



WATER-ENERGY-LAND USE LINKAGES

Nexus solutions for
a climate resilient Central Asia

NEXUS Assessment Methodology

Draft v.8

Nexus-Based Screening of Agricultural Technologies in Central Asia



WATER | ENERGY | LAND | FOOD

Presentation of the Phase I (ag techs) - 18 September 2026

Supported by:



based on a decision of
the German Bundestag

Unlocking Greater Transition Impact Through a Nexus Approach

Connecting Country Needs with Technology Impacts



Agriculture Faces Large Regional Disparities in Water, Land, Energy and Infrastructure

About 90% of river runoff forms in the highlands of Kyrgyzstan and Tajikistan

Irrigated plains and the main water withdrawals are concentrated in Uzbekistan, Turkmenistan and southern Kazakhstan

Water, energy and food systems are interconnected within and across countries, creating shared opportunities and risks





Phased Methodology Development: From Primary Production to Food Processing

TC SCOPE

PHASE 1: AGRICULTURE

Field · farm · direct
Impact on resource



PHASE 2: FOOD PROCESSING (yet to be developed)

Post-harvest handling, aggregation, storage, processing



Question to EBRD: What Are the Top 10 Food Processing Technologies Financed by EBRD in the Last 10 Years?



Technology - Country Fit: How well does the technology respond to the country's needs?

1. What does the technology affect?

Magnitude and direction of its impact across the Nexus pillars

2. What does the country need?

Level of pressure, vulnerability or priority need across the same pillars

3. Do they match?

The stronger the alignment between technology impact and country need, the higher the score

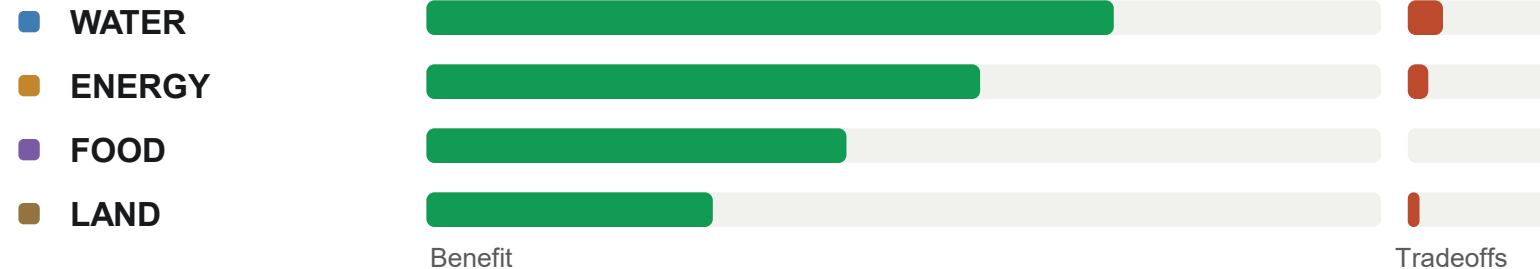


Technology evidence does not change from country to country. The country profile does not depend on the technology selected.



Technology score

One technology can affect multiple Nexus pillars, often with both positive and negative impacts



A single composite indicator can hide the accompanying trade-off: the purpose of assessment is a system of impacts



E.g., drip irrigation can raise water use efficiency and at the same time increase total withdrawal through the rebound effect.
Both impacts are considered.



The methodology is based on a robust evidence by:



JRC Publications

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Science is behind every

score: the Nexus assessment is grounded in the EC JRC evidence library, drawing on 600+ meta-analyses and 5,600+ quantified effects across agricultural practices and sustainability outcomes.

The JRC farming practices evidence library

Not an expert opinion, but **a systematic and traceable evidence base** linking agricultural technologies to quantified impacts on water, energy, land, inputs, and productivity.

As the Programme progresses, **investor-level MRV systems will generate and feed new data** into the database, continuously strengthening its evidence base, accuracy, and relevance.



The evidence base is organized at the *technology × indicator* pairs

488 “technology × indicator” pairs

39 measurable indicators

4 NEXUS pillars

1955 observations structured in the database



Example, *No Till* impacts:

Water	Productivity	Consumption	Quality	Conservation
Energy	Consumption	Productivity	Embedded	Renewable
Land	Soil health	Physical quality	Degradation	Land use
Food	Production	Sustainability	Nutritional value	

Each evidence cell carries 4 calculated inputs:

1. Direction of the effect: benefit / trade off
2. Effect magnitude: observed effect
3. Study count behind the estimate
4. Range across the evidence

Technology matrix

43 technologies · benefit and harm shown apart

SORT BY ⓘ

Benefit

Harm

Net

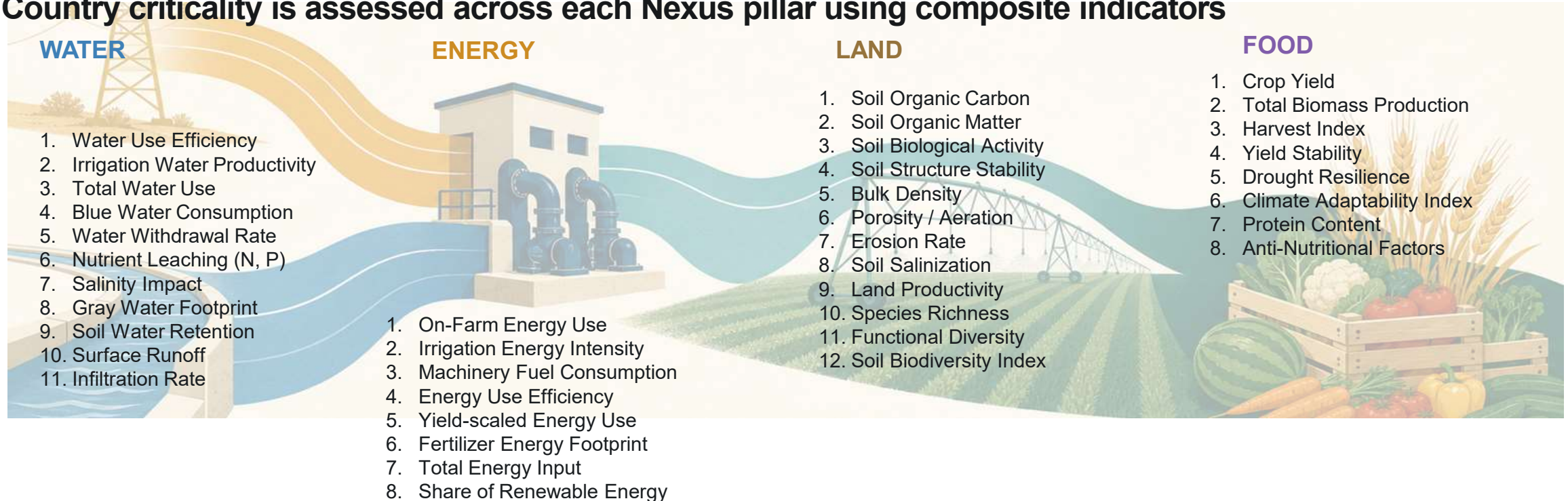
Coverage

		IMPACT STRUCTURE	← HARM	0	BENEFIT →	BEN	COV
1	No-Till / Zero Tillage	<div><div></div><div></div><div></div><div></div></div>	-20		<div><div></div></div>	267	<div><div></div></div>
	Soil & Tillage						
2	Mulching (plastic/straw)	<div><div></div><div></div><div></div><div></div></div>	-93		<div><div></div></div>	256	<div><div></div></div>
	Water Management tradeoff						
3	Agroforestry Systems	<div><div></div><div></div><div></div><div></div></div>	.		<div><div></div></div>	230	<div><div></div></div>
	Crop & Rotation						
4	Drip Irrigation	<div><div></div><div></div><div></div><div></div></div>	-7		<div><div></div></div>	228	<div><div></div></div>
	Water Management						
5	Cover Crops / Catch Crops	<div><div></div><div></div><div></div><div></div></div>	-3		<div><div></div></div>	227	<div><div></div></div>
	Crop & Rotation						



Country Nexus Diagnostic (= Criticalities)

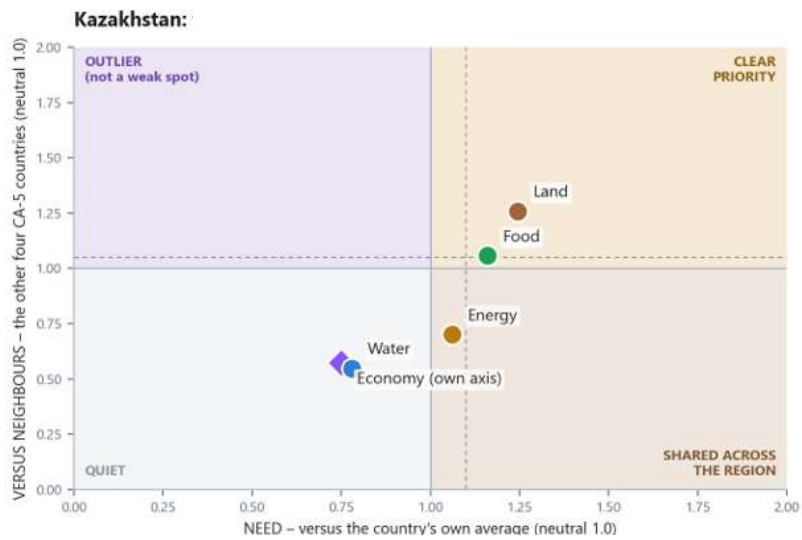
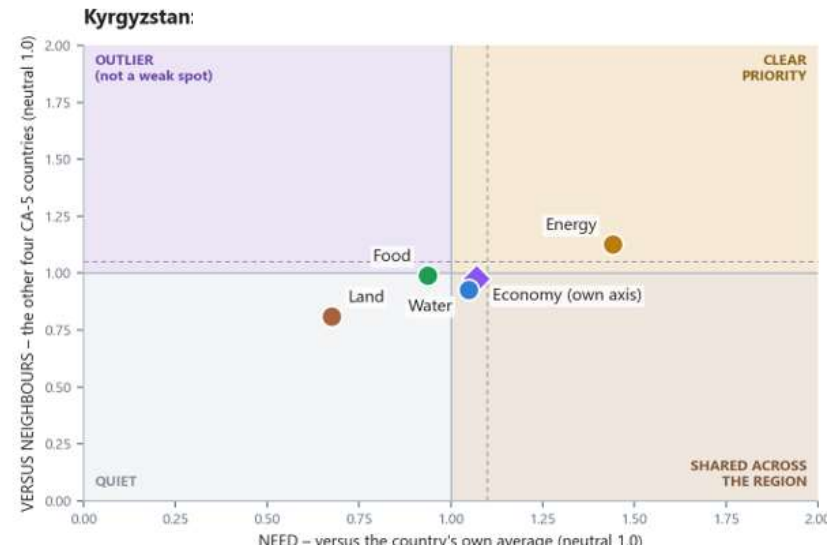
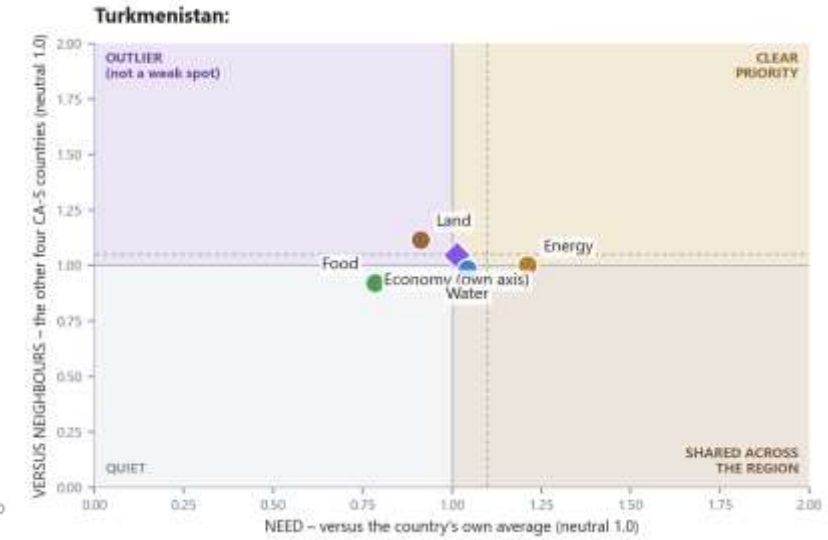
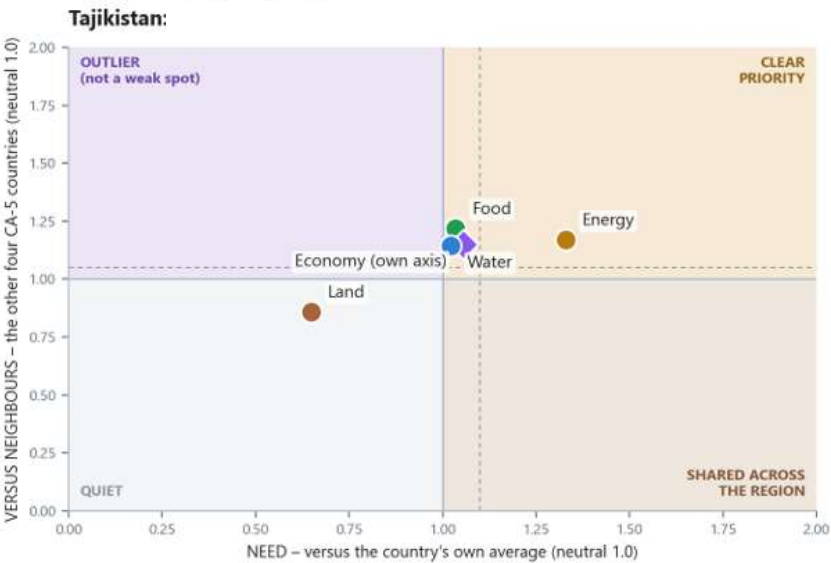
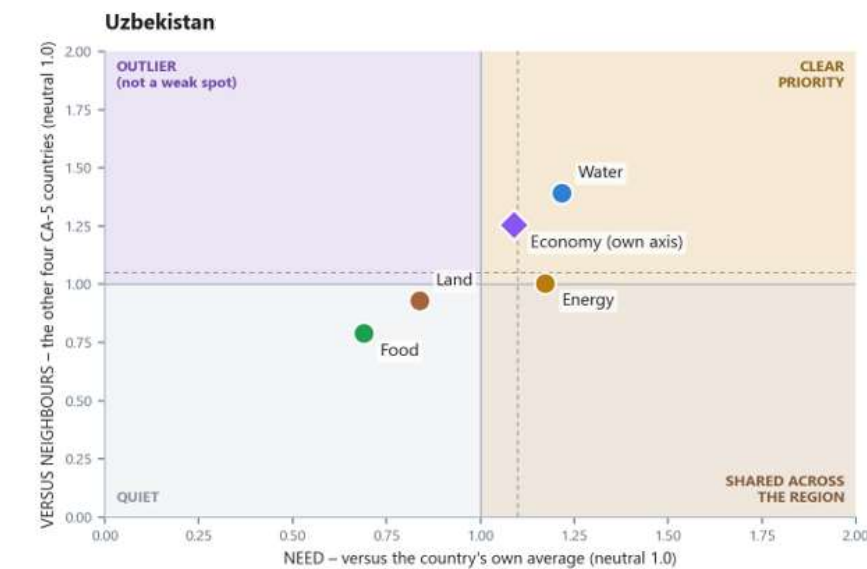
Country criticality is assessed across each Nexus pillar using composite indicators



Official sources of data: FAO, FAOSTAT, FAOSTAT FBS, FAO GSOCmap, UN SDG, World Bank WDI.

The methodology applies a **percentile-based** framework to **compare indicators consistently across different metrics**. The methodology is flexible and can **incorporate national datasets** where available.

Approach to Country Nexus Diagnostics: each criticality signal is converted into a percentile



Organisation for Economic Co-operation and Development

DOCUMENT CODE

For Official Use

English - Or. English

Quantitative Analysis

Nexus Hotspots in Central Asia: Mapping Water, Energy and Land use Risks to Guide Climate-Resilient Policy and Investment

Business Case

Atameken Agro, Kazakhstan



6 GPS-gearred tractors

27 combine harvesters for No Till

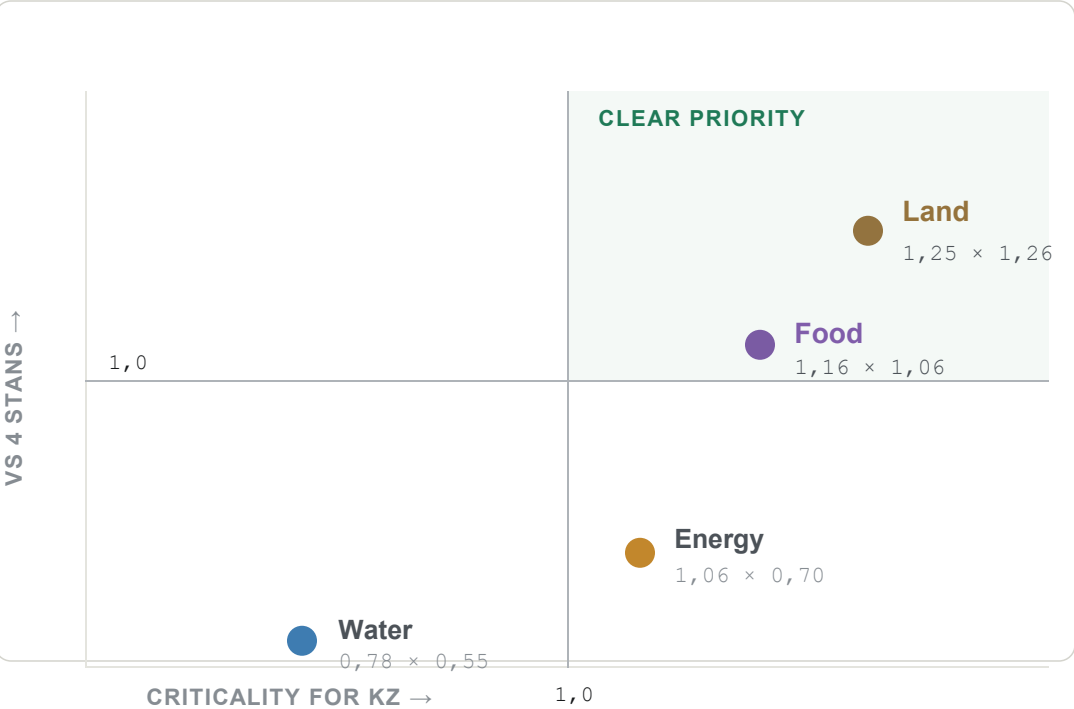
3 sprayers

1 forage harvester



Kazakhstan's priorities: land and food

At the aggregate level KZ stands out for elevated pressure on its **land resources** and **food** system.



NEXUS PILLRS	COUNTRY CRITICALITY	COMPARED TO CA	READ
Land	1,25	1,26	CLEAR PRIORITY
Food	1,16	1,06	CLEAR PRIORITY
Energy	1,06	0,70	not a priority
Water	0,78	0,55	not a priority

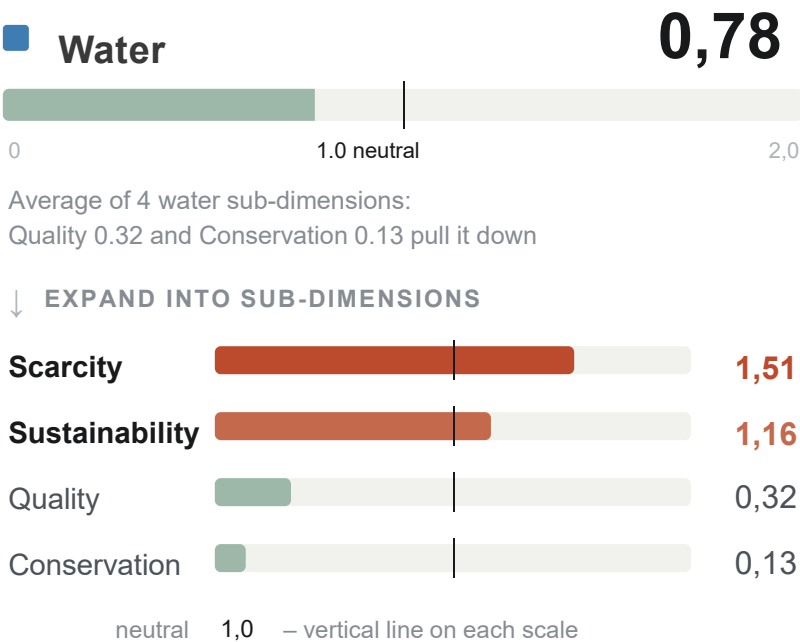
The priorities show where the **country context** makes a technology's effect particularly significant.



Why Granularity Matters: Aggregated Resource Needs Can Hide Other Bottlenecks

KAZAKHSTAN'S KEY CRITICAL POINTS ≥ 1.10

SUB-DIMENSION	KZ	VS. 4 STANS	READING
Land use efficiency	1,91	1,59	ACUTE · EXCEPTIONAL
Land degradation	1,76	1,10	CLEAR PRIORITY
Energy intensity	1,60	0,99	pressure shared across the region
Soil health	1,52	0,95	pressure shared across the region
Water scarcity	1,51	0,93	INSIDE A “QUIET” BLOCK
Food production	1,16	1,18	CLEAR PRIORITY





Effects Supported By The Evidence

Soil biodiversity · no-till	+78,5 %	1 obs.
Climate resilience · no-till	+54,0 %	1 obs.
Greenhouse gas emissions · pulses	-60,0 %	3 obs.

N and P leaching · pulses	-44,2 %	10 obs.
Grey water footprint · pulses	-44,2 %	10 obs.
Total biomass · pulses	+39,5 %	7 obs.

WHERE A TRADE-OFF EXISTS

Land use: return per hectare -5.0% under no-till (2 obs.).

Physical soil quality: bulk density +13.0% (4 obs.) – mixed.

Sources: expert note on Atameken-Agro; NexusEngine



STEP 2: HOW WELL THE PROJECT MEETS THAT NEED?

NEXUS Assessment

III · APPLICATION

Investment package has a clear positive Nexus profile

CLIENT **Kazakhstan**

T34 GPS-Guided

T01 No-Till

T21 Pulses Integration

RESOURCE ASSESSMENT OF THE PACKAGE · 2 VECTORS

– TRADE-OFF

11,3

BENEFIT +

357,2

Trade-off is shown separately, concentrated in the “Land” pillar

DISTRIBUTION OF BENEFIT ACROSS NEXUS PILLARS



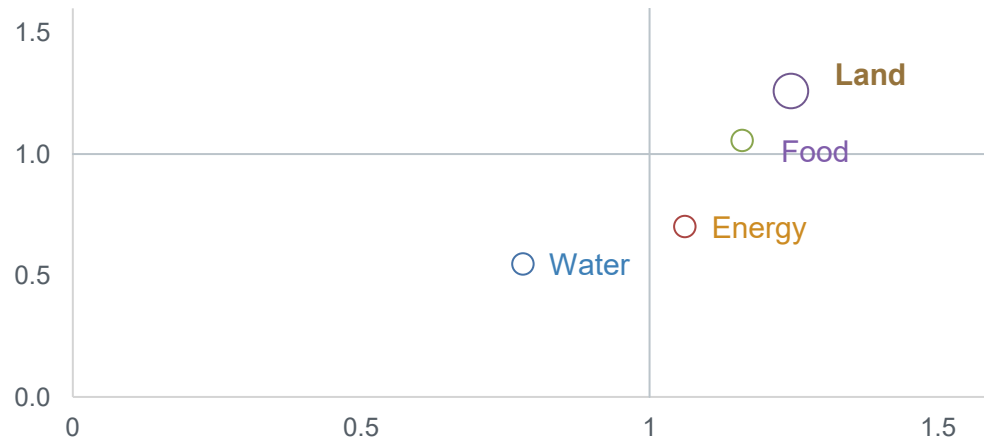
Atameken Agro’s investment generates benefits across all 4 Nexus pillars.

The largest shares fall within food and land – Kazakhstan’s critical Nexus points.



Land: a Kazakhstan priority and 27.1% of AA's positive impact

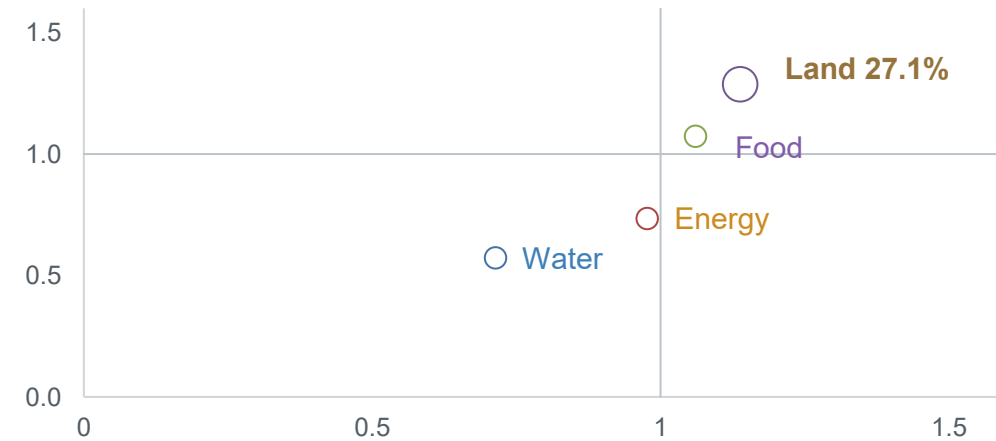
COUNTRY PROFILE



X: need within the country

Y: difference from the four CA neighbours

PROJECT ALIGNMENT



X: criticality relative to the world

Y: difference from the four CA neighbours

1. Identify the “Land” priority in the country profile

2. Check the package's land effect: benefit and trade-off separately

3. Compare the priority with its 27.1% benefit share

How Country Priorities Are Linked to Technology Financing Decisions:

1. **Country Criticality** (identifies hotspots)
 2. **Tech Impact** (quantifies change)
 3. **Nexus Alignment** (measures fit)
 4. **Investment Relevance**
-

Team Behind the Screens



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Thank you for your attention

We look forward to your questions and feedback on the methodology

