

32ND INTERNATIONAL INPUT-OUTPUT ASSOCIATION CONFERENCE

Cereal Systems & Food Security in Senegal

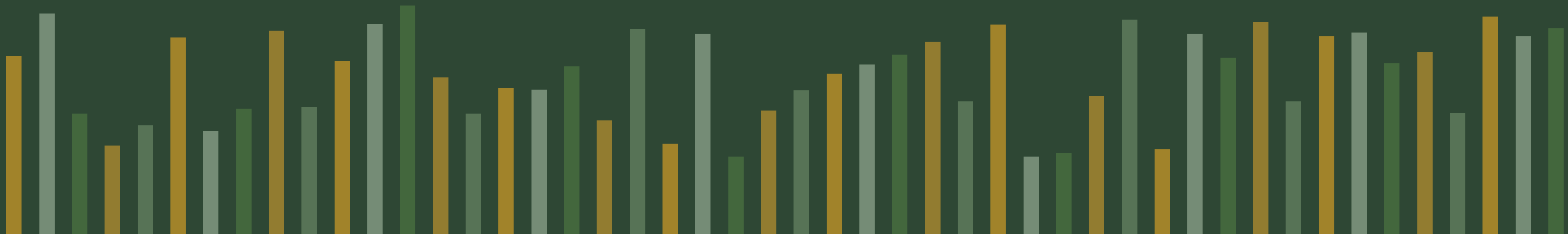
A recursive-dynamic, economy-wide and distributional analysis

RICE

MILLET

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Senegal's Food Security Challenge

RESEARCH QUESTION

Which cereal strategy delivers the greatest gains for growth, resilience, food security and poverty reduction?

R Extreme Rice Dependency

- Rice consumption exceeds 80 kg per capita per year
- Domestic production remains insufficient
- Heavy reliance on imports
- Exposure to global food-price shocks

M Millet's Untapped Potential

- Supports rural livelihoods
- Highly climate-resilient
- Strengthens food security
- Underinvested compared with rice

Senegal's Dual Cereal System

Rice System

URBAN

Irrigated production

Commercial farming

Strong market integration

Urban-oriented consumption

Import dependent

Millet System

RURAL

Rainfed production

Smallholder farming

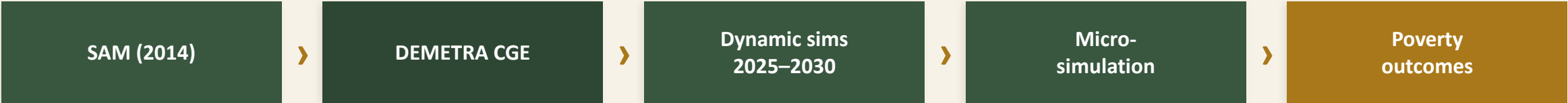
Subsistence-oriented production

Rural food security

Climate resilience

Key message Two complementary systems — rice anchors urban demand and market integration, while millet sustains rural livelihoods, food security and climate resilience.

Model Framework & Policy Experiments



FIVE POLICY EXPERIMENTS (2025-2030)

S1	Rice productivity growth	+10%
S2	Millet productivity growth	+10%
S3	Rice import price shock	+15%
S4	Diversification package	combined
S5	Rice value-chain upgrading	Armington 1.5→2.5

DEMETRA CGE MODEL

- Dynamic CGE built on the 2014 SAM
- Projected annually to 2030
- 61 activities · 70 commodities
- 14 regions
- Linked household microsimulation

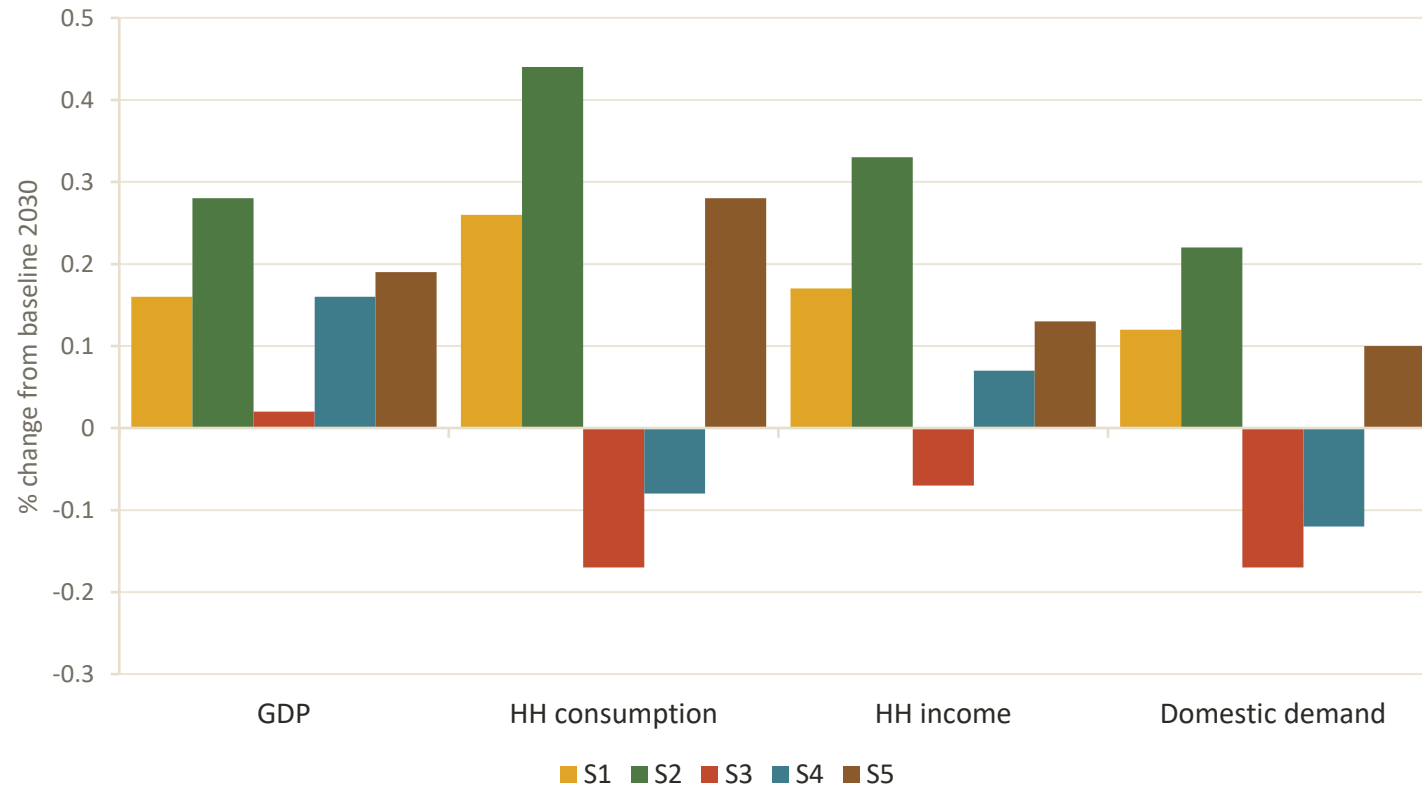
Outcomes contrasted against the baseline 2030.

Executive Summary Dashboard

Strategic objective	Best scenario	Evidence from results
GDP growth	S2	GDP +0.28%, household consumption +0.44%
Household welfare	S2	Highest income and consumption gains
Rice production	S5	Rice output +26.0%
Rice competitiveness	S5	Exports +37%, imports –7.4%
Poverty reduction	S1	Largest reduction in poverty indicators
Food-system resilience	S4	Most balanced performance
Rural income growth	S5	Strongest gains in key rural regions

No silver bullet. Different policy objectives require different interventions — the right strategy depends on the goal.

Macroeconomic Impacts



TAKEAWAY

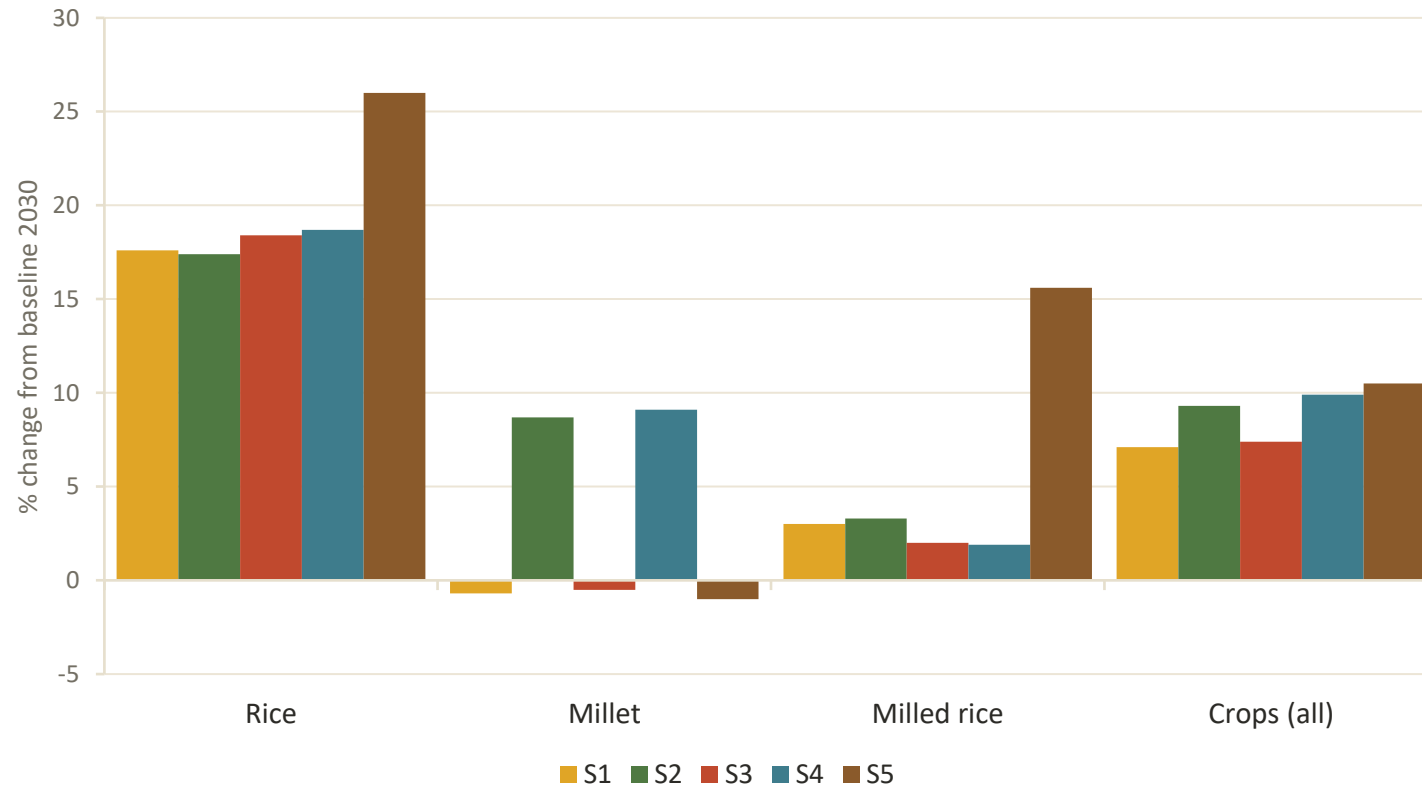
Millet productivity (S2) delivers the largest economy-wide welfare gains.

- S2 gives the biggest GDP gain (+0.28%) and consumption gain (+0.44%)
- Import price shocks (S3) cut welfare and domestic demand
- Rice value-chain upgrade (S5) lifts GDP +0.19% and consumption +0.28%

SCENARIOS

- S1** Rice productivity +10%
- S2** Millet productivity +10%
- S3** Rice import price +15%
- S4** Diversification package
- S5** Rice value-chain upgrade

Production Effects



TAKEAWAY

Value-chain upgrading (S5) produces the strongest rice-sector transformation.

- S5 raises rice production +26% and milled rice +15.6%
- Millet productivity (S2) lifts millet output +8.7%
- Diversification (S4) generates broad-based crop expansion

SCENARIOS

- S1** Rice productivity +10%
- S2** Millet productivity +10%
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Rice Value-Chain Upgrading

▲ +26.0%

Rice production

▲ +15.6%

Milled-rice production

▲ +37.0%

Rice exports

▼ -7.4%

Rice imports

▼ -3.5%

Rice price

▼ -3.9%

Milled-rice price

INTERPRETATION Better quality, stronger consumer acceptance and improved milling strengthen the domestic rice value chain — raising competitiveness while cutting import dependence.

Trade Effects

% change from baseline 2030

	Exports					Imports				
Commodity	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Crops (all)	+11.3%	+11.3%	+11.0%	+11.0%	+11.6%	-0.8%	-0.8%	-5.0%	-6.7%	-3.1%
Rice	+35.5%	+35.5%	+35.2%	+35.1%	+37.0%	-1.1%	-1.3%	-12.6%	-17.6%	-7.4%
Other food crops	-0.4%	-0.4%	-0.4%	-0.3%	-0.5%	-1.8%	-2.1%	+0.1%	+0.8%	-0.9%
Cash crops	-0.2%	0.0%	-1.1%	-1.1%	-0.9%	0.0%	+0.4%	-0.9%	-0.9%	-0.3%
Livestock	-0.2%	0.0%	-1.3%	-1.4%	-1.3%	-1.0%	-1.4%	+0.4%	+0.8%	-0.1%
Forest	-0.5%	-0.9%	-0.2%	-0.2%	-0.9%	+0.6%	+0.9%	+0.1%	+0.2%	+1.1%
Fish	-1.0%	-1.2%	-0.9%	-0.9%	-1.8%	+0.4%	+0.4%	+0.2%	+0.3%	+0.5%
Mining	-0.7%	-0.9%	-0.6%	-0.7%	-1.6%	0.0%	-0.1%	-0.1%	-0.1%	0.0%
Industries	-0.4%	-0.2%	-1.0%	-1.0%	-1.1%	+0.1%	+0.1%	-0.4%	-0.4%	-0.5%
Processed meat	-0.3%	-0.5%	-0.5%	-0.5%	-0.9%	+0.2%	+0.3%	0.0%	+0.2%	+0.4%
Other proc. food	-0.4%	+0.8%	-2.8%	-2.7%	-1.4%	0.0%	-0.3%	-1.4%	-2.2%	-3.9%
Petroleum	-0.5%	-0.7%	-0.4%	-0.5%	-1.2%	+0.1%	+0.3%	-0.2%	-0.1%	+0.2%
Chemicals	-0.1%	-0.2%	-0.1%	-0.1%	-0.2%	+0.1%	+0.2%	-0.1%	0.0%	+0.3%
Other manufact.	-0.5%	-0.9%	-0.3%	-0.4%	-1.1%	+0.1%	+0.1%	-0.2%	-0.1%	+0.1%
Services	-0.3%	-0.2%	-0.7%	-0.7%	-1.1%	+0.3%	+0.5%	-0.1%	+0.1%	+0.6%

Key messages **Diversification (S4) cuts rice imports most (-17.6%)** • **Value-chain upgrade (S5) drives competitiveness (exports +37%)** • **Productivity growth lifts farm trade broadly**

Food Security Outcomes

% change from baseline 2030

	Domestic demand					Domestic prices				
Commodity	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Crops (all)	+5.4%	+8.1%	+5.9%	+8.9%	+9.6%	-2.1%	-4.4%	+0.1%	-1.1%	-1.6%
Rice	+13.3%	+13.1%	+14.4%	+14.9%	+23.5%	-4.6%	-4.6%	0.0%	+2.1%	-3.5%
Millet	-0.7%	+8.6%	-0.5%	+9.0%	-1.0%	+0.2%	-8.0%	+0.2%	-7.9%	+0.5%
Other food crops	+9.7%	+9.6%	+10.6%	+11.1%	+17.4%	-0.4%	-0.1%	+0.3%	+0.7%	-0.1%
Cash crops	-0.1%	+0.3%	-1.1%	-1.1%	-0.6%	0.0%	+0.2%	-0.1%	-0.1%	-0.2%
Livestock	-0.6%	-0.7%	-0.5%	-0.3%	-0.7%	-0.2%	-0.4%	+0.3%	+0.5%	-0.1%
Forest	+0.1%	+0.1%	0.0%	0.0%	+0.2%	+0.2%	+0.4%	0.0%	+0.1%	+0.1%
Fish	-0.3%	-0.3%	-0.4%	-0.3%	-0.6%	+0.3%	+0.3%	+0.2%	+0.2%	+0.2%
Mining	-0.3%	-0.5%	-0.3%	-0.4%	-0.8%	-0.1%	0.0%	0.0%	0.0%	-0.4%
Industries	+0.1%	+0.5%	-0.2%	+0.1%	+0.6%	-0.1%	-0.2%	+0.2%	+0.2%	-0.4%
Milled rice	+2.8%	+3.0%	+2.0%	+2.0%	+15.6%	-1.8%	-1.7%	+2.8%	+5.1%	-3.9%
Processed food	+0.1%	+1.0%	-0.5%	+0.2%	-0.1%	-0.2%	-0.6%	+0.5%	+0.5%	-0.6%
Services	-0.1%	0.0%	-0.2%	-0.2%	-0.2%	+0.2%	+0.3%	+0.1%	+0.1%	+0.1%
Hotel	+0.1%	+0.3%	-0.3%	-0.2%	0.0%	0.0%	-0.1%	+0.2%	+0.3%	+0.1%

Key messages Productivity cuts food prices — millet -8.0% under S2 • Import shock (S3) raises food prices • Diversification (S4) strengthens resilience

Regional Income by Agro-Ecological Zone

Agro-ecological zone	S1	S2	S3	S4	S5
Irrigated Zone	+0.10%	+0.18%	+0.08%	+0.20%	+0.20%
Casamance	+0.33%	+0.43%	+0.28%	+0.43%	+0.65%
Groundnut Basin	+0.34%	+0.41%	+0.35%	+0.49%	+0.71%
Other Regions	+0.25%	+0.34%	+0.12%	+0.23%	+0.38%

Average household income change vs baseline 2030 (%)

KEY FINDINGS

- S5 generates the largest income gains in the Groundnut Basin (+0.71%) and Casamance (+0.65%)
- S2 (millet productivity) delivers broad-based regional gains
- S4 (diversification) provides the most balanced regional outcomes
- The irrigated-zone average masks strong gains in Matam (+2.2%) and losses for Saint-Louis urban households (−1.5%)

Factor Returns



TAKEAWAY

Benefits accrue primarily to agricultural producers and rural households.

- S5 lifts agricultural capital returns +4.11% — the largest factor gain
- Unskilled labour (+1.19%) and land (+0.90%) also gain under S5
- Returns to skilled labour and non-agricultural capital are broadly flat

SCENARIOS

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Poverty Impacts

% change from baseline 2030 · negative = poverty reduction

Scenario	National			Rural			Urban		
	Incidence	Gap	Severity	Incidence	Gap	Severity	Incidence	Gap	Severity
S1	-3.05	-3.25	-3.74	-3.28	-3.41	-3.87	-1.75	-2.39	-3.10
S2	-1.84	-2.11	-2.39	-2.17	-2.38	-2.70	0.00	-0.65	-0.84
S3	+0.52	+1.61	+1.94	+0.60	+1.39	+1.68	+0.08	+2.86	+3.23
S4	-2.12	-2.44	-2.74	-2.50	-3.08	-3.42	+0.05	+1.08	+0.75
S5	-0.60	-0.54	-0.54	-0.70	-0.66	-0.67	0.00	+0.12	+0.08

KEY FINDINGS

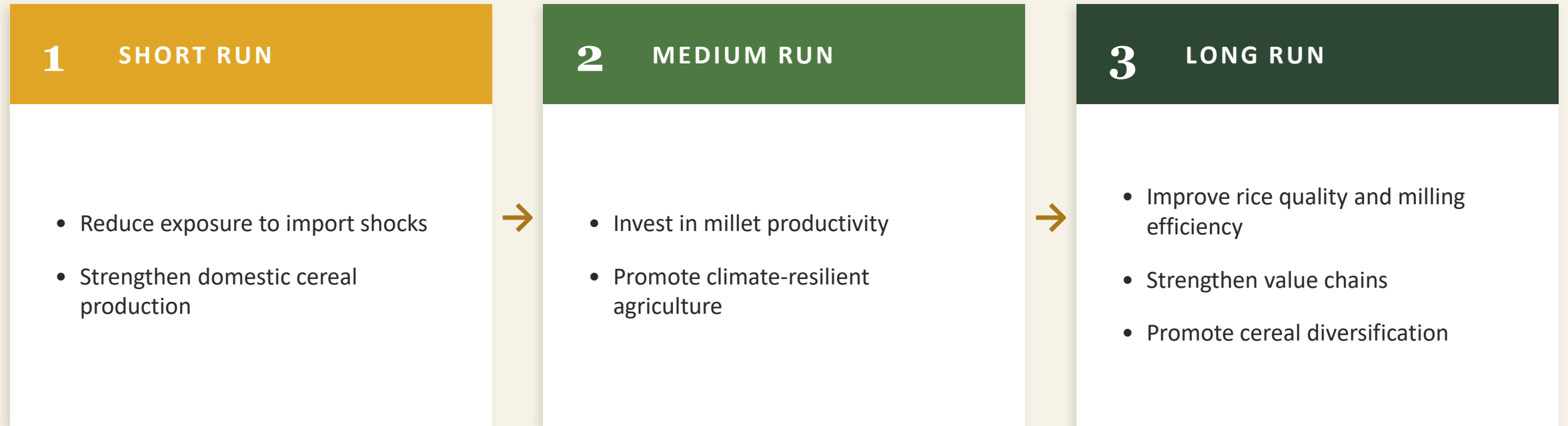
- Rice productivity (S1) generates the strongest reductions in poverty depth and severity
 - Diversification (S4) provides balanced poverty reduction and resilience
- Import price shock (S3) increases poverty incidence, gap and severity
 - Productivity gains reduce both the share and the intensity of poverty

Scenario Comparison



Relative performance: ●○○ limited ●●○ moderate ●●● strong

Policy Messages



To achieve balanced, resilient growth, Senegal must pivot from short-run shock responses toward a diversified, efficiency-driven value-chain strategy.

CONCLUSIONS

Three findings for Senegal's cereal strategy

1

Millet

Millet productivity generates the largest economy-wide welfare gains.

2

Rice

Rice value-chain upgrading produces the strongest competitiveness effects.

3

Diversify

Diversified cereal systems provide the most resilient pathway to food security and poverty reduction.