



Standing Committee for Economic and Commercial Cooperation of the
Organization of Islamic Cooperation (COMCEC)

Promoting a Climate-Resilient Agriculture Sector against Climate Change in OIC Member Countries

Lessons Learnt from the Selected Case Studies

COMCEC Coordination Office · 2026



Structure of the Presentation

01



Country Case Studies (Chapter III)

Uzbekistan · Morocco · Türkiye · the Netherlands · Saudi Arabia · Australia — climate risks, institutions, policies and incentives, lessons for OIC Member Countries

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Cross-Case Lessons

What the six experiences have in common — and where they diverge

03



Member Country Survey

41 experts · 28 items · four dimensions — where capacity is stronger, where it is weakest, and the central message

04



Cluster-Specific Recommendations (Chapter IV, 4.1–4.3)

Three performance clusters and tailored recommendations for each

05



Closing Messages

What the cases, the survey and the cluster analysis tell us

Why These Six Cases?

No one-size-fits-all: cases were chosen to span climate exposure, water availability, institutional capacity and farm structure

Uzbekistan (Field Visit)

Transforming irrigation agriculture under growing water stress and legacy environmental constraints

Morocco (Field Visit)

Adaptation in semi-arid farming systems vulnerable to drought and rainfall variability

Türkiye (Desk Research)

Large agricultural potential, growing vulnerability and increasingly sophisticated institutional responses

Saudi Arabia (Desk Research)

System change under extreme water scarcity through technology investment and state coordination

Netherlands (Comparative Case Studies)

Non-OIC reference: long-term planning, water governance, research integration and innovation

Australia (Comparative Case Studies)

Non-OIC reference: risk-based drought policy, farm-level financial instruments, resilience-first agriculture

Each case follows a common structure — background, climate risk analysis, institutional framework and key actors, policies, strategies and incentive mechanisms, concluding assessment. Recurring themes: irrigation efficiency, climate-smart agriculture, digital technology, agricultural insurance, early-warning systems and institutional coordination.

Uzbekistan – Field Visit (1/3)

Transforming an irrigation-dependent system under growing water stress and legacy environmental constraints

0.63 → 0.73

irrigation efficiency target of Water Concept 2030; water-saving tech on 2.0 m ha

Agricultural and climate profile Table 26

Agriculture, value added (% of GDP)	18.33	WDI 2024
Agricultural employment (% of total)	25.65	WDI / ILO 2024
Arable land (% of land area)	9.14	WDI / FAO 2023
Renewable freshwater per capita (m³/yr)	1,398.7*	AQUASTAT 2022
Agricultural water withdrawal (% of total)	92.1	AQUASTAT 2022
Area equipped for irrigation (% cultivated)	97.0	AQUASTAT 2022
Water stress level	Extremely high (>80%)	WRI Aqueduct 2023
ND-GAIN adaptation score (rank / 182)	53.5 (67th)	ND-GAIN 2023



Background

- Cotton specialisation from the late 1950s pushed the irrigated area from ≈1.85 m ha before WWII to ≈4.28 m ha by 1994; Uzbekistan supplied 61% of Soviet cotton and was the world's 4th producer and 3rd exporter by the mid-1990s
- The diversion of the Amu Darya and Syr Darya drove the **shrinking of the Aral Sea** — one of the most serious ecological problems of the modern era
- Today ≈4.2 m ha are equipped for irrigation; 79% of on-farm canals are unlined earthen channels, network efficiency is ≈63% (75–78% in post-1960 lined systems) and **almost 30% of irrigation water is lost before reaching the farm**
- Pumped irrigation used 7.15 bn kWh in 2023; ≈94% of pump stations operate beyond their service life, so outages translate directly into lower yields
- Reforms now aim to reduce cotton–wheat monoculture and diversify towards horticulture and higher-value crops

Why this case: how irrigation agriculture can be changed in the context of growing water stress and structural environmental constraints — informed by field visits and consultations with ministries and stakeholders.

Uzbekistan – Field Visit (2/3)

Transforming an irrigation-dependent system under growing water stress and legacy environmental constraints



Climate risk analysis

Temperature increase and drought

Central Asia is projected to warm faster than the global average; heat stress raises evapotranspiration and irrigation demand, summer-concentrated crops face yield losses and heatwaves become longer and more frequent.

Irrigation dependency and water scarcity

Over 92% of withdrawals go to agriculture and supply depends on upstream hydropolitics. The World Bank projects basin water availability down 30–40% by mid-century while irrigation demand rises ≈25%.

Smallholder vulnerability

Larger farms access finance, technology and irrigation; small dehkan farms do not. Even with subsidies, drip installation costs remain too high — water-saving technologies are viable only above a farm-size threshold.

Aral Sea legacy, salinity and environmental stress

Dust and salt storms from the exposed Aralkum seabed degrade land and pastures; soil salinisation affects ≈1.94 m ha and rising evaporation is likely to worsen it. Rehabilitation is costly.



Institutional framework and key actors

Ministry of Agriculture

Agricultural policy, crop diversification, sectoral reform; lead on the Agriculture Development Strategy 2020–2030; extension and farm modernisation

Ministry of Water Resources

Irrigation infrastructure and canal networks, water allocation, Water Concept 2030; expanding automated monitoring under the "Smart Water" initiative

National Committee on Ecology and Climate Change

Created by Decree PD-217 (Nov 2025), reporting directly to the President; environmental protection, Yashil Makon afforestation, desertification; steward of NDC 3.0 (–50% GHG per unit of GDP by 2035 vs 2010; carbon neutrality by 2055)

International financial institutions

World Bank, ADB and AIIB finance irrigation modernisation, adaptation, infrastructure rehabilitation and the green transition

Uzbekistan – Field Visit (3/3)

Transforming an irrigation-dependent system under growing water stress and legacy environmental constraints

Policies, strategies and incentive mechanisms

Agriculture Development Strategy 2020–2030 — modernisation, diversification, food security, export competitiveness and sustainability; a gradual shift from a cotton-dominated, centrally managed system

Water Concept 2030 (Decree UP-6024, 2020) — irrigation efficiency 0.63 → 0.73; 560,000 ha lifted out of low water supply; water-saving technology on 2.0 m ha incl. 500,000 ha drip; salinised land 1.935 → 1.722 m ha; "Smart Water" at up to 1,000 facilities

Water-Saving Technology Programme — subsidised drip, sprinkler and laser land-levelling; domestic equipment production growing — but uptake concentrated in larger farms

Cotton and wheat reform — diversification to fruit, vegetables and horticulture; an adaptation strategy as much as an economic one

Climate-smart agriculture — drought-resistant crops, water, land and soil management; extension and technical assistance scaled up

Digital agriculture — remote sensing, satellite monitoring, digital cadastre and precision tools for water allocation and farm decisions

Green Economy Transition Strategy 2019–2030 — renewable energy, sustainable land management and stronger environmental governance as the overall frame

Concluding assessment

Progress

- Rapid irrigation modernisation, wider water-saving technology and take-off of diversification
- Water Concept 2030 and agricultural reforms give an increasingly coherent adaptation framework

Constraints

- Water remains the binding constraint: ageing network, high losses, salinity, uneven producer capacity
- Adoption is uneven: larger farms benefit most; smaller producers face finance and technical constraints
- Transboundary dependence adds uncertainty domestic reform cannot remove

LESSONS LEARNT

- Institutional reform — irrigation modernisation, digital water management, diversification — is the key enabler of adaptation under extreme pressure
- Technology-based adaptation has limits while pressures on water persist
- The deeper issue is the coexistence of irrigation dependence, declining water, transboundary vulnerability and the legacy of past production systems

Morocco – Field Visit (1/3)

Adaptation in a semi-arid dual system: irrigated perimeters and rain-fed smallholders

Agricultural and climate profile Table 27

Agriculture, value added (% of GDP)	10.57	WDI 2024
Agricultural employment (% of total)	28.27	WDI / ILO 2024
Arable land (% of land area)	15.40	WDI / FAO 2023
Renewable freshwater per capita (m³/yr)	776.9	AQUASTAT 2022
Agricultural water withdrawal (% of total)	87.8	AQUASTAT 2022
Area equipped for irrigation (% cultivated)	16.4	AQUASTAT 2022
Water stress level	Extremely high (>80%)	WRI Aqueduct 2023
ND-GAIN adaptation score (rank / 182)	53.1 (69th)	ND-GAIN 2023



Background

- A dual system: irrigated agriculture covers only 16.4% of the cultivated area yet contributes disproportionately to output and export revenue; the majority of cultivated land is rain-fed and highly exposed to rainfall variability
- Climate risk is therefore unevenly distributed — smallholders in rain-fed areas have far less adaptive capacity than larger farms in irrigated perimeters
- Consecutive droughts since 2018 have cut production, depleted reservoirs and strained groundwater; cereal output dropped sharply in 2023–24
- Water is now the most limiting factor: 776.9 m³ per capita is below the water-stress threshold and 87.8% of withdrawals go to agriculture, leaving little margin for error
- Policy has gradually shifted from production growth alone towards water efficiency, resilience and sustainability

Why this case: adapting semi-arid farming systems vulnerable to drought and rainfall variability — informed by field visits and consultations with ministries and stakeholders.

Morocco – Field Visit (2/3)

Adaptation in a semi-arid dual system: irrigated perimeters and rain-fed smallholders



Climate risk analysis

Drought and rainfall variability

Cereals remain highly exposed to seasonal rainfall. Projections point to a 10–20% decline in average annual rainfall over most of Morocco and up to 30% in parts of the south, adding to production variability.

Smallholder vulnerability

Commercial farms in irrigated perimeters have technology, finance and risk tools; rain-fed smallholders often do not. Recent droughts squeezed household incomes through lower yields and pasture decline.

Groundwater depletion and water security

In dry seasons farmers turn to groundwater for relief; extraction is becoming unsustainable in key agricultural basins and could jeopardise future adaptation where alternatives are scarce.

Land degradation and soil health

Drought, overgrazing, rising temperatures and poor cultivation have reduced soil quality; degradation erodes productivity even where irrigation exists, making sustainable land management part of adaptation.



Institutional framework and key actors

Ministry of Agriculture, Maritime Fisheries, Rural Development and Water and Forests

Lead on the Green Morocco Plan and Generation Green; irrigation modernisation, climate-smart agriculture and rural development; incentives via ADA and the Agricultural Development Fund (FDA)

Ministry of Equipment and Water

Dams, groundwater management, desalination and the National Water Plan; coordination with agriculture increasingly essential

MAMDA

Mutuelle Agricole Marocaine d'Assurances — the backbone of agricultural insurance, covering drought, frost, hail and flood

Crédit Agricole du Maroc

The main agricultural bank; finance for irrigation, equipment and adaptation investments

Morocco – Field Visit (3/3)

Adaptation in a semi-arid dual system: irrigated perimeters and rain-fed smallholders



Policies, strategies and incentive mechanisms

Plan Maroc Vert 2008–2020 — first national modernisation drive: productivity, value chains, exports, rural poverty; progress in irrigation and investment — but the model still promoted water-intensive systems in scarce areas

Generation Green 2020–2030 — successor strategy centred on sustainability, human capital, rural inclusion and adaptation: climate-smart agriculture, drought-tolerant crops, digital tools, better farmer services

National Water Plan 2020–2050 and PNAEPI — dams, desalination plants, wastewater reuse, groundwater protection and irrigation modernisation to secure water for drinking and irrigation

Drip irrigation programme — subsidies and investment incentives converted hundreds of thousands of hectares; larger commercial producers adopted faster than smallholders

Agricultural insurance — MAMDA and public support cover drought, frost and flood — among the most advanced systems in Africa and MENA

Desalination–renewable energy nexus — Casablanca and Agadir plants; the Noor solar complex reduces the energy intensity of water production

Climate-smart and digital agriculture — drought-resistant crops, conservation farming, soil management; satellite monitoring, remote sensing and digital weather services still at early stages



Concluding assessment

Progress

- A fairly advanced institutional set-up and 20 years of investment in irrigation, insurance, climate-smart agriculture and water governance
- Gradual transition from a production-growth focus to a resilience and sustainability approach
- Tension between export-oriented irrigated agriculture and sustainable water use

Constraints

- Water scarcity remains the main limit on agricultural development
- Smallholders disproportionately vulnerable — limited finance, irrigation and technical assistance
- Unresolved tension between export-oriented agriculture and sustainable water use

LESSONS LEARNT

- Drip irrigation, insurance, climate-informed planning and water governance show how adaptation can be embedded in the mainstream development strategy
- Resilience depends on the ability of instruments to reach the farmers and communities most affected by climate change
- The core challenge is the combination of acute water shortage, a large rain-fed smallholder base and export-oriented irrigated agriculture

Türkiye – Desk Research (1/3)

Large agricultural potential, growing climate vulnerability and increasingly sophisticated institutional responses

Agricultural and climate profile Table 28

Agriculture, value added (% of GDP)	5.82	WDI 2024
Agricultural employment (% of total)	14.55	WDI / ILO 2024
Arable land (% of land area)	26.35	WDI / FAO 2023
Renewable freshwater per capita (m³/yr)	2,430.6	AQUASTAT 2022
Agricultural water withdrawal (% of total)	86.9	AQUASTAT 2022
Area equipped for irrigation (% cultivated)	14.9	AQUASTAT 2022
Water stress level	High (40–80%)	WRI Aqueduct 2023
ND-GAIN adaptation score (rank / 182)	55.3 (56th)	ND-GAIN 2023



Background

- Several agro-ecological zones: cereals and livestock in central Anatolia, fruit, vegetables and greenhouses on the coasts, expanding irrigated agriculture in the southeast under the Southeastern Anatolia Project (GAP); key exports include hazelnuts, wheat products, fruit, vegetables and greenhouse crops
- Located in the Mediterranean Basin — **a global climate-change hotspot**; agriculture still buffers rural poverty and economic volatility in many provinces
- Only 14.9% of the cultivated area is equipped for irrigation, yet irrigated production carries high-value crops and drought-prone areas; GAP remains the flagship agricultural transformation project
- Structural constraints persist: land fragmentation, productivity differentials, regional disparities and water-use inefficiency; groundwater over-extraction in the Konya Closed Basin signals rising water stress

Why this case: a balanced middle ground between the most advanced adaptation models and the most vulnerable cases — substantial capacity combined with rising environmental pressure.

Türkiye – Desk Research (2/3)

Large agricultural potential, growing climate vulnerability and increasingly sophisticated institutional responses

Climate risk analysis

Drought and water scarcity

Central Anatolia, the southeast and parts of the Aegean are most exposed. In the Konya Closed Basin heavy pumping has lowered the water table and opened sinkholes; irrigation need is rising as supply declines.

Extreme weather and production volatility

Wildfires and long heatwaves in the Mediterranean, heavy rain and floods in the Black Sea region, sudden frost for fruit growers — pushing demand for insurance and early warning.

Heat stress and productivity

Rising temperatures pressure crop yields, livestock and planting cycles; wheat is particularly exposed in drought-prone regions, while some northern and high-altitude areas may see short-term gains.

Land degradation and water efficiency

Erosion removes ≈642 m tonnes of soil a year (8.24 t/ha). Of 24 m ha of farmland 6.7 m ha are irrigated, and 61.6% of that still uses surface irrigation at 40–60% efficiency versus ≈90% for pressurised systems.

Institutional framework and key actors

Ministry of Agriculture and Forestry

Agricultural policy, rural development, subsidies, extension, irrigation coordination and national adaptation coordination; growing focus on water management, digital and climate-smart farming

DSİ — State Hydraulic Works

Dams, irrigation systems and flood management; its investments have shaped production patterns nationwide

TARSiM — Agricultural Insurance Pool

Public–private scheme covering drought, hail, frost, flood, storms and livestock losses

TÜBİTAK and agricultural research institutes

Drought-resistant varieties, irrigation efficiency, sustainable agriculture, climate monitoring and farm-level extension

Turkish State Meteorological Service

Climate monitoring and forecasting for agricultural planning, disaster preparedness and early warning

Türkiye – Desk Research (3/3)

Large agricultural potential, growing climate vulnerability and increasingly sophisticated institutional responses

Policies, strategies and incentive mechanisms

GAP and irrigation modernisation — multi-sectoral irrigation, hydropower and regional development; higher productivity and crop diversification in the southeast — but irrigation growth does not by itself deliver sustainability

Climate Change Adaptation Strategy and Action Plan — drought preparedness, climate-resilient agriculture, efficient irrigation, risk management and coordination, with attention to regional vulnerabilities; farm-level implementation uneven

National Water Efficiency Strategy Document — drip and sprinkler systems, water-saving technologies, loss reduction and better irrigation management across sectors

TARSİM agricultural insurance — multi-risk cover that works both as adaptation tool and compensation system as production volatility rises

Climate-smart agriculture and precision irrigation — drought-resistant crops, soil conservation, sensors, satellite monitoring and digital water management — adoption concentrated in commercial producers

Digital agriculture and smart farming — ministry platforms, agricultural databases, remote sensing and monitoring for planning, data collection and risk management

Concluding assessment

Progress

- Large-scale irrigation investment, insurance, adaptation planning and digital agriculture have strengthened resilience
- DSI, TARSİM and the Ministry provide a relatively strong foundation compared with countries facing similar risks

Constraints

- High water stress, groundwater depletion and inefficient irrigation
- Land fragmentation and regional inequalities slow the spread of climate-smart and precision technologies
- Climate risks expected to grow in water-stressed and drought-prone regions

LESSONS LEARNT

- Institutional capacity — irrigation, insurance, adaptation planning — can support resilience
- Infrastructure investment is not sufficient without water efficiency, governance and the capacity to implement
- No single programme delivers resilience; it emerges step by step through institutional learning and the integration of climate into agricultural planning

Saudi Arabia – Desk Research

Water scarcity turned from a marginal constraint into the driver of systemic change

2.5%

agriculture's share of GDP; 2.6% of employment — yet strategic for food security

8 bn m³

annual saving of non-renewable agricultural water under the National Water Strategy 2030

57 → 83%

Integrated Water Resources Management index; agricultural GDP +38% (2020–24)

≈ 80%

of food needs still met by imports — exposure to external supply shocks

Climate risk profile

- Limited water supply; drying up of fossil aquifers (legacy of wheat self-sufficiency policy)
- Heat stress, extreme temperatures and dust storms
- Desertification and land degradation
- Import dependence and vulnerability of food supply chains

Policies, strategies & incentives

- Vision 2030 and National Transformation Programme; MEWA as lead institution
- Saudi Green Initiative: 10 bn trees by 2030; 115 m planted, 250,000 ha restored by 2024
- National Water Strategy 2030 (WEF nexus): solar desalination >16 m m³/day, irrigation optimisation, wastewater reuse, 1,000 dams
- Digital agriculture, precision irrigation, controlled-environment farming; Farmer Field Schools

Lessons for OIC Member Countries

- Institutional consolidation, public funding and knowledge infrastructure designed as one coherent system
- Where alignment is achieved, results are tangible; where incomplete, gaps appear between strategy and farm practice
- Advanced technologies are costly and inaccessible to smaller producers
- Extension reach and farmer-level knowledge gaps persist

Concluding assessment: a mutually reinforcing architecture of institutional coordination, financing instruments, digital technology and integrated water management has produced tangible results; implementation gaps persist between national strategies and farm-level practice.

Saudi Arabia – Desk Research (1/3)

System change under extreme water scarcity through technology investment and state coordination

≈ 80%

of food needs still met by imports — exposure to external supply shocks

Agricultural and climate profile Table 30

Agriculture, value added (% of GDP)	2.54	WDI 2024
Agricultural employment (% of total)	2.57	WDI / ILO 2024
Arable land (% of land area)	1.60	WDI / FAO 2023
Renewable freshwater per capita (m³/yr)	74.6	AQUASTAT 2022
Agricultural water withdrawal (% of total)	81.6	AQUASTAT 2022
Area equipped for irrigation (% cultivated)	90.1	AQUASTAT 2022
Water stress level	Extremely high (>80%)	WRI Aqueduct 2023
ND-GAIN adaptation score (rank / 182)	58.2 (42nd)	ND-GAIN 2023



Background

- For much of the 20th century production relied on non-renewable fossil aquifers; wheat self-sufficiency made the Kingdom a grain exporter in the 1980s–90s, but rapid aquifer drawdown forced a reversal — output was cut and food security rebuilt through import diversification, stockpiling and farmland investment abroad
- Agriculture is 2.54% of GDP and 2.57% of employment — among the **least agriculture-dependent OIC economies** — yet retains strategic significance; arable land is under 2% of territory
- Any agricultural base strains the scarcest resource: 74.6 m³ of renewable water per capita, 90% of cultivated area irrigated, "Extremely high" water stress
- The response has been systemic — digital irrigation, Water–Energy–Food nexus governance and a structural shift of the sector under Vision 2030

Why this case: how agricultural systems can be reconfigured at the extreme end of the global water-scarcity spectrum with well-designed technology investment and strong state coordination (desk research).

Saudi Arabia – Desk Research (2/3)

System change under extreme water scarcity through technology investment and state coordination

Climate risk analysis

Drying up of fossil aquifers

Most agricultural water is still non-renewable. The National Water Strategy has saved 8 bn m³ of non-renewable water a year by 2025, but the target of cutting non-renewable groundwater use by 90% by 2035 shows how far the problem is from resolved.

Desertification and land degradation

Overgrazing, land-use practices and a changing climate shrink an already tiny cultivable base — a main driver of the Saudi Green Initiative. The G20 Atlas projects agricultural drought frequency +80% by 2050 and losses above 12% of GDP.

Heat, extremes and dust storms

2024 was the hottest year on record for the Arab region (WMO); up to +5 °C by 2100 under high emissions; ~20 heatwaves a year by the 2050s; pest populations +15–20% (KAUST); evaporation set to exceed precipitation by 40% after 2030.

Import dependence and supply chains

Around 80% of food needs are imported; COVID-19 exposed price and supply-chain risk, making diversification of supply a pillar of the food-security architecture.

Institutional framework and key actors

MEWA — Ministry of Environment, Water and Agriculture

Agriculture, water, environment and food security under one umbrella; precision-agriculture and smart-irrigation pilots; IWRM index raised from 57% to 83% with UNDP — recognised by the UN as an SDG 6 success

Agricultural Development Fund (ADF)

Concessional loans for modernisation, greenhouses, irrigation renewal and aquaculture — SAR 4.2 bn approved by mid-2023; up to 75% financing for greenhouses and 10-year tax exemptions

SALIC (Public Investment Fund)

Overseas farmland, livestock and fisheries holdings in Brazil, Ukraine, India, Australia and Africa — spreading the geography of food imports

Estidamah research centre

Arid-zone crop research (quinoa, moringa, stevia, safflower) — locally validated, climate-adapted agronomic knowledge

Saudi Food and Drug Authority

Food safety standards and compliance; among the top five countries globally on trans-fat elimination

Saudi Arabia – Desk Research (3/3)

System change under extreme water scarcity through technology investment and state coordination

57 → 83

Integrated Water Resources
Management index; agricultural GDP
+38% (2020–24)

Policies, strategies and incentive mechanisms

Vision 2030 and National Transformation Programme — food security, sustainability and modern agriculture; >SAR 20 bn a year on the food sector; self-sufficiency 131% dairy, 121% dates, 103% eggs; agricultural GDP SAR 85.1 → 117.9 bn (2020–24, +38%)

Saudi Green Initiative (2021) — 10 bn trees by 2030 — 115 m planted and 250,000 ha restored by end-2024; emissions cut of 278 Mt CO₂e a year by 2030

National Water Strategy 2030 — WEF-nexus transition from fossil groundwater: solar desalination, irrigation optimisation, wastewater reuse, surface-water capture; 8 bn m³ saved a year, 1,000 dams (>1 bn m³), cloud seeding (≈6.4 bn m³); desalination >16 m m³/day at ≈50% lower energy cost

Digital, precision and controlled-environment agriculture — IoT sensors, satellite imagery and AI-assisted irrigation; water efficiency above 90% in hydroponics, greenhouses and vertical farms; NEOM integrates vertical farming with aquaculture

Farmer Field Schools and rural extension — MEWA's Weqaa Centre with FAO in date-palm areas; AI-Ahsa fieldwork finds knowledge gaps and perceived lack of support still limit smallholder uptake

Concluding assessment

Progress

- 8 bn m³ of non-renewable water saved annually; IWRM index 57 → 83
- Self-sufficiency above 100% in dairy, dates and eggs; agricultural GDP +38% in four years

Constraints

- ≈80% of food still imported — high exposure to external supply shocks
- Advanced technologies priced beyond smaller producers
- Extension reach and farm-level knowledge gaps not closed by national strategy documents alone

LESSONS LEARNT

- Water scarcity was turned from a marginal constraint into the driver of systemic change — from open-field farming to technology-driven, resource-efficient production
- Institutions, financing and knowledge infrastructure were designed as one coherent system rather than as parallel projects
- Where alignment is incomplete, gaps appear between national strategies and farm-level practice

The Netherlands – Comparative Case (1/3)

Non-OIC reference case: what aligned technology, water governance and institutions can achieve — and what it costs

6.4× yield

greenhouse vs open field; but 231× energy footprint

Agricultural and climate profile Table 29

Agriculture, value added (% of GDP)	1.73	WDI 2024
Agricultural employment (% of total)	1.75	WDI / ILO 2024
Arable land (% of land area)	29.97	WDI / FAO 2023
Renewable freshwater per capita (m³/yr)	5,082.5*	AQUASTAT 2022
Agricultural water withdrawal (% of total)	3.3	AQUASTAT 2022
Area equipped for irrigation (% cultivated)	50.2	AQUASTAT 2022
Water stress level	Low (<10%)	WRI Aqueduct 2023
ND-GAIN adaptation score (rank / 182)	65.9 (18th)	ND-GAIN 2023



Background

- A small land base but the world's second-largest agricultural exporter by value (≈€129 bn in 2024, after the United States) — the product of a knowledge-intensive model, not land abundance
- Water governance as state capability: about a third of the country lies below sea level; dikes, drainage canals, pumping stations and barriers evolved alongside agricultural planning, and controlled water tables make polder soils highly productive
- The water paradox: more than 5,000 m³ per capita, yet 88% arrives as transboundary inflow; agriculture withdraws only 3.3% thanks to high efficiency, rain-fed open-field cropping and water-recycling greenhouses
- Decades of intensive production now raise concerns over nitrogen, biodiversity, greenhouse-gas emissions and water quality, moving sustainability to the centre of agricultural policy

Why this case: a deliberate methodological choice — lessons on long-term planning, water governance, research integration and technological innovation in highly productive systems (desk research).

The Netherlands – Comparative Case (2/3)

Non-OIC reference case: what aligned technology, water governance and institutions can achieve — and what it costs



Climate risk analysis

Sea-level rise and flood risk

Around 26% of the country lies below sea level and up to 55% is vulnerable to river, coastal or storm-surge flooding; heavier rainfall and shifting river discharge raise the risk to crops, soils and transport.

Vulnerability of intensive agriculture

Greenhouses buffer weather, but intensive livestock and open-field systems face heat stress, drought, heavy rain and disease; strong technology, insurance and research capacity keep adaptation proactive.

Water stress, salinity and drought

National water stress is below 10%, yet hotter, drier summers increasingly shape planning at critical crop stages, and saltwater intrusion threatens coastal groundwater and soils.

Nitrogen pressure and sustainability

Intensive livestock production drives nitrogen deposition on protected ecosystems; a 2019 court ruling upended the permitting system, prompting stricter law and transition support for cleaner production.



Institutional framework and key actors

Ministry of Agriculture, Fisheries, Food Security and Nature

Agricultural policy, biodiversity, food systems; coordinates adaptation and transition programmes; close links with research and producer organisations

Ministry of Infrastructure and Water Management

Flood protection, freshwater systems, adaptation planning and long-term water resilience

Regional Water Authorities (Waterschappen)

Water levels, drainage, flood protection and water quality; a decentralised, participatory model in which farmers sit in decision-making — potentially applicable to OIC countries

Delta Programme and Rijkswaterstaat

The long-term plan for flood protection and freshwater security, updated annually; Rijkswaterstaat executes large-scale water projects

Wageningen University & Research (WUR)

World-leading research in precision agriculture, greenhouse technology and climate-smart systems; a model of science–policy–advisory integration

The Netherlands – Comparative Case (3/3)

Non-OIC reference case: what aligned technology, water governance and institutions can achieve — and what it costs

Policies, strategies and incentive mechanisms

Delta Programme and climate adaptation — integrates adaptation into water management, infrastructure and spatial planning beyond 2050; drought resilience as well as flood avoidance; anticipation rather than reaction

Greenhouse innovation and controlled agriculture — precise control of temperature, humidity, water and nutrients; water recycling, sensors, LED and climate control; already applied in the Gulf — the most directly transferable element

Precision farming and digital agriculture — sensors, drones, satellites, robotics and AI for irrigation, fertiliser, pest control and crop monitoring; faster reaction to drought and disease

Climate-smart agriculture and circular production — resource efficiency, resilient crop systems, renewable energy and sustainable nutrient management; a circular model that cuts waste and ecological cost

Concluding assessment

Progress

- Resilience built from long-term planning, strong institutions and sustained public investment
- Ranked 18th globally on ND-GAIN adaptation readiness

Constraints

- Nitrogen, biodiversity and ecosystem stress are the legacy of decades of high-intensity production
- These pressures proved much harder to address later than to foresee earlier
- Productivity and environmental sustainability are not automatically aligned

LESSONS LEARNT

- The transferable insights are governance principles, science–policy coordination and water management rather than technologies as such
- Resilience came slowly — shaped by years of investment, policy adjustment and institutional reform, not one technological breakthrough
- Productivity gains without environmental safeguards create costs that can ultimately constrain the sector
- Long-term planning and public investment are as decisive as innovation

Australia – Comparative Case (1/3)

Non-OIC reference case: risk-based drought policy, farm-level financial instruments and resilience-first agriculture

+28% / +68%

cumulative productivity growth since 1989 in broadacre / cropping despite deteriorating climate

≈ 70%

of production exported; A\$71.5 bn agricultural exports (2023–24)

Agricultural and climate profile ABARES / ABS

Agriculture, value added (% of GDP)	2.4	ABS / ABARES
Agricultural employment (% of total)	2.2 (315,600)	ABS
Share of national land use	55% (426 m ha)	ABARES 2023
Share of national water consumption	74%	ABS
Agricultural exports, 2023–24	A\$71.5 bn (10.8%)	ABARES
Share of production exported (volume)	≈70%	ABARES
Broadacre productivity growth, p.a.	2.18% → 0.72%	ABARES (pre/post 2000)
Agricultural R&D funding, 2023–24	A\$2.98 bn	ABARES



Background

- A modest share of output with a large claim on resources: 55% of land and 74% of water consumption for 2.4% of value added; ≈70% of production exported (A\$71.5 bn in 2023–24)
- Land use is dominated by grazing on native vegetation (286.7 m ha); cropping covers 28.3 m ha and horticulture only 0.5 m ha — most production is extensive and directly exposed to rainfall variability
- Consolidation and scale: broadacre and dairy farms fell ≈33% since 1999–2000 to ≈56,500; record gross value of production of A\$101 bn forecast for 2025–26, with a 5% fall expected in 2026–27
- Sustainable practice is the norm, not the exception: 85% of cropping farms retain stubble, 68% use minimum tillage, 65% optimise inputs; 61% of livestock farms use planned grazing

Why this case: a non-OIC reference on risk-based drought policy, farm-level financial instruments and research partnership under high inter-annual climate variability (desk research).

Australia – Comparative Case (2/3)

Non-OIC reference case: risk-based drought policy, farm-level financial instruments and resilience-first agriculture

Climate risk analysis

Warming and drying

Average temperature up ≈ 1.47 °C since 1910; cool-season rainfall down 9–20% across the southern production zones. In a largely rain-fed system this translates directly into yield and income losses.

Risk differs by farm type

Cropping farms carry more climate risk (yield collapse in drought); livestock farms more price risk and can de-stock in the short term — so no single support instrument is sufficient.

Quantified profit loss

ABARES FarmPredict: seasonal conditions in 2001–2020 reduced average broadacre farm profit by 23% ($\approx$ A\$29,200 per farm) relative to 1950–2000, concentrated in the south-west and south-east.

Variability, not averages

A near-record winter crop in 2025–26 coincides with below-average autumn 2026 rainfall forecasts; drought is now a persistent feature and productivity growth slower and more volatile.

Institutional framework and key actors

DAFF and ABARES

National agricultural and drought policy, the statutory levy system and programme coordination; ABARES supplies forecasts, farm surveys and the FarmPredict model; states and territories deliver programmes and extension locally

CSIRO and Bureau of Meteorology

Climate monitoring and projection; My Climate View gives 50-year projections for 20 commodities at 5 km² resolution; AADI turns models into outcome-based drought indicators

Research and Development Corporations (15)

Producer levies matched by government up to 0.5% of gross value of production; $\approx$ A\$800 m a year for research and extension (GRDC, AgriFutures)

Regional Investment Corporation

A\$3.37 bn in concessional loans over six years; a further A\$1 bn announced in August 2025 with a broadened climate-resilience mandate

Drought Resilience Hubs and the National Drought Agreement 2024–29

Eight regional hubs translate science into practice; the Commonwealth–state agreement clarifies roles and reduces duplication; NFF 2030 Roadmap, Rural Financial Counselling Service and Services Australia complete the delivery chain

Australia – Comparative Case (3/3)

Non-OIC reference case: risk-based drought policy, farm-level financial instruments and resilience-first agriculture

A\$5 bn

Future Drought Fund (2024) — ≈ A\$100 m per year for drought and climate resilience

Policies, strategies and incentive mechanisms

Strategic objectives — Ag2030 — a A\$100 bn sector by 2030; innovation priorities of exports, climate resilience, biosecurity and digital agriculture

Drought policy architecture — Future Drought Fund: A\$3.9 bn in 2019, A\$5 bn by 2024, ≈A\$100 m a year; Drought Resilience Funding Plan 2024–28; A\$519.1 m package over eight years; the December 2024 Drought Plan spans preparedness, management and recovery

Farm-level financial instruments — Farm Management Deposits — tax-deductible savings in good years, drawn in bad years (cap A\$800,000; drought withdrawals keep tax treatment; balances A\$7.08 → 5.93 bn in 2025–26); RIC loans; Farm Household Allowance; financial counselling

Research partnership — the RDC model — levies matched by public funds so priorities are set jointly with industry and results move quickly into practice

Redesign of the production system — water-efficient irrigation and land management; GRDC target of heat-tolerant wheat yielding ≥10% more by 2026; growAG platform (2,000+ projects); minimum tillage and stubble retention at scale; My Climate View and AADI usable at farm scale

Concluding assessment

Progress

- Cumulative productivity growth since 1989 of ≈28% (broadacre) and ≈68% (cropping) despite a deteriorating climate
- Record gross value of production in 2025–26 shows capacity to absorb short-term shocks

Constraints

- Broadacre productivity growth has slowed to 0.72% a year and become more volatile
- FMD balances fell A\$7.08 → 5.93 bn within a year — the buffer is being drawn on; the risk has not been eliminated
- Adaptation policies determine whether loss can be borne, not whether it occurs

LESSONS LEARNT

- A risk-based approach with a portfolio of instruments — tax-incentivised liquidity, concessional lending, income support, capability programmes — matched to farm type
- Counter-cyclical savings can substitute for public insurance; research works best as a levy-matched partnership; a written intergovernmental framework reduces duplication
- Bring climate information down to the farm scale and design policy for crisis scenarios, not averages: resilience-first agriculture

Cross-Case Lessons

Adaptation is a gradual, cumulative process — policy learning, institutional development, investment and flexibility



Water efficiency is the common denominator

Irrigation modernisation, drip systems and water governance recur in every OIC case; gains are real but adoption is uneven.



Governance and implementation matter as much as infrastructure

Even with technology and investment, outcomes depend on coordination, extension reach and local implementation capacity.



Targeting the vulnerable is the unresolved challenge

Larger, commercial producers adopt faster; smallholders in rain-fed areas remain the least served everywhere.



Risk-sharing instruments are central

Insurance (TARSIM, Morocco), counter-cyclical savings (Australia) and contingency funds turn shocks into bearable losses.



Resilience is built over decades

Netherlands, Australia and Saudi Arabia show cumulative institutional learning; late correction of side-effects is costly.



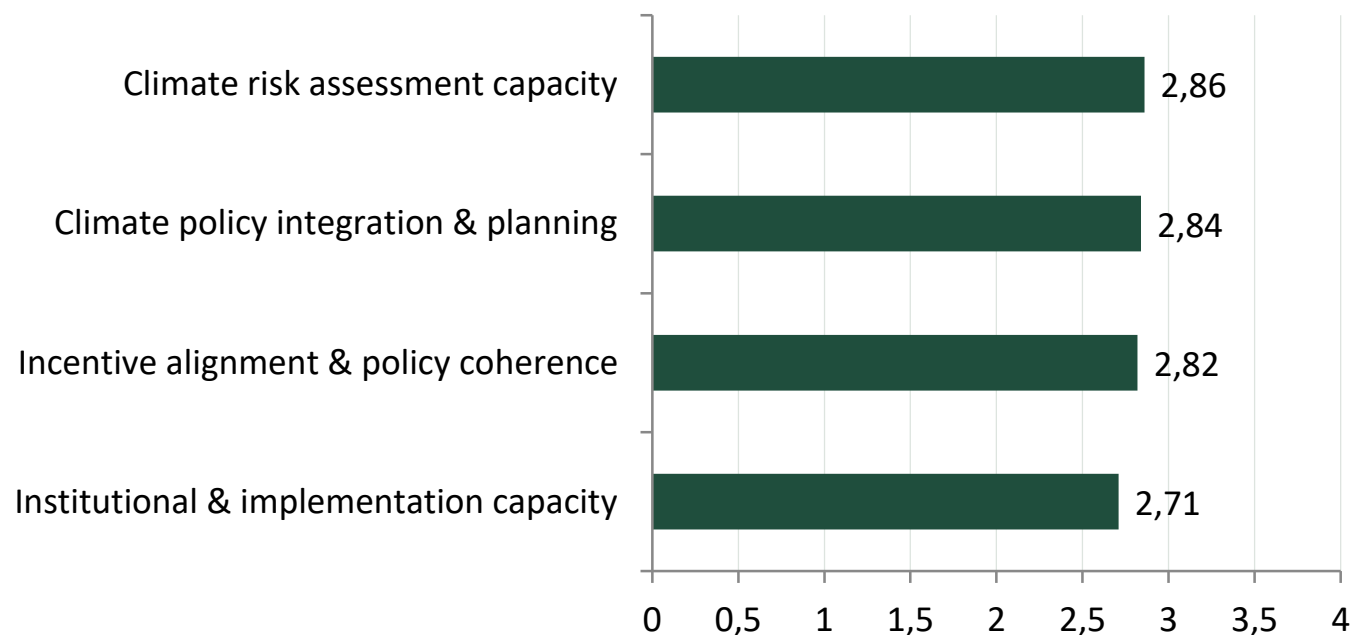
Coherent systems outperform parallel projects

Institutions, finance and knowledge infrastructure deliver most when designed together — the Risk–Planning–Incentive chain in practice.

Member Country Survey: Design and Overall Results

Perspectives of experts and institutional representatives across the OIC

Mean scores by dimension (1 = not implemented ... 4 = fully implemented)



Overall average of all 28 item means: 2.81 · Source: Section 3.7 of the report.

Design

- Target group: experts and officials in agriculture, climate change, water, agricultural finance and insurance, adaptation policy
- National contact points approached by e-mail in two rounds
- 28 items in four dimensions mirroring the Risk–Planning–Incentive Nexus plus implementation capacity

≤ 4.9% of responses rated any item as “fully/effectively implemented”. Answers cluster in “partially” and “very limited”.

- Reading: mechanisms exist but have not reached a broadly established, fully effective level. Differences between dimensions are small; institutional and implementation capacity is comparatively weakest.

Survey: Where Capacity Is Stronger — and Where It Is Weakest

Highest and lowest mean scores across the 28 items

Highest scores

3.24 Accessibility of climate risk information to policymakers

3.17 Integration of climate risks into agricultural insurance schemes

3.10 Use of up-to-date climate data and projections in risk assessments

3.10 Incorporation of climate risks into agricultural development plans

3.07 Clear definition of institutional responsibilities

Lowest scores

2.41 Capacity of local-level institutions to implement national policies

2.49 Use of climate risk assessments to inform policy decisions

2.49 Mechanisms for reviewing and reforming maladaptive incentives

2.54 Regular updating of climate risk assessments

2.56 Incorporation of future climate risks into long-term planning

Pattern: information generation, some planning mechanisms and some financial instruments are relatively developed; systematic use, feedback and local implementation lag behind.

Survey: Three Patterns and One Central Message

The constraint is generally not the absence of policies, institutions or instruments — it is implementation

01

Knowledge–decision gap

Climate risk information is accessible to policymakers (3.24), but its explicit use to inform agricultural policy decisions scores far lower (2.49). Access is ahead of systematic use.

02

Strategy–resource gap

Climate risks are incorporated in development plans (3.10), yet prioritising public investment on the basis of risk (2.68) and long-term planning for future risks (2.56) lag. Integration in documents does not translate into investment.

03

National–local implementation gap

Institutional responsibilities are clearly defined (3.07), but local-level capacity to implement national policies is the lowest score in the survey (2.41). Coordination, technical capacity, monitoring and use of evaluation results are also weak.

Central message: the principal challenge is ensuring the effective implementation, coordination, continuity and translation to local level of existing frameworks and mechanisms — strengthening the systematic use of what is already in place.



Policy Framework and Road Map: Cluster-Specific Recommendations

Recommendations tailored to three performance clusters identified through EPI and FAOSTAT evidence

Three Performance Clusters as a Diagnostic Map

Classification based on EPI 2024 and FAOSTAT evidence — a basis for policy transfer and capacity building, not a ranking

1

Cluster 1 High-performing states

High-income Gulf economies and forest-rich carbon-sink countries (e.g. Suriname, Gabon)

Binding constraints

- Strong financial capacity and smart-agriculture experience
- Extreme heat and the highest thermal acceleration
- Severe water scarcity; carbon-intensive desalination and industry

2

Cluster 2 Industrialising, intensive-agriculture economies

Türkiye, Egypt, Morocco, Indonesia and similar

Binding constraints

- High output volumes with a heavy chemical (nitrogen) footprint
- “Demographic gap”: rising output absorbed by population growth
- Horizontal land expansion, post-harvest losses, urban air pollution

3

Cluster 3 Highly vulnerable, infrastructure-deficient countries

Many in Sub-Saharan Africa and South Asia (e.g. Afghanistan, Chad, Niger, Sierra Leone)

Binding constraints

- Rain-fed agriculture; irrigation and energy grids largely absent
- Droughts and floods decimate already weak infrastructure
- Adaptation treated as emergency response rather than long-term strategy

Recommendations for Cluster 1

High-performing states: strong financial capacity, extreme heat, severe water scarcity



Smart agriculture integration

The Water–Energy–Food (WEF) Nexus approach applied in Saudi Arabia may offer a useful reference point, and digital, sensor- and satellite-based irrigation could help improve water and resource efficiency, where capacities allow.



Industrial carbon mitigation

As emissions in this context relate largely to desalination, petrochemicals and industrial fuel use, powering agricultural technologies—vertical greenhouses, cooling systems and water networks—with solar and wind may offer opportunities to reduce carbon intensity, depending on national energy conditions.



Higher implementation rates of climate planning

NAPs, regional action plans and NDCs are in place, while financing and implementation capacities remain uneven. Complementing short-term considerations with longer-term transformation objectives, and further aligning plans with policies, could be explored.



OIC climate-technology policy collaboration

Knowledge exchange among Member Countries could be further encouraged, particularly on irrigation technologies and drought-resistant seed varieties, in both financing and technical expertise, drawing where relevant on the Saudi WEF experience.



Preservation of natural carbon sinks

Forest-rich Member Countries such as Suriname and Gabon may find opportunities in valorising their "net carbon sink" areas, including through high value-added products compatible with the preservation of forest integrity.

Recommendations for Cluster 2

Industrialising, intensive-agriculture economies



Mitigate the nitrous oxide (N₂O) chemical footprint

Excess nitrogen fertiliser releases N₂O, a gas roughly 300 times more potent than CO₂. Applying fertiliser in line with soil analysis and crop needs, while avoiding periods shortly before rainfall, could help reduce such emissions



From horizontal to vertical growth

Raising productivity on land already under cultivation, rather than expanding into forested areas, may be a useful direction, supported by precision agriculture, drought- and heat-resistant seed varieties and no-till methods. Satellite-triggered support payments for smallholders in cases of drought or excess rainfall, as illustrated by the Green Morocco Plan, may serve as a helpful reference.



Prevent post-harvest losses

Real-time tracked cold chains, on-site processing (drying, freezing, canning, puree and paste production) and solar-powered village-level cold storage could help increase net supply without additional production, where investment and infrastructure conditions allow.



Bypass intermediaries

Digital platforms, as partially applied in Indonesia and Morocco, may enable smallholders to reach supermarket chains and urban consumers directly, which could improve net margins and rebalance the production risk currently borne by producers.



Improve rural social amenities

Ageing farm populations and the departure of younger generations remain a shared challenge. Improvements in rural healthcare, education and digital infrastructure could help retain the workforce needed for smart irrigation and digitalisation, depending on national circumstances.



Urban air quality and circular waste solutions

PM2.5 emissions from fossil-fuel-intensive industry, traffic and stubble burning could be addressed through approaches such as "Industry–Agriculture Symbiosis", converting biomass and harvest residues into industrial raw materials and biochar. Incentives for circular and green production may further support progress in this area.

Recommendations for Cluster 3

Highly vulnerable, infrastructure-deficient countries — urgent strategic priorities addressing fundamental deficits



Water security and irrigation infrastructure

Rain-fed systems remain exposed to droughts and flash floods, often in settings where electricity supply is limited or intermittent. Micro-irrigation projects supported by national and international funding could be explored in this context, and solar-connected drip irrigation may help protect scarce water resources while reducing crops' vulnerability to power interruptions.



Clean energy infrastructure and post-harvest logistics

In rural areas of several Member Countries, including Afghanistan, Chad, Niger and Sierra Leone, energy access remains limited, reliance on traditional biomass carries respiratory health implications, and post-harvest losses persist where cold chains, roads and storage capacity are constrained. Encouraging agricultural cooperatives and expanding solar-powered modular cold storage and clean cookstoves may offer useful opportunities in these settings.



Sanitation, waste management and clean water

Where agricultural areas and sewage systems are not clearly separated, flood events can allow wastewater to reach drinking water sources and cultivated land, with associated cholera and typhoid risks. Greater attention to clean water networks, and to resources allocated for this purpose, could be considered in line with national circumstances and fiscal capacities.



Low-tech digital early warning and disaster risk networks

Where resources for advanced systems are constrained, widely available mobile coverage may offer a practical alternative: simple SMS or voice-based warnings in local languages ahead of floods or thermal shocks could help smallholders protect harvests and livestock in good time.

General Policy Recommendations

Cross-cutting directions for the OIC as an institution — cooperation, knowledge exchange and capacity development — Chapter IV



Climate-responsive agricultural planning

Integrating climate risk assessments into agricultural planning, investment prioritisation and budgeting could help connect identified risks with adaptation priorities. Common planning guidelines and shared good practices may support Member Countries in this direction.



Incentives aligned with resilience

Reviewing financial, market-based and regulatory instruments so that subsidies, concessional finance and insurance increasingly favour resilient practices may be useful. Exchanging successful incentive models could assist Member Countries where conditions allow.



Coordination of the Water–Energy–Food nexus

Where agriculture, water, energy and climate mandates rest with separate institutions, closer coordination could reduce overlapping or conflicting measures. The OIC may offer a platform for transferring good practices across clusters.



Climate-conscious investment frameworks

For large and long-lived agricultural investments, considering 20–30 year agro-ecological and hydrological scenarios at the feasibility stage could reduce exposure to stranded assets and maladaptation, in line with national procedures.



Index-based climate insurance

Index-based schemes drawing on satellite data and automated weather stations may allow faster payouts after droughts or floods. Türkiye's TARSİM, Azerbaijan's Agrarian Insurance Fund and Uzbekistan's models offer useful references.



Early warning and disaster risk management

Linking meteorological, satellite and agricultural information to practical advisories could help farmers adjust planting, irrigation and livestock decisions in time. Where capacities are limited, SMS or mobile-based warnings may offer a low-cost option.

Closing Messages

Bringing the country experiences, the survey and the cluster analysis together



A systemic, not purely biophysical, threat

Impacts extend from yields to prices, livelihoods, fiscal pressure and lasting structural damage to agrifood systems.



Resilience is a system-level property

Risk analysis, planning and incentives must align as one policy chain; misalignment explains many failures.



Cross-cutting enablers

Reliable agricultural data; integrated Water–Energy–Food management; long-term climate scenarios in investment; appropriate digital and early-warning tools; climate finance; attention to smallholders and female farmers.



The OIC is not a monolithic bloc

The three-cluster classification identifies distinct binding constraints — water scarcity and thermal acceleration; chemical footprint and demographic gap; fundamental infrastructure deficits — so action must be tailored.



The identification–implementation gap is the decisive constraint

Information and strategies are increasingly available; systematic use in investment, budgets and local implementation is not.



Resilience is a dynamic, long-term capacity

Investing in risk-informed planning, aligned incentives and implementation is far less costly than absorbing recurrent losses.



Thank you

Questions and discussion

Promoting a Climate-Resilient Agriculture Sector against Climate Change in OIC
Member Countries — Draft Research Report

COMCEC Coordination Office · 2026

