processing technologies, many actors – including producers, processors and distributors – face significant skills gaps that hinder effective adoption and scaling-up.

The following case studies highlight that addressing the food-water nexus requires more than technology alone. Scaling-up depends on collaborative ecosystems that align value chain incentives, support early-stage innovation and adapt solutions to local agricultural and water contexts. With integrated policy frameworks, blended finance and cross-sector partnerships, emerging economies can move from isolated pilots to scalable, resilient food-water systems.

> **Water stewardship has to move from compliance to competitive advantage. What we've built in China is more than a set of efficiency measures – it's a new way of thinking about value creation in food systems. By aligning with national priorities, co-investing in infrastructure and partnering with farmers through shared models, we've embedded water efficiency into the business model itself. The result is a more resilient supply chain, stronger farmer networks and a scalable blueprint for food-water innovation in high-risk regions.**
>
> Anne Tse, Chief Executive Officer, Asia-Pacific, PepsiCo

TABLE 1 | **13 corporate food-water case studies demonstrating innovations in technology and business models**

No.	Company name	Innovations in the case study	
		Technology innovations	Business model innovations
1	Kweichou Moutai	— Food and water circularity — Green production and logistics — Sustainable packaging	— Soil-to-soil circular economy
2	Yara	— Soil improvement	— Digital farmer connect platform — Partnership on regenerative agriculture
3	Majid Al Futtaim	— Blockchain traceability	— Consumer engagement and incentives — Product promotion and accessibility — Pilot store
4	Al Dahra	— Soil improvement — Smart irrigation — Genetic improvement	— N/A
5	Mengniu Dairy	— Sustainable packaging	— N/A
6	Sunner Group	— Food and water circularity	— Waste-to-energy circular business
7	CR Beer	— Precision agriculture — Green production and logistics — Sustainable packaging — Food and water circularity	— Short-chain production model
8	China Shengmu	— Blockchain traceability — Green production and logistics — Food and water circularity	— N/A
9	Beijing Organic and Beyond	— N/A	— Upstream collaboration — Downstream market integration
10	COFCO International	— Soil improvement — Food and water circularity	— Low-carbon, nature-positive sourcing strategy — Sustainability-linked financing — Sustainable trade flows using COFCO's responsible agriculture standard
11	Bayer	— N/A	— Farmer empowerment through knowledge transfer — Localized innovation for resilient agriculture
12	PepsiCo	— N/A	— Farmer support and technical partnerships — Stable purchase agreements — Infrastructure enablement
13	Cargill	— N/A	— Reduce disaster risk through fertigation system upgrades — Enhance farmers' ability to manage market risks using financial tools — Empower farmers through training

Note: The innovations listed in this table of case studies include some of the "12 high-impact technology levers" represented in Figure 6, plus additional business model innovations.

Case study 1

Kweichou Moutai's soil-to-soil circularity model

Headquartered in Guizhou, Moutai is a leading Chinese liquor producer renowned for its traditional brewing craftsmanship and dominant market position in the premium *baijiu* (traditional Chinese liquor) sector. Leveraging the Chishui River Basin's unique ecosystem, the company is committed to full value-chain environmental stewardship, allocating 1.5% of its operating revenue to dedicated environmental stewardship. It promotes circular economy practices, achieving 100% resource utilization of its brewing by-products.

Technology and business model innovations

Food and water circularity

- **"Soil-to-soil" circular economy:** Built circular industrial parks to convert brewing by-products into organic fertilizer, feed and biogas, closing the loop with organic farming. Expanded into biotech by leveraging microbial expertise to transform brewing waste into high-value products like collagen, peptides and biodegradable materials (PHA).
- **Water circularity:** Implemented advanced denitrification and anti-scaling technologies in wastewater treatment, alongside reclaimed water reuse to enhance water recycling efficiency.

Green production and logistics

- **Achieved 100% green power** coverage in production through renewable energy procurement and applied technologies such as CO_2 heat pumps to cut energy use and emissions.

Sustainable packaging

- **Explored bio-based packaging** film, packaging (bottle) base and biodegradable ribbons. Piloted glass bottle recycling.

Others

- **Microbial conservation:** Preserved indigenous microbes and developed AI models to assess ecosystem capacity for sustainable production.

Outcomes

- **Water efficiency:** Reduced water consumption per unit of product by 7.3% compared to 2023.
- **Energy recovery:** Achieved ~90% heat recovery rate in sauce fragrance liquor distillation.
- **Carbon reduction:** Lowered CO_2 emissions per industrial output unit by 19% compared to 2020.
- **By-product utilization:** Achieved 100% resource utilization of brewing by-products.

Lessons learned

- Moutai's closed-loop system achieves full by-product utilization and water-use efficiency improvement and emissions reduction.
- However, scaling-up requires significant infrastructure investment and cross-sector collaboration.

Source: Kweichou Moutai interviews and materials review.

Case study 2

Yara's water-efficient crop nutrition solutions

Founded in 1905 to solve the emerging famine in Europe, Yara has established a unique position as the industry's only global crop nutrition company. Yara's ambition is to grow a nature-positive food future. In China, through partnerships with distributors, retailers and food companies, Yara focuses on providing innovative solutions to enhance agricultural productivity, while promoting environmental sustainability and farmers' livelihoods.

Technology innovations

Soil improvement

- **Water soluble fertilizer:** In 2023, Yara launched a water-soluble fertilizer production facility in Huaibei, Anhui Province. Tailored to the needs of Chinese agriculture, the facility supplies high-efficiency, high-quality fertilizers to improve crop productivity, particularly in improving soil heath and water use efficiency.

Business model innovations

- **Digital Farmer Connect platform (Wenwennong):** An agricultural knowledge-sharing and technology service platform to connect farmers with experts and provide digital solutions. Key features include agronomy content, online consultations and digital farming tools, such as AI-powered pest and deficiency diagnostics and weather-based farming tips.
- **Partnership on regenerative agriculture:** Yara and Ingredion (a global food and beverage ingredient provider) have partnered on regenerative maize farming in several provinces of China, applying subsurface drip irrigation, natural-based fertilizers and staged fertilizer applications. The collaboration also boosts farmer livelihoods through improved ROI and stable contracts.

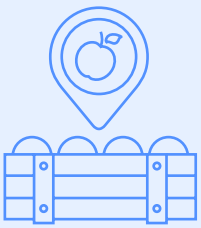
Outcomes

- **Fertigation with water-soluble fertilizer:** Improved water-use efficiency by 30-40% and crop yields by 5-20% compared to traditional methods.
- **Digital platform:** Connected 5.6 million farmers and generated over 111 million views across social media channels.
- **Regenerative agriculture:** Pilot project achieved 6-7% increase in yields, up to 60% reduction in nitrogen use and 40% lower carbon emissions.

Lessons learned

- Localized solutions, digital tools and value-chain partnerships drive scalable improvements in water-use efficiency, sustainable farming and farmer prosperity.

Source: Yara interviews and materials review.



Case study 3

Majid Al Futtaim's Carrefour "Choose Better" programme

Based in Dubai, Majid Al Futtaim is a leading regional conglomerate renowned for its pioneering role in retail and real estate. Its retail business, Carrefour, launched the "Choose Better" programme focusing on three pillars – "Better for You", "Better for the Planet" and "Better for Communities". The programme aims to support healthier lifestyles, environmental sustainability and community support.

Technology innovations

Blockchain traceability

- **Data transparency and sustainability labelling:** Carrefour – in collaboration with HowGood, a US-based independent research company with the world's largest database on product sustainability – introduced climate labels that provide sustainability ratings for products, evaluating key dimension such as emissions and social-environmental impacts. In-house, the company developed a nutrition calculator to help consumers make informed choices. The company uses blockchain to enhance product traceability.

Business model innovations

- **Consumer engagement and incentives:** To promote better choices, Carrefour highlights quality products in stores, rewards customers with extra loyalty points, hosts wellness events and partners with public and private sectors to drive awareness through in-store engagement and community outreach.
- **Product promotion and accessibility:** The company expanded healthier, sustainable private-label products while strengthening local sourcing to support nutrition, affordability and the local economy
- **Pilot store:** A COP28 flagship store showcased circular design and energy-efficient features, offering sustainability features such as reverse vending machines to recycle plastic bottles and cans, fostering sustainable habits.

Outcomes

- 8.3% sales increase on products with environmental attributes in pilot stores.

Lessons learned

- Labels and data transparency can drive consumers towards more sustainable choices.
- However, sufficient incentives, simplified metrics and consumer education are crucial to promoting long-term behaviour change.

Source: Majid Al Futtaim interviews and materials review.

Case study 4

Al Dahra's integrated strategies for arid-land agricultural development

Headquartered in Abu Dhabi, Al Dahra is a vertically integrated agri-food enterprise with global operations spanning farming, animal feed, grains and food production. The company focuses on optimizing resource efficiency in arid regions. In Egypt, through its innovative "sand-to-soil" approach, Al Dahra has transformed 16,000 hectares of desert into high-yielding agricultural land and has emerged as the largest private sector wheat producer over the past three years.

Technology innovations

Soil improvement

- **Desert reclamation:** Applied a sand-to-soil approach to convert saline desert into arable land through soil rehabilitation and no-till practices, enabling carbon sequestration in previously barren areas.
- **Improved fertility** and reduced erosion in Toshka by using Egyptian clover for cover cropping and adopting no-till farming to retain moisture and eliminate stubble burning.

Smart irrigation

- **Piloted the Dragon-Line system** in Toshka, combining drip irrigation with mechanized pivots for efficient surface watering. Adopted iCrop technology and automated pivots in East Owainat to conserve groundwater.

Genetic improvement

- **Cultivated drought-tolerant sorghum** and sesame varieties, reducing water requirements while maintaining yield, with 1,000 acres cultivated by 2024.

Outcomes

- **Food security:** Produced a diverse range of essential crops and delivered 450,000 tonnes of wheat to government silos, reducing Egypt's import bill by over $250 million since inception.
- **Water management:** Dragon-Line irrigation pilot project is expected to reduce water usage by up to 20%, with broader implementation planned for 2025.
- **Carbon sequestration:** Measurable increases in soil carbon levels across rehabilitated desert lands through regenerative practices and no-till farming methods.
- **Biodiversity enhancement:** Observed an increase in the number and variety of bird species onsite.

Source: Al Dahra interviews and materials review.

Lessons learned

- Success relies on soil rehabilitation, government partnerships for regulatory support and ecosystem collaboration to reduce risks in land reclamation and infrastructure.
- Private sector initiatives can support national agricultural goals while ensuring commercial viability.

Case study 5

Mengniu Dairy's focus on sustainable packaging

Mengniu Dairy, China's 2nd largest and the world's 9th largest dairy producer, operates under its GREEN sustainability strategy, targeting carbon peaking by 2030 and full value-chain carbon neutrality by 2050.

Technology innovations

Sustainable packaging

- **Green packaging working group:** In 2024, Mengniu established a green packaging working group, prioritizing packaging transformation through its 4R1D framework (reduce, recycle, reuse, renew, degradable). Key targets include eliminating PVC/EPS by 2025, supporting industry-wide recycling rates of 40% for paper cartons and >90% for PET bottles, reducing fossil-based plastic by 35,000 tonnes by 2030 and ensuring 20% recycled plastic content in packaging by 2035.[38]
- **Design optimization:** Uncoated paper surfaces, plant-based bottle caps, label-free packaging and material substitutions (e.g. bamboo fibre). Plant-based caps reduce carbon footprint by 19% versus conventional counterparts.
- **Data infrastructure:** A proprietary packaging material database tracks 20+ materials and 5,000+ packaging records.

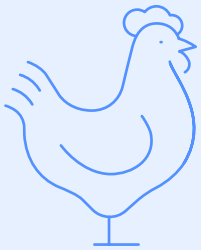
Outcomes

- **100% of outer cartons use recycled paper** and 98.5% of total packaging weight is recyclable.
- **Six products are certified carbon-neutral** under ISO and PAS standards.

Source: Mengniu Dairy interviews and materials review.

Lessons learned

- Policy-aligned targets drive circularity.
- However, material R&D costs may remain prohibitive for SMEs.



Case study 6

Sunner Group's circularity in poultry production programme

Sunner Group is the largest chicken supplier to McDonald's China. Through its waste-to-energy circular business model, it achieved annual emissions reductions of 128,500 tonnes.

Technology and business model innovations

Food and water circularity

- **Converts breeding waste into renewable products:** the waste is turned into fertilizers, feed and fuel for electricity generation.
- **Chicken manure is converted into biomass fuel** at the company's biomass power plant. The plant is the largest biomass power plant in Asia that runs on chicken manure and generates 240 million kWh annually.

Outcomes

- **Generated GHG emissions reduction equivalent to 128,500 tonnes** annually through circular practices.
- **Produced 31,933 tonnes of organic fertilizer from manure** and converted 267,000 tonnes of chicken residues into protein ingredients for the animal feed industry annually.

Source: Sunner Group interviews and materials review.

Lessons learned

- Waste-to-energy models reduce emissions.
- However, they depend on centralized infrastructure and long-term public-private partnerships.

Case study 7

CR Beer's innovations across the value chain

Listed in Hong Kong, CR Beer is a leading Chinese beer company that commands about 30% of the Chinese beer market. In 2023, the company launched an initiative to standardize barley cultivation, improve breeding quality and strengthen supply chain resilience, partnering with the National Barley and Highland Barley Industrial Technology Center Hulunbuir and Jiangsu State Farm Groups, along with suppliers including Chunlei Malt and Gansu Xiangyong. The initiative has saved $150,000 annually in wastewater treatment costs.

Technology and business model innovations

Precision agriculture

- **Uses genotype analysis of barley varieties** and integrates smart technologies such as precision fertilization, chemical control and variable-rate irrigation.

Green production and logistics

- **Optimizes processes and applies lean management** to reduce carbon emissions across the value chain.
- **Established a short-chain model:** from developing wheat seeds, to growing wheat locally and brewing in the same region, reshaping a more sustainable, efficient and community-orientated industrial ecosystem.

Sustainable packaging

- **Develops eco-friendly packaging** materials, including high-performance PET bottles (non-toxic, 100% recyclable plastic) and recyclable aluminium cans.

Food and water circularity

- **Supplied treated wastewater** to 10+ sewage treatment plants through negotiated emissions agreements; the sewage treatment plants can use organic matter from the brewery's wastewater as a carbon source, reducing chemical purchases and operational expenses and therefore cutting the treatment cost.

Outcomes

- **3000+ acres of barley** have been harvested.
- **Saved $150,000 annually** in wastewater treatment costs.
- **Reduced carbon emissions by hundreds of tonnes** per treatment plant each year.

Lessons learned

- Short-chain production cuts emissions.
- However, the company needs to integrate the fragmented landscapes of smallholders to optimize resource allocation and improve production standards to achieve greater efficiency.

Source: CR Beer interviews and materials review.

Case study 8

China Shengmu's innovation for sustainable organic milk

As China's largest organic dairy company, China Shengmu Organic Milk Limited plays a pioneering role in scaling-up certified organic dairy production. It was one of the first companies in the world to be publicly listed in the organic raw milk industry and remains the only domestic brand certified under both Chinese and EU organic standards.[39]

Technology innovations

Blockchain traceability

- **Implemented a blockchain-based monitoring system** to track herd health, feed sources and milk production.

Green production and logistics

- **Feed optimization:** Introduced low-protein diets to reduce nitrogen excretion, paired with precision feeding systems to enhance feed conversion rates.
- **Renewable energy:** Installed 2.5 MW of distributed solar photovoltaic (PV) panels across pastures, powering facilities and electrifying equipment such as feed loaders.

Food and water circularity

- **Smart metering:** Deploys real-time water monitoring systems to track usage across 18 ranches, identifying leaks and optimizing irrigation.
- **Recycling infrastructure:** Reduces groundwater extraction, by employing wastewater treatment and filtration systems that recycle water for irrigation.
- **Manure management:** Utilizes strip composting aerobic digestion to convert dairy manure into organic fertilizers, integrated with precise irrigation technology to implement a "water-fertilizer integration" system, maximizing the efficient use of water and fertilizer resources.

Outcomes

- **Emissions reduction:** Solar PV installations cut annual CO_2 emissions by 3,768 tonnes.
- **Water efficiency:** Achieved an 8% reduction in water consumption intensity from 2023 to 2024.
- **Operational impact:** Scope 1 and Scope 2 GHG emissions intensity decreased by 8.8% from 2023 to 2024.

Lessons learned

- Integrated sustainability systems (e.g. blockchain, solar, water circularity) achieve measurable emissions and water savings.
- However, scaling-up requires significant upfront investment.

Source: China Shengmu interviews and materials review.

Case study 9

Beijing Organic and Beyond Corporation's integrated model

Established in 2007, Beijing Organic and Beyond Corporation is a China-based sustainable brand engaged in the production, trade and direct-to-home delivery of certified organic products. The company operates organic farming initiatives in China and Latin America, while developing B2B partnerships to expand the adoption of organic products.

Business model innovations

- **Upstream collaboration:** risk-sharing partnerships with farmers.
  - Established long-term sustainable partnerships with farmers in Colombia and Panama to transition conventional farms to organic practices.
  - Alleviated farmers' financial risks through guaranteed minimum order commitments.
- **Downstream market integration:** demand-driven corporate alliances.
  - Focused on corporate clients with sustainability requirements (e.g. new energy, technology and finance industries) to obtain stable bulk orders.
  - Utilized co-branding activities (e.g. custom-labelled organic gift boxes) to meet corporate sustainability goals and enhance product exposure.

Outcomes

- **Production scale:** Developed a 100-hectare farm in Colombia, with 50% of the area dedicated to organic cultivation, while the rest is for living areas and rainforest reserves. The farm produces carbon-neutral products including Cavell Geisha Coffee.
- **Market reach:** Provided sustainable gifting solutions to over 20,000 corporate clients, promoting the application of organic products in the B2B sector.

Lessons learned

- Guaranteed purchase agreements and corporate co-branding effectively scale-up organic transitions.
- However long-term growth depends on stabilizing market demand and building farmer trust across different regions.

Source: Beijing Organic and Beyond interviews and materials review.

Case study 10

COFCO International's sustainable soy and corn sourcing through innovation

COFCO International is the overseas agricultural business platform for COFCO Corporation, China's largest food and agriculture company. It has operations in over 30 countries, while providing farmers around the world with direct access to the Chinese market via multiple technology and business model innovation. The company has achieved large-scale sustainable soy and corn sourcing, reducing emissions while promoting agricultural production.

Technology innovations

Soil improvement

- **Crop rotation systems:** Integrates cultivation of sustainable soy and other nitrogen-fixing crops into sugarcane plantations to improve soil health and sugar cane yield, reduce fertilizer dependency and generate additional sources of revenue.

Food and water circularity

- **Use of vinasse by-products:** Mineral-sourced, nitrogen-based fertilizers are a significant source of GHG emissions in agricultural production. To reduce the ratio of mineral nitrogen per tonne of sugarcane produced, COFCO International is using organic sources such as nitrogen from vinasse by-products of sugar processing and compost to gradually replace mineral-sourced nitrogen with organic nitrogen.

Business model innovations

- **Low-carbon, nature-positive sourcing strategy:** Uses data to prioritize sourcing of soy from regions without recent land-use change (e.g. deforestation and conversion), to enable emissions reduction and protect biodiversity in key sourcing regions.
- **Sustainability-linked financing:** Secured a $600 million Oversea-Chinese Banking Corporation (OCBC) 1.5°C loan tied to land-use emissions targets, incentivizing progress on Scope 3 reductions. The loan builds on previous multilateral sustainability-linked loans and includes interest rate discounts tied to sustainability KPIs.
- **Sustainable trade flows using COFCO's responsible agriculture standard:** Developed a certification framework aligned with the Soy Sourcing Guidelines of FEFAC (the European Feed Manufacturers' Federation) and signed a strategic cooperation framework agreement for the delivery of 1.5 million tonnes of soybean certified under this standard to Mengniu.

Outcomes

- **Land use:** 22,340 hectares under sustainable crop rotation in Brazil (directly managed).
- **Productivity:** Achieved up to 10% gains in sugar cane production over five years through rotation.
- **Emissions reductions:** In 2024, Scope 3 FLAG (Forest, Land and Agriculture) soybean and corn emissions intensity decreased by 9% and 14% respectively compared to 2023.

Lessons learned

- Strategic sourcing enabled by traceability, sustainability-linked financing and sustainable trade deals accelerates lower emissions and nature-positive production, while increasing business resilience.
- However, scaling-up hinges on incentivizing smallholder adoption of regenerative agriculture practices including minimal to no conversion of natural ecosystems.

Source: COFCO International interviews and materials review.

Case study 11

Bayer's sustainable agriculture through local empowerment and innovation

Bayer is a global enterprise with core competencies in the life science fields of healthcare and nutrition. Bayer and Silal, a leading agri-tech food company in United Arab Emirates (UAE), have established a strategic partnership to enhance sustainable agriculture in UAE, focusing on empowering local farmers and driving agricultural innovation adapted to the region's unique climatic and environmental conditions.

Business model innovations

- **Farmer empowerment through knowledge transfer:** Through Bayer's global capacity building programme (BayG.A.P.), a train-the-trainer model equips agricultural engineers and farm managers in UAE with skills in pest management, crop protection and efficient irrigation, enabling scalable knowledge transfer within Silal's network.
- **Localized innovation for resilient agriculture:** Bayer and Silal conduct targeted seed trials under both open-field conditions and low-tech and mid-tech net house and greenhouse conditions. These trials focus on identifying vegetable varieties optimized for local soil salinity, climate stress and water efficiency – ensuring that agricultural innovation is context-specific and aligned with national food security goals.

Outcomes

- **Farmer capacity:** More than 300 local growers trained through the programme.
- **Crop innovation:** Over 40 vegetable seed varieties trialled across six categories of products, including tomatoes, cucumbers etc.

Source: Bayer interviews and materials review.

Lessons learned

- Partnership with local entities is essential to bridge knowledge gaps and ensure that innovation is effectively adapted to local conditions.
- Trial findings offer insights for global regions facing climate challenges, especially rising wet-bulb temperatures.

Case study 12

PepsiCo's water-use efficiency models in China

PepsiCo is a global leader in convenient food and beverages, with 500+ brands of products sold in 200+ countries and territories worldwide. In response to water scarcity in high-risk areas, such as Inner Mongolia and northern potato-growing regions of China, PepsiCo has developed precision agriculture programmes that improve water efficiency while supporting farmer livelihoods. These efforts align with local water conservation mandates and reflect PepsiCo's global commitment to sustainable sourcing.

Business model innovations

- **Farmer support and technical partnerships:** PepsiCo collaborates closely with local farmers, offering high-quality potato varieties, agronomic expertise and training in water-saving techniques such as high-efficiency irrigation and soil moisture monitoring.
- **Stable purchase agreements:** To reduce farmers' exposure to market volatility, PepsiCo enters into pre-agreed contracts that guarantee a fixed price per tonne of produce, creating a stable income stream and encouraging sustainable farming practices.
- **Infrastructure enablement:** PepsiCo co-finances farm modernization efforts that enhance productivity and resource efficiency, with a focus on scalable technologies adaptable to local contexts.

Outcomes

- **Achieved a 15% improvement in water-use efficiency** at high water-risk locations in China, compared to the 2015 baseline.

Source: PepsiCo interviews and materials review.

Lessons learned

- Shared-value models can drive water-efficient agriculture through collaboration and incentives.
- However, high infrastructure costs and limited scalability in smallholder systems remain key barriers.

Case study 13

Cargill's risk management and fertigation system upgrades

Cargill is a leading multinational corporation focused on agriculture and food. Leveraging its global agricultural supply chain, Cargill promotes the transition of the agri-food industry towards greener and more sustainable practices. In collaboration with the World Food Programme, Cargill implemented an agricultural risk management project in Songyuan, in China's Jilin province. Through risk management, fertigation system upgrades and farmer training, the project aimed to enhance farmers' resilience to climate and market risks while conserving water and reducing fertilizer use.

Business model innovations

- **Reduce disaster risk through fertigation system upgrades:** Supported smallholder farmers in adopting fertigation technology through infrastructure development. Demonstrated the benefits of fertigation in saving water, reducing fertilizer use and increasing yields.
- **Enhance farmers' ability to manage market risks using financial tools:** Piloted the "insurance + futures" product to help farmers hedge against price volatility and weather risk.
- **Empower farmers through training:** Conducted sessions on agricultural risk management, financial literacy and sustainable agricultural technologies.

Outcomes

- **Resource conservation:** The fertigation system was implemented across 2,175 hectares, benefiting over 1,000 corn farming households. It achieved a 30.7% reduction in water use, a 24.2% reduction in fertilizer use and a 10% increase in crop yield in 2023.
- **Improved farmer livelihoods:** From 2022-24, the "futures + insurance" income protection scheme paid out over 1.5 million RMB to participating corn farmers. As a result of the scheme's demonstration effect, the township's insurance coverage increased from 45% in 2022 to 85% in 2024.
- **Farmer training:** Three in-person training sessions were held, reaching over 500 participants.

Source: Cargill materials review.

Lessons learned

- Farmer education and acceptance of modern agriculture and risk management knowledge are critical for the successful promotion of sustainable agricultural practices.

3

Five-step blueprint for green food-water transformation

The success of technologies hinges on supportive ecosystems to transform isolated innovations into systemic resilience.

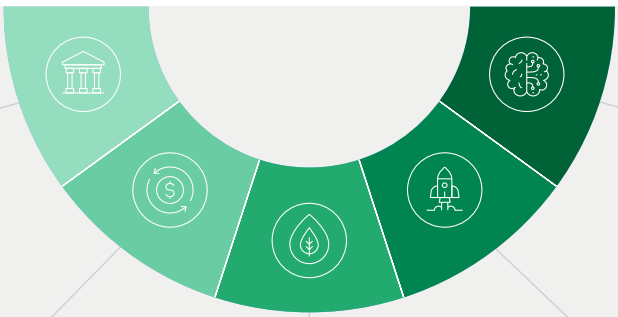
Success lies in the ability to dismantle silos, align incentives and embed green food-water technologies across systems.

Systemic challenges in food and water systems demand integrated solutions that transcend traditional boundaries. Success lies in the ability to dismantle silos, align incentives and embed green food-water technologies across systems. Achieving this requires robust ecosystems that enable effective governance, mobilize finance, accelerate innovation, de-risk scale-up efforts and strengthen capacity and acceptance across the value chain.

This in turn requires coordinated action from governments, industries, farmers and communities.

The following blueprint outlines five enabling actions to achieve this interconnected transformation, ensuring scalability and inclusive access in the pursuit of green food-water systems (see Figure 7).

FIGURE 7 **Five-step blueprint for green food-water transformation**



Build a holistic policy framework	Forge a robust financial ecosystem	Cultivate food-water-centric strategic clusters	Leverage private sector to scale-up food-water technologies	Upskill value chain and bolster consumer acceptance
— Unified governance that sets clear national goals while incorporating local feedback. — Prioritized inter-ministerial cohesion. — Empowered local implementation. — Targeted technological support through dedicated funding and regulatory incentives.	— Blended capital that leverages public grants with catalytic philanthropic and longer-term private investment. — Technology-powered finance that embeds AI, IoT and remote sensing into financial tools. — Risk sharing that aligns incentives through partnerships. — Managing volatility through a comprehensive insurance system.	— Physical proximity that accelerates technology iteration. — Shared incentives that link environmental outcomes to revenue. — Working across sectors and collaborating to scale-up innovation.	— Phased innovation that employs iterative, context-specific adoption to build stakeholder trust and mitigate risks. — Ecosystem alignment to consolidate resources and policy support to reduce fragmentation. — Corporate risk absorption where industry leaders underwrite upfront costs and validate ROI, aligning profitability with environmental impact.	— Certification frameworks to build consumer trust. — Tech-driven transparency to validate sustainability claims. — Collaborative data ecosystems to optimize resource use. — Contextual training and co-design to ensure on-ground adoption.

Enabling action #1
Build a holistic policy framework

A cohesive policy framework is essential to align national priorities, regional adaptations and technological innovations in the transition towards sustainable agriculture and water systems.

Drawing on lessons from China and the UAE, such frameworks can balance centralized vision with localized flexibility while targeting high-impact technologies.

China: Integration of national strategy and local agility

China has driven measurable progress in green food and water transformation through a structured approach combining national strategy, regulations and targeted innovation. By embedding long-term hydrological resilience into national strategies, the country has prioritized innovations such as seed breeding, precision agriculture, smart irrigation and blockchain traceability.

While retaining separate ministries, China has bridged institutional divides through cross-agency task forces embedded in its Five-Year Plan to advance agricultural and rural modernization (2021–2025). The plan aims to build and upgrade 70 million hectares of high-standard farmland with efficient water-saving systems by 2025.[40] Local governments tailor implementation, for example green farming in grain regions and smart agriculture in economic crop zones. Meanwhile, national strategic investments focus on:

- **Tech breakthroughs** – more than 95% of crop varieties are independently cultivated,[41] while the self-sufficiency ratio of key livestock and poultry breeds exceeds 75%.[42]
- **Digital transformation** – 2.2 million agricultural machines nationwide have been equipped with Beidou satellite terminals for precision farming.[43]
- **Value-chain cultivation** – $2.76 trillion of value has been added to agriculture and related industries in 2023, through building logistics networks, promoting refining and processing, and ecosystem integration.[44]

UAE: Unified vision for cross-sector innovation

> UAE's Ministry of Climate Change and Environment consolidates food, water and environmental mandates under a single ministry, enabling cohesive strategies.

In one of the world's most water-stressed regions, UAE has adopted a policy approach that integrates immediate needs with forward-looking strategies, leveraging technologies such as advanced desalination and AI-driven irrigation. For example, UAE's Ministry of Climate Change and Environment consolidates food, water and environmental mandates under a single ministry, enabling cohesive strategies, including its *National Food Security Strategy 2051*, which prioritize solar-powered desalination and drought-resistant crops.

This integrated governance model eliminates bureaucratic fragmentation, accelerates decision-making and aligns funding for technologies. Local authorities adapt strategies to arid conditions. For example, Dubai's initiatives on agricultural sustainability promote hydroponics and desert agriculture, while Abu Dhabi focuses on water-efficient aquaculture, enforced by agencies such as the Abu Dhabi Agriculture and Food Safety Authority. Strategic support includes financial incentives (e.g. R&D grants, long-term land leases in free trade zones) and streamlined approvals for agri-tech projects, accelerating innovations such as smart irrigation and sustainable supply chains.

> Effective policy design hinges on transforming fragmented governance into an "innovation highway" – a seamless alignment of ministries overseeing food, water and environmental priorities.

Keys to success

Effective policy design hinges on transforming fragmented governance into an "innovation highway" – a seamless alignment of ministries overseeing food, water and environmental priorities. China, while retaining separate ministries, bridges institutional silos through cross-agency task forces tied to national priorities. UAE reflects this by consolidating these mandates under a single ministry, enabling agile scaling-up of food-water technologies without bureaucratic lag.

Success requires the following:

- **Unified governance** – to embed water valuation with clear national goals while incorporating local feedback, as seen in China's national strategy that balances water conservation targets with provincial adaptations.
- **Prioritized inter-ministerial cooperation** – to break down institutional silos and foster coordinated action, as illustrated by China's cross-agency task force and UAE's consolidation of mandates under a single ministry.
- **Empowered local implementation** – as reflected in UAE's region-specific strategies (e.g. Dubai's hydroponics focus, Abu Dhabi's strategic support for aquaculture), which aligns localized practices with federal objectives.
- **Targeted technological support** – through dedicated funding and regulatory incentives, such as China's seed innovation or UAE's piloting of solar desalination, ensuring that innovations achieve tangible impact.

By prioritizing cooperation among ministries over siloed mandates, policy-makers can ensure strategic vision becomes on-the-ground execution, accelerating sustainable practices across diverse agricultural systems.

Enabling action #2

Forge a robust financial ecosystem

Scaling-up green food-water innovations hinges on financial ecosystems that de-risk adoption, incentivize R&D and align stakeholders. Government funding remains foundational – often addressing 20-30%[45] of total investment needs for green food-water systems. Finding the remaining balance demands proactive participation from financial institutions, philanthropy and the private sector. Examples from China and the Middle East illustrate how strategic financing can accelerate the shift towards more resilient systems.

China's Ministry of Agriculture and Rural Affairs allocated

$700 million

in 2023 for innovations such as smart irrigation equipment and drought-resilient crops.

China develops blended finance tools from government-led funding to risk-mitigation measures

China's approach to advancing water-efficient agricultural practices integrates government-led funding mechanisms, institutional financial tools and risk-mitigation frameworks. Public initiatives have prioritized R&D investments in water-saving technologies, with the Ministry of Agriculture and Rural Affairs allocating $700 million[46] in 2023 for innovations including smart irrigation equipment and drought-resilient crops. State-guided funds, such as the Seed Fund, facilitated broader adoption by channelling $470 million into 41 firms in 2023, which subsequently attracted $2.7 billion in private-sector capital.[47] To support on-farm implementation, subsidies covering 30-40% of equipment costs[48] and preferential loans were extended to farmers adopting smart irrigation.

Chinese financial institutions have introduced tech-driven solutions to address rural financing challenges. The Agricultural Development Bank's $370 billion of green loans (as of 2024) have helped save 500 million tonnes of water.[49] Satellite-based risk assessment tools have improved credit accessibility for smallholders, while partnerships with agribusinesses – such as Wens Foodstuff's contract farming model – have provided income stability for over 43,000[50] households through guaranteed pricing and technical support.

Middle East integrates sovereign wealth funds and private capital

The Middle East offers parallel lessons in forging a robust financial ecosystem. For example, Saudi Arabia's NEOM project integrates sovereign wealth funds and private capital to drive innovation across sectors, including sustainable food and water systems. Beyond this flagship project, broader agricultural development initiatives led by the Kingdom's Agricultural Development Fund provide interest-free loans to support farmers in adopting modern and water-efficient practices.

In UAE, agri-tech incentive programmes blend financial and non-financial support with company partnerships and philanthropic investment to develop next generation agriculture solutions in arid and desert climates.

Keys to success

The approach of China and the Middle East to mobilizing capital for water-efficient agriculture reflects how coordinated financial mechanisms can drive technology adoption. Central to this model is the integration of three principles:

- **Blended capital:** by combining public grants with catalytic philanthropic and longer-term private investment, stakeholders can scale-up high-impact technologies.
- **Technology-powered finance:** embedding AI, IoT and remote sensing into financial tools reduces risks for lenders while expanding access to underserved smallholders.
- **Risk-sharing partnerships:** aligning incentives through partnerships has proved critical in stabilizing incomes and accelerating adoption.
- **Managing volatility:** addressing volatility in agricultural markets requires shared approaches to risk management. A comprehensive insurance system is essential for agricultural commodities, as it enables stakeholders to hedge against water scarcity and price volatility.

Other regions can adapt these elements to mobilize capital more effectively and mainstream sustainable practices in green food and water systems.

Enabling action #3

Cultivate food-water-centric strategic clusters

Food-water-centric clusters are concentrated hubs of innovators, industries, public and value-chain stakeholders that are pivotal to water-smart agriculture and resilient water systems.

Strategic food-water-centric clusters are concentrated hubs of innovators, industries, public actors and value-chain stakeholders. They are pivotal in scaling-up water-smart agriculture and resilient water systems. By co-locating stakeholders, these clusters enable rapid prototyping of water-saving technologies, shared infrastructure for circular water use, and trust-building partnerships to tackle shared challenges such as aquifer depletion and drought resilience.

Government-led clusters: food-water innovation at scale

Public-sector leadership can integrate cross-sector resources to de-risk food-water innovation. For example, China's Changshu Agri-Tech Park unites research institutes, agri-tech firms and farms to deploy smart water-saving irrigation across 104 hectares and a seed processing facility with an annual capacity of 10 million kilogrammes.[51]

Meanwhile Saudi Arabia's NEOM Agri-Food Tech Accelerator connects innovators with corporates and investors.

Both models prioritize proximity for real-time feedback and shared incentives such as market access to align environmental and economic goals.

Private-sector clusters: sustainable stewardship in value chains

Corporations are increasingly adopting cluster models to align suppliers with sustainability targets, leveraging scale to drive systemic change. For example, McDonald's China Supply Chain Smart Industrial Park co-locates four partners, including Tyson Food, Grupo Bimbo, XH Supply Chain and Zidan Packaging. The park features 25,000 square metres of high-standard automated warehousing, enhancing logistical efficiency by 90% and exploring green practices. For example, Zidan Packaging has reduced sludge moisture content to below 80% by adopting low-temperature heat pump drying technology, cutting annual sludge production by 60% and reducing waste generation. This integration turns fragmented suppliers into a unified green value chain.[52]

The example of Qingshan Village in China also showcases how multi-stakeholder collaboration — involving NGOs, companies, farmers, villagers, local government and others — can restore watershed functions and build inclusive rural economies (see Box 3).

BOX 3 | **Multi-stakeholder collaboration integrates sustainable water management with community-led conservation and local livelihoods[53]**

Project context

In Hangzhou, China, Qingshan Village's reservoir became undrinkable, after decades of chemical-dependent bamboo farming caused nitrogen and phosphorus pollution. Government programmes focused more on urban and industrial pollution, leaving rural issues unaddressed.

Collaborative solution: a multi-stakeholder approach

- **NGO and corporate philanthropy leadership:** The Nature Conservancy, Alibaba Foundation and Wanxiang Trust launched a water fund to manage ~33 hectares of bamboo forest entrusted by farmers. The management plan prohibited chemical use, promoted eco-friendly practices and developed local green industries such as eco-agriculture, handicrafts, nature education and ecological experiences.
- **Farmer engagement:** Farmers earned income via eco-payments and profit-sharing, while receiving training on sustainable practices and reducing reliance on fertilizers.
- **Tourism industry partnership:** Homestays and hotels leveraged the restored ecosystem, donating approximately 15% of earnings to the fund for watershed protection.
- **Government support:** The local government increased funding for ecological conservation and restoration in Qingshan Village, with over $1.4 million invested since 2019.

Outcomes

- **Economic growth:** Farmers earned 20% higher income compared to when they managed the land by themselves. Over 50 homestays joined the initiative and each increased their annual income by 10,000-20,000 RMB (~$1,400-2,800).
- **Water quality and ecosystem recovery:** The reservoir was upgraded from undrinkable (grade IV) to drinkable (grade I) within five years. Biodiversity increased, with bird and mammal species returning to the area.
- **Scalability:** Building on the Qingshan Village model, The Nature Conservancy, Alibaba Foundation and Mingsheng Tonghui Charity Foundation together launched the Qiandao Lake Water Fund with an initial investment of RMB 10 million (10 times the value of Qingshan) to expand the project from reservoir-scale to basin-wide water quality improvement. The project not only establishes an ecological benefit-sharing mechanism among stakeholders, it also leverages Alibaba's e-commerce platform to expand market access for sustainably produced local agricultural products, such as rice and tea. Recognition and demand from end-consumers further incentivize farmers to adopt sustainable farming practices. As a result, the initiative has improved water quality, while enhancing the quality, productivity and market value of local agricultural production.

Keys to success

Building effective, scalable food-water-centric clusters to accelerate innovation requires three key critical pillars:

- **Physical proximity:** to accelerate technology iteration and enable clusters to thrive.
- **Shared incentives:** to link environmental outcomes with revenues.
- **Working across sectors:** to enable clusters to embed resilience into rural economies and water systems, proving that collaboration is key to scaling-up solutions in water-scarce regions.

Enabling action #4

Leverage private sector to scale-up food-water technology

The private sector's capacity to bridge innovation and scalability is critical in accelerating the adoption of sustainable food-water technologies.

The private sector's capacity to bridge innovation and scalability is critical in accelerating the adoption of sustainable food-water technologies. While start-ups drive cutting-edge solutions, they often face systemic barriers including high upfront costs, fragmented ecosystems and low trust among smallholders. For instance, PepsiCo's partnership with Mimosa Tech in Viet Nam's Central Highlands has shown initial success, deploying advanced water probes ($1,000/unit) to optimize water use for around 300 growers.[55] However, scaling-up required addressing deeper challenges, including unsustainable subsidy models and farmer scepticism toward data-driven practices.

Public-private partnerships can amplify impact by aligning stakeholders, sharing risks and securing policy incentives. Collaborative platforms such as the World Economic Forum's Food Innovation Hubs (see Box 4) enable corporates and governments to source innovations, validate ROI and embed solutions across value chains – turning isolated pilots into sector-wide transformation.

BOX 4 **World Economic Forum's Food Innovation Hubs**

Overview

The Forum's Food Innovation Hubs leverage multi-stakeholder and market-based partnerships to scale-up fit-for-purpose innovations.

- **Leadership:** the hubs are catalysed and co-led by the World Economic Forum alongside several governments, private sector organizations, philanthropies, farmers, civil society leaders and innovators.
- **Core approach:** the hubs create multi-stakeholder partnerships to accelerate adoption of technologies and practices tailored to local needs to unlock investment at scale; they also leverage a formidable global network of practitioners, building a trusted ecosystem for exchange and driving cutting-edge insights on global frontiers in food innovation.
- **Global footprint:** the initiative operates several country/regional hubs in Colombia, India, Viet Nam, Europe, Africa and UAE, connected by a global Food Innovators Network.

UAE Food Innovation Hub: catalysing solutions for arid-climate futures

Background

Launched at COP28, the Food Innovation Hub UAE drives scalable solutions for arid-climate food security and circular supply chains. The hub has three strategic priorities that seek to expand beyond food production to capture high-impact opportunities: 1) Localization and alternatives, 2) Arid climate food production and 3) Supply chain integrity and circularity.

Partnerships and ecosystem support

The hub fosters strong partnerships to empower innovators at every stage, from sourcing and incubation to scaling-up. Building on catalytic support from philanthropies, the hub is governed by a national council that brings together public, private and academic institutions and is chaired by the Minister of Climate Change and Environment. Since its incubation, the hub has convened a robust innovation ecosystem with several partnerships:

- **Industry:** Silal, Pure Harvest, Bustanica, Al Dahra, Majjid Al Futtaim, Abu Dhabi National Hotels.
- **Academia/research:** Khalifa University, International Center for Biosaline Agriculture, SOMA Mater.
- **Funding and leadership:** Ministry of Environment and Climate Change, UAE, complemented by the Mohammed Bin Rashid Al Maktoum Global Initiatives foundation and incubated by the World Economic Forum.

Key outcomes

- **Access programme:** Provides mentorship, incubation and UAE market access for innovators.
- **Producers' collective:** Unites UAE agri-producers to align initiatives with national food security goals, representing over 1 billion Dirhams (~$270 million) in investments and a significant share of local retail supply.

> **Emerging markets such as the Middle East are test-beds for powerful innovations across the food-water nexus. Their progress in technologies like climate-resilient agriculture offers valuable lessons for the world. In the MENA region, CGIAR is creating holistic, locally-tailored models that promote water-efficient technologies, improved land use practices and regional cooperation, restoring degraded lands and improving agricultural productivity, as well as introducing circular bioeconomy solutions for the urban environments. To accelerate impact, we need collaborative platforms like the Food Innovation Hubs that can help connect stakeholders, share knowledge and scale context-appropriate innovation solutions.**
>
> Ismahane Elouafi, Executive Managing Director, CGIAR

Keys to success

The scalability of food-water technologies hinges on three interdependent principles:

1. **Phased innovation,** which employs iterative, context-specific adoption to build stakeholder trust and mitigate risks.
2. **Ecosystem alignment,** where public-private partnerships consolidate resources and policy support to reduce fragmentation, ensuring solutions meet both farmer needs and corporate sustainability targets.
3. **Corporate risk absorption,** requiring industry leaders to underwrite upfront costs and validate ROI, thereby aligning profitability with environmental impact.

By prioritizing these principles, the private sector can convert systemic barriers into scalable opportunities, advancing solutions that harmonize agricultural productivity with water resilience.

Enabling action #5

Upskill value chain and bolster consumer acceptance

> Affordability, transparency and accessibility are interdependent pillars that foster trust, provide localized empowerment and shape market adoption.

The transition to green food-water systems hinges not only on technological innovation but also on aligning producer's incentives, capabilities across the value chain and consumer trust. Affordability, transparency and accessibility are interdependent pillars that foster trust, provide localized empowerment and shape market adoption.

Certification frameworks build consumer trust

China has built a comprehensive food certification system to enhance public confidence and acceptance, encompassing green food certification, organic food certification and a geographical certification (see Figure 8). Certification labels feature unique information codes that allow consumers to verify the products' and company's authenticity. While certifications enhance consumer trust and market penetration, ensuring income improvements for producers requires complementary measures such as cooperative bargaining, cost-sharing partnerships and premium market access.

For example, Alibaba's Hema Fresh offers organic vegetables at competitive prices by optimizing logistics and bulk purchasing, expanding its organic SKUs to 1,800+ products and attracting 10 million+ organic consumers.[56] In Inner Mongolia's Ulan Buh Desert, where climatic conditions produce sweeter and starchier organic pumpkins, farmers previously struggled with market access. Through contract farming, Hema Fresh guaranteed off-take, boosting producer confidence and enabling scale-up —with planting scale rising from 400,000 pumpkins in 2022 to over 2 million in 2023.[57]

FIGURE 8 **China's food certification system**

Certification name	Certification bodies	Requirements and features
Green Food Certification	— China Green Food Development Centre	— Limited use of synthetic inputs — Eco-friendly production environment
Organic Food Certification	— Third party agencies accredited by National Certification and Accreditation Administration	— No synthetic chemicals (e.g. fertilizers, pesticides, additives) — Strict environmental and sustainability standards
Geographical Indication Agricultural Products	— Ministry of Agricultural and Rural Affairs	— Product linked to a specific region — Reflects local, natural and cultural factors

Tech-driven value chain transparency validates sustainability claims

Aligning farmers' capabilities with consumer expectations is critical to closing the sustainability loop. As consumers increasingly demand transparency – such as ethically sourced ingredients or verified carbon footprints – the industry needs to adopt practices that meet these standards to secure market access and premium pricing.

In the Middle East, Majid Al Futtaim employs blockchain to track products. Consumers can scan QR codes to view production processes, halal and hygiene certifications, dates of production and nutritional information, providing them instant access to food supply chain data from farm to store shelf.

Collaborative data ecosystems optimize resource use

Scaling-up alignment across water-food systems requires robust data ecosystems where governments and industry co-create non-competitive platforms to aggregate anonymized farm data (e.g. soil health, water use) and consumer trends. Open-access hubs – such as regional agri-water repositories tracking climate patterns and certification benchmarks – paired with interoperable metrics for water efficiency enable cross-sector collaboration.

For arid regions, ecosystems such as the Forum's Food Innovation Hubs demonstrate this approach and their potential to provide global analytics access and advanced data analytics capacity. Such ecosystems empower stakeholders to co-design solutions – from drought-resilient farming to eco-label verification – transforming fragmented innovations into systemic resilience and linking farmer livelihoods with sustainable consumer demand.

Contextual training and co-design empower farmers and ensure tech adoption

Localized onsite training brings the latest research and knowledge to rural areas to ensure new technologies and methods are a good fit for the region's farmers. Furthermore, co-design with farmers is fundamental to ensure the successful adoption of technology.[58] Private companies excel at tailoring training to local agro-climatic conditions and value chain needs. For example, through its partnership with Silal in UAE, Bayer has implemented a train-the-trainer programme to empower local farmers with knowledge and best practices adapted to desert farming conditions and to identify crop varieties best suited to local environments.

The Cultivator Programme, developed by Tencent and China's Ministry of Agriculture and Rural Affairs (MARA), offers 200+ online courses covering policies, methodologies, tools and practical training. With ~$70 million of investment, the programme provides training to over 1.8 million rural farmers, entrepreneurs and officials, and features an online marketplace to sell agricultural products, bridging the gap between education and income generation.[59]

In addition, CGIAR – a global network of food security research centres – is actively working to enhance the capability of countries in the Middle East and North Africa to develop and use drought monitoring and early warning systems to support early responses to drought-related risks. CGIAR is also strengthening the capacity of agricultural managers to provide drought-affected communities with guidance and training in mitigation solutions, including resilient agricultural practices.[60]

Keys to success

Aligning producers and consumers, as well as building value-chain capabilities, hinges on four interdependent pillars:

- **Certification frameworks** to build consumer trust.
- **Tech-driven value chain transparency** to validate sustainability and health claims.
- **Collaborative data ecosystems** to optimize resource use.
- **Contextual training and co-design** to empower farmers and ensure tech adoption.

By embedding these principles, stakeholders can create systemic resilience, where the value chain adopts green food-water practices linked to premium markets and consumers access verified sustainable products – turning environmental stewardship into shared economic value.

Call to action

Global food-water transformation demands expanded partnerships and governance to turn regional breakthroughs into global shared abundance.

"There is no food security without water security." This truth, voiced by a top UN official more than a decade ago, demands urgent, sustained leadership and collective action that moves from rhetoric to investment.

China and the Middle East are showing what is possible. Through integrating policy, finance and innovation, they are beginning to align food and water agendas, scaling-up water smart agriculture and prioritizing accessibility. But this is only the start. Now, these regions need to deepen their own collaboration and pioneer seamless governance models and cooperation mechanisms – with the aim of addressing unresolved gaps in infrastructure, fragmented ecosystems and economic alignment, and embedding water as central pillar of food systems transformation.

Globally, stakeholders need to build on the leadership highlighted in this report, mobilizing capital, forging collaborative ecosystems, and building alliances that connect water innovation with food systems outcomes.

The time for fragmented efforts is over. The urgency shown by China and the Middle East has the potential to ignite a movement where no region acts alone. By building bridges between their progress and the world's needs, countries and regions can scale-up what works, adapt what falters and ensure that breakthroughs in one region become solutions for all.

Now is the time to act. The blueprint exists. Let these regions inspire action towards a global movement – where investing in food systems means investing in water, transforming scarcity into shared abundance.

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