AgriConnect LEADS Learning Series

Evidence for Better Jobs in Farming and Agribusiness

Episode #2: Making Irrigation Deliver

WORLD BANK GROUP
LEADS | LEARN. ADAPT. SCALE.

WORLD BANK GROUP
INSTITUTE FOR ECONOMIC DEVELOPMENT

Agenda

Irrigation in the wider institutional context

Florence Kondylis
Research Manager
DEC Research, WBG

Curated evidence that supports program design

Douglas Collin
Professor of Economics
Tufts University

John Loeser
Economist
DEC Impact, WBG

Reflections on clients' evidence needs

Richard Colback
Global co-Lead Water
for Food, WBG

Mission AgriConnect:

Building the right ecosystem to transform farming and the agrifood sector for millions

1. Strengthening Foundations

- Rural infrastructure
- Natural capital
- Digital ag solutions
- Research extension and skills

Focusing on value chains:

- Business development for cooperatives
- Better inputs (seeds, fertilizer, machinery)

2. Revamping Policies

- Policy alignment (agriculture & food policies, standards, trade facilitation, land tenure)
- Repurposing of agricultural subsidies to reduce environmental impact, foster healthier diets, and create jobs

3. Finance Solutions:

- Derisking instruments (digital finance, guarantees, ag insurance)
- Climate finance (outcome bonds, paving the way for carbon finance)
- Partnerships with private sponsors and philanthropies

Ensuring inclusion as guiding principle for all investments

Six scalable solutions to help farmers move up the value chain and fosters thriving agribusinesses

Aggregation Models	AgTech Solutions	Physical Infrastructure	Skills, Extension & Research	Building the Financial Ecosystem for Farmers	Policy Reforms
• Build capacity for cooperatives (POs) • Farmer-led aggregation models ("productive alliances") • Anchor firm models to link smallholders to value chains	• Bundled AgTech solutions • Investments in Digital Public Infrastructure • Seed and VC financing • Digital footprints that unlock farmers' access to finance, markets and knowledge	• Integrated spatial approaches • PPP models to scale irrigation infrastructure, and farmer-led irrigation • Energy solutions for agriculture (irrigation; cold chain infrastructure), incl. with ESMAP, M300	• Investing in critical agribusiness sector skills gap • Standardizing farmers' skills • Expanding the adoption of innovations through public-private Agriculture Research Systems	• Revamped engagement with public agriculture banks • Scaling agricultural insurance • Mobilizing financial institutions to lend to agriculture/agribusiness • Leveraging debt swaps, carbon finance for agriculture	• Compacts and policy lending (PfRs, DPOs) • Technical assistance to support policy work and Agriculture Public Expenditure Reviews • Accelerating reforms (Impact Programs /knowledge academies)

Ensuring social inclusion

The Planet Lab Toolkit

Toolkit: Curated operations-oriented evidence to support the design of impactful projects.

Masterclass and Self-paced eLearning

Access here:

https://bit.ly/arico nnect-knowledge

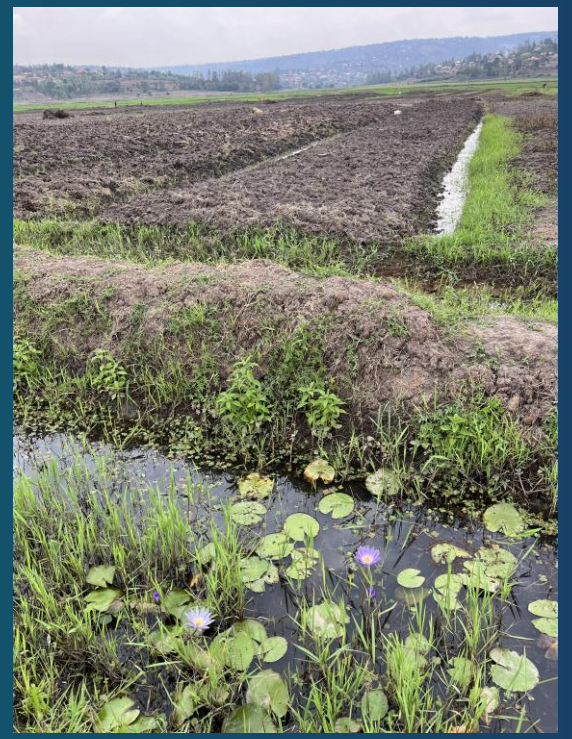
Irrigation, Agricultural Productivity, and Structural Transformation

Douglas Gollin
Professor of Economics, Tufts University

Planet Lab Toolkit: curated evidence to inform program design

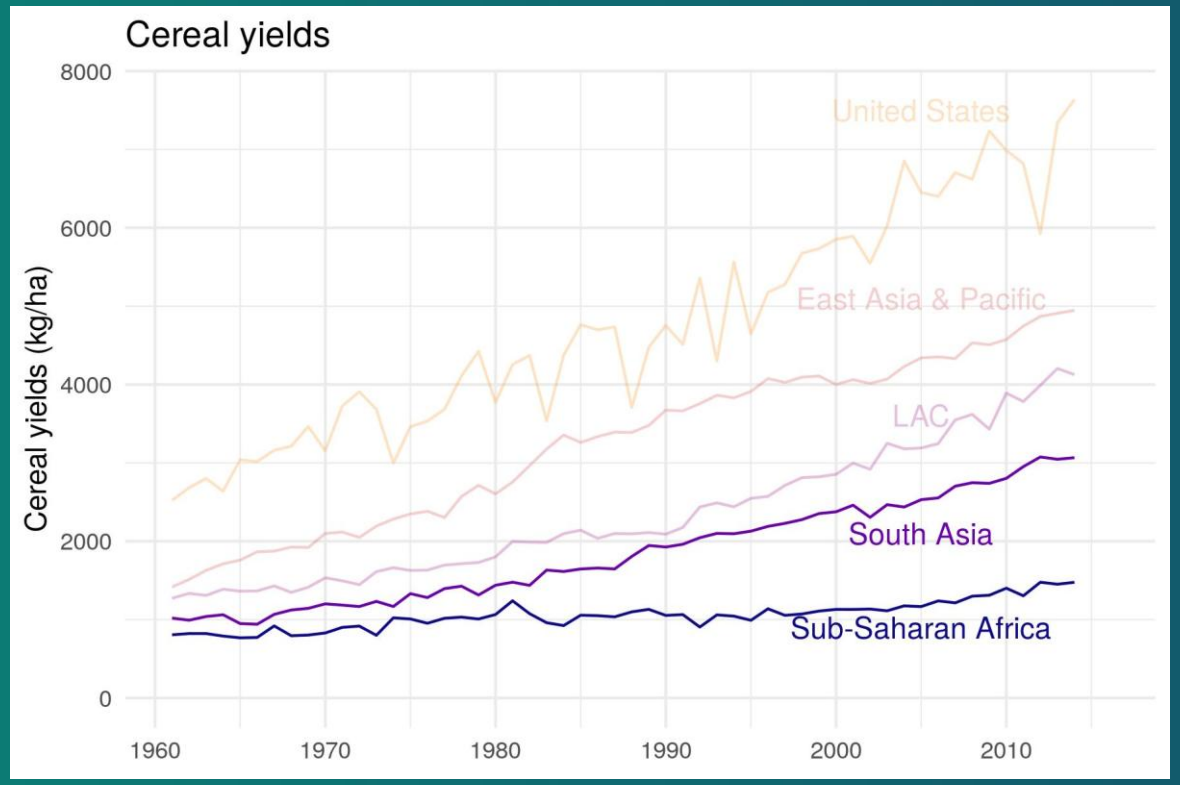
John Loeser
Economist, DEC Impact, WBG

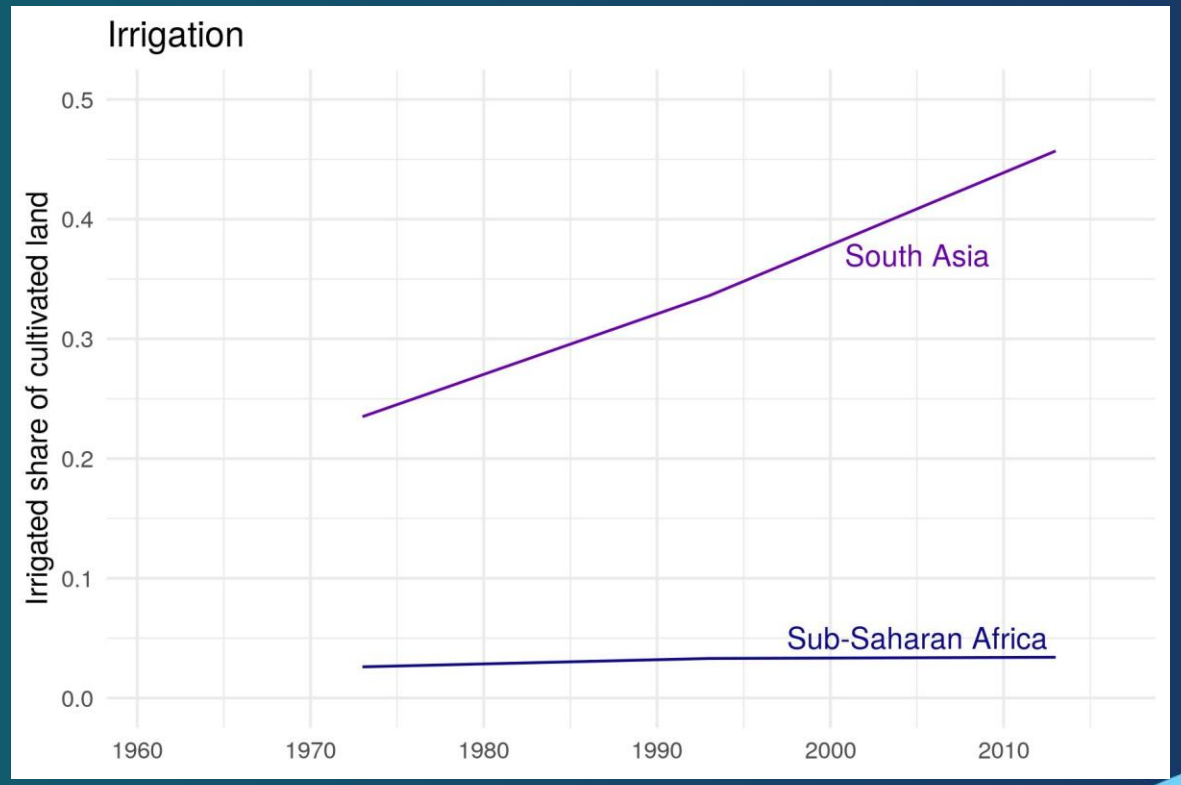
Irrigation is a transformative productive investment that can boost farmers' resilience



Irrigated agriculture increases land productivity by 50%-100%, typically by adding a dry season (Duflo & Pande, 2007; Jones et al., 2022)

A "Blue Revolution": Productivity growth in South Asia tied directly to increased irrigation





30% of post-Green Revolution divergence in cereal yields between Africa and South Asia explained by divergence in irrigation

Public investments in irrigation infrastructure are expensive and must be sustainable

- Large-scale irrigation projects rarely achieve "best-practice" construction cost of $3000/ha (Foster & Briceño-Garmendia (Eds.), 2010)

- Higher costs =
  Higher required returns *
  Higher required utilization *
  Higher required sustainability

- Substantial variation in sustained utilization across irrigation projects, e.g. in Senegal (Cisse et al., 2026)

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Opportunities for impact: Irrigation

1. How can we reduce the **costs** of building irrigation schemes?

2. How can we increase the **returns** to irrigation?

3. How can we increase the **utilization** of public irrigation?

4. How can we increase the **sustainability** of irrigation?

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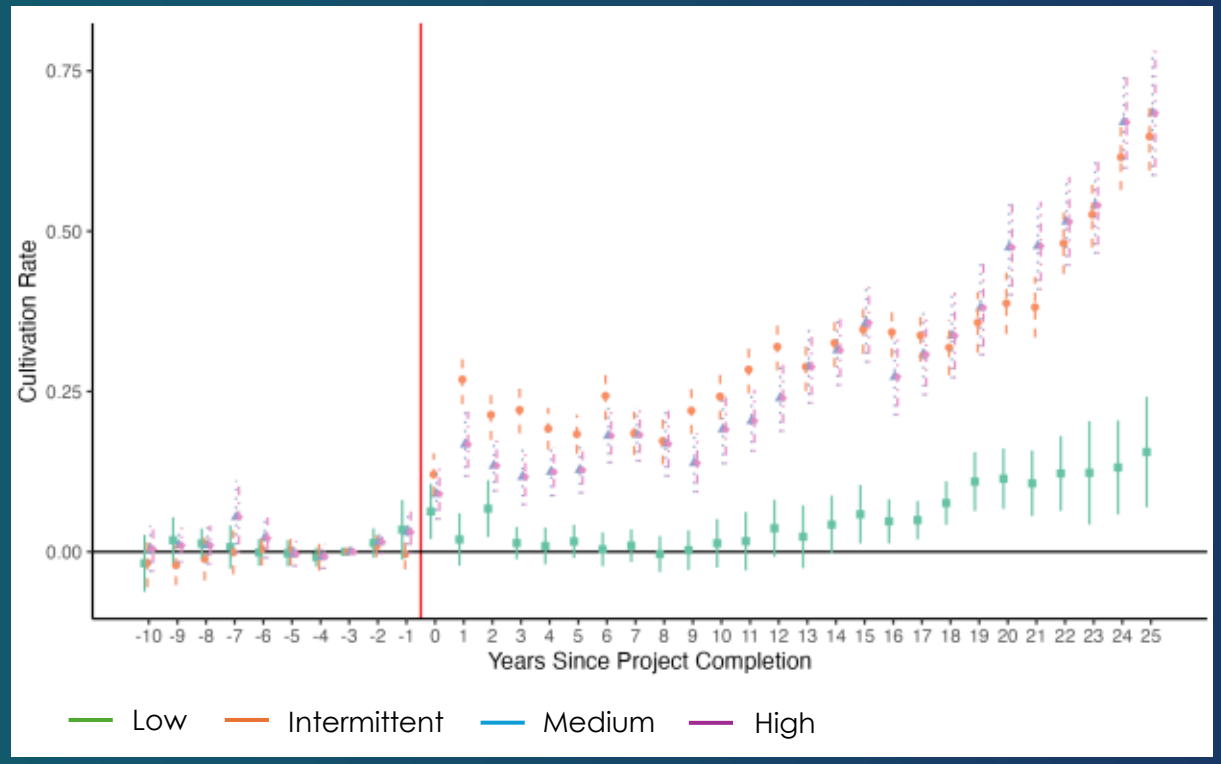
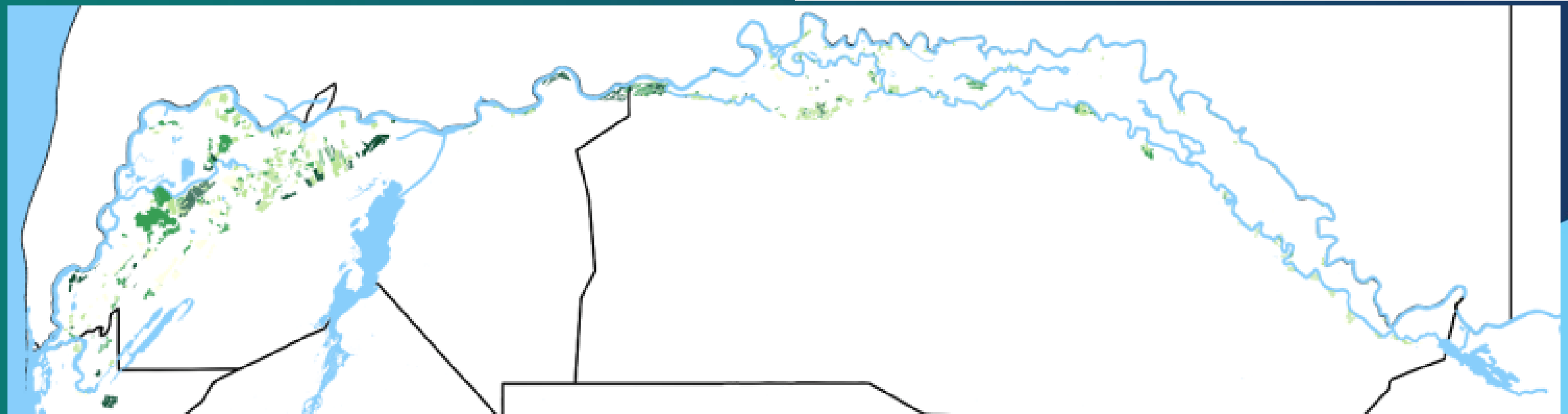
Designing irrigation for success

- Variation in success of irrigation schemes in Senegal River Valley (Cisse et al., 2026)
- High **utilization** causes high **sustainability** ("Infrastructure death spiral")
- High **utilization** when **infrastructure** management, **land** rights, and source of **capital** are aligned (all private or all public)

Cultivation rate by level of irrigation use

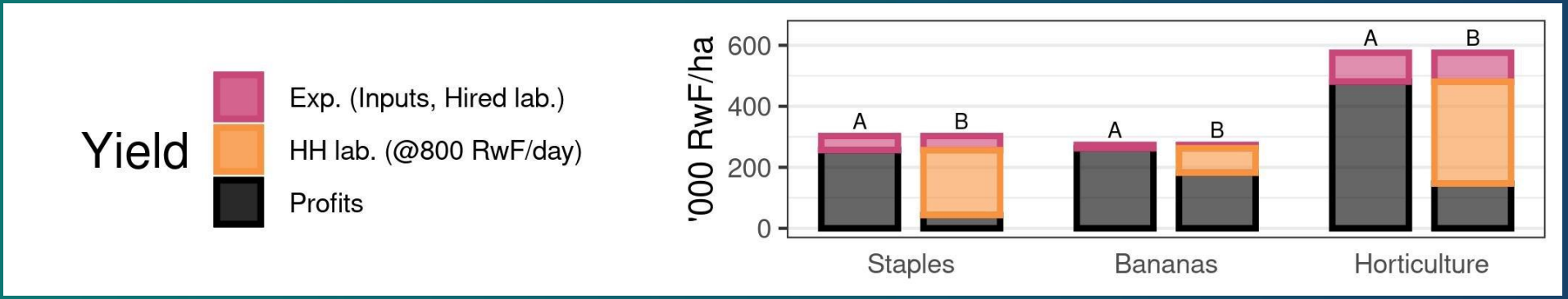




Identifying the causes of underutilized public irrigation infrastructure

If utilization is low, the root causes vary by context:

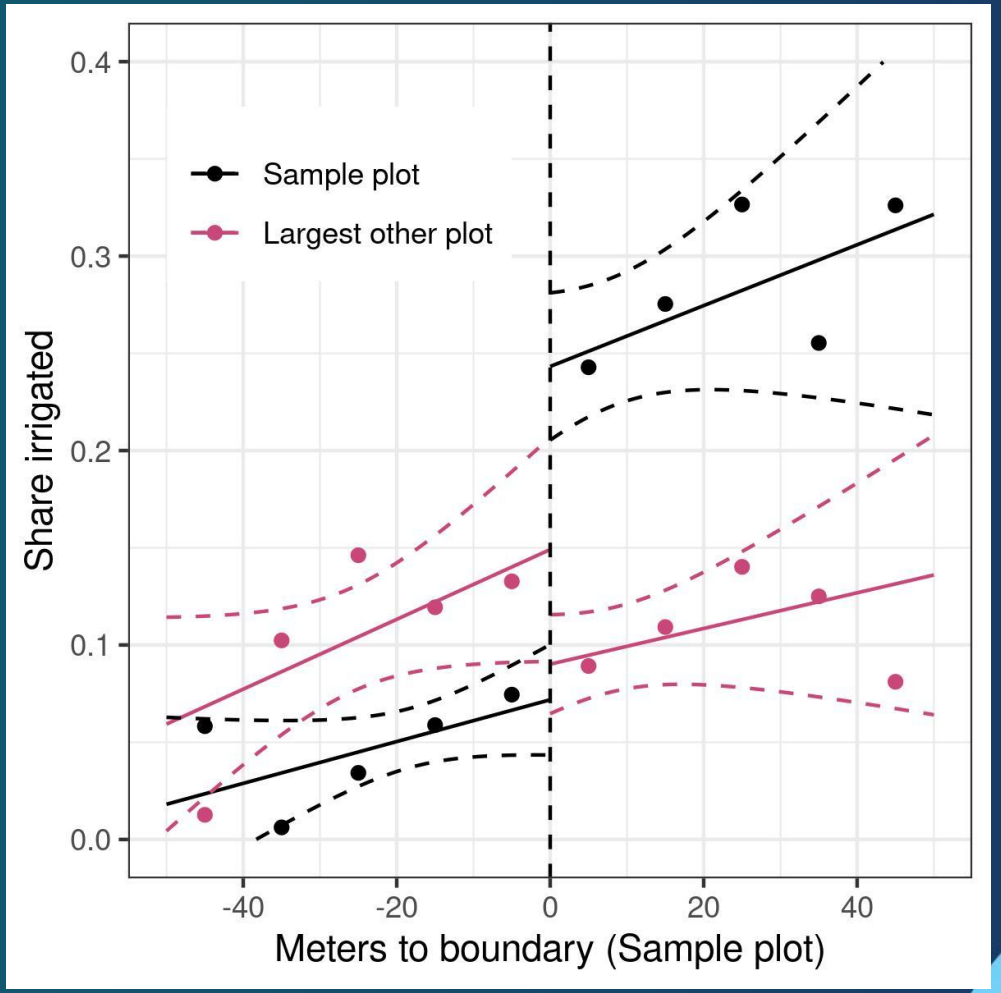
- high **labor** intensity
- thin **land** markets
- low **output prices**
- high **input** costs
- low **information**
- **o&m** failures



(Jones et al., 2022)

Complementary interventions and design choices to realize the transformative potential of public irrigation

- 5 years post-construction, **30% utilization** in hillside schemes due to high **labor** intensity and thin **land** markets (Jones et al., 2022)
- Marshland schemes achieve near **100% utilization**: built on public **land**, rental market allocates land to surplus **labor** households
- Recent titling reforms support hillside sales



Reflections on clients' evidence needs

Richard Colback
Global co-Lead Water for Food, WBG

Q&A: we want to hear from you!!

What are the challenges / solutions you have observed in your projects in making sure irrigation delivers?

Share your feedback on this session

Stay tuned for more!

- **April:** Land reforms and farmer registries
- **May:** Repurposing subsidies
- **TBD**: AgTech solutions

And more to come:

Resilience, Value chain interventions, Access to finance and cooperatives, Scaling Insurance, Standards and traceability

Thank you!

Share your feedback on this session

https://bit.ly/4sldba4

Access from the other evidence products (toolkit, e-learning etc.)

https://bit.ly/ariconnect-knowledge

Irrigation, Agricultural Productivity, and Structural Transformation

Douglas Gollin

Tufts University

Irrigation Learning Event
World Bank
8 April 2026

Irrigation and its impacts

Irrigation can be transformative for farming and rural communities.

- Water is essential for agriculture.
- Water control allows for more productive farming.
- An essential input to the Green Revolution in Asia
- Well documented impacts from canal irrigation in India.
- Good evidence of impact in sub-Saharan Africa.

But these gains are not present on all projects, and not all farmers take up irrigation even when it is available.

- How do we reconcile these two facts?

Irrigation successes

Many papers document the positive impacts of irrigation ina wide range of development contexts.

- Asher et al. (2026) look at irrigation canals in India; other recent papers include Blakeslee et al. (2023); Boudot-Reddy and Butler (2025); Cisse et al. (2025); Jones et al. (2022).
- Key questions:
  - What benefits does irrigation generate?
  - Why is take-up low in many settings?

Irrigation successes, cont.

- Asher et al. (2026) considers impact at a large scale – across 600,000 villages in India.
  - Focuses on canal irrigation and compares adjacent villages (within narrow geographic regions).
  - Looks at those villages that are *just below* the elevation of the canal and compares these villages that are *just above* the canal's elevation.
  - Tightly drawn comparison shows the impact of irrigation canals on agricultural production, crop choices, and long-term patterns of economic growth and urbanization.
  - Argues that irrigation canals played a significant role in India's structural transformation over time.
- How general is this story?
- Need to reflect on some conceptual and theoretical issues.

On-farm impacts of irrigation

Irrigation provides water that is a complementary input to land, labor, and inputs in agriculture.

- Complementarity with land:
  - Extends the length of the growing season (in many but not all locations).
  - Allows for intertemporal reallocation of water.
  - Improves the productivity of land for agriculture.
- Complentarity with labor:
  - Increases demand for labor.
- Complementarity with other inputs:
  - Increases returns to seed, fertilizer, etc.

Technical success does not imply profitability

Irrigation projects often focus on technical (agricultural) outcomes:

- Impact on yield potential for specific crops
- Feasibility of introducing new crops or a second-season crop.

But farmers care about profitability of the entire farm-household enterprise!

- Not just crop output or even agricultural output...
- Profits across all activities, including non-farm enterprises.
- When markets are incomplete, optimal choices for households may deviate from what appears to be profit-maximizing behavior.
- The "agricultural household model" of Singh, Squire, and Strauss (1986) made this point.
- Need to understand the entirety of the household activity portfolio!

Heterogeneity at the farm level

Profitability will vary across individual farmers, even within a scheme.

- Not just a matter of technical impacts (soil conditions, etc.)
- Adoption may also depend on farmer characteristics.
  - Irrigation adoption may require additional capital investments, purchased inputs (seed, fertilizer, herbicide).
  - Farmers facing credit constraints may not be able to make these investmets and purchases.
- Households with limited family labor may not find irrigation profitable (i.e., if hired labor is more costly than family labor).
- Households may differ in their non-farm opportunities and activities.

Heterogeneity at the project level

Questions to ask in planning for irrigation investments:

- Location: is there good market access?
  - Irrigation generally pays highest returns when farmers can use it to grow high-value crops with reliable markets (e.g., horticulture)
  - Is transport available, reliable, and moderately competitive?
- Labor markets: Is there abundant labor, including at peak periods of the agricultural season?
  - Irrigated agriculture tends to require labor; in areas of extensive outmigration, this may not be available.
  - Family labor may already be stretched thin across farm and non-farm activities.
  - Hired labor may not be locally available.

Irrigation canals in India

Consider again the case of India's irrigation canals.

- Asher et al. (2026) find that canals have had a long-lasting impact on agricultural productivity, especially in the dry season.
  - Note that this is a context with an abundant supply of landless labor.
  - In villages that benefited from irrigation, we find substantial in-migration of labor – not immediate, but over decades.
  - No clear effect on wages. (Medium-term in-migration erodes short-term gains.)
  - Biggest long-run economic gains accrue to land owners, rather than workers.
- Would not expect to get the same outcomes in locations with little landless labor or less-well developed markets for output.

Implications

Irrigation can be transformative, but impacts are heterogeneous.

- Technical feasibility does not make success inevitable.
- Missing markets for land, labor, and credit will complicate outcomes.

Successful cases may not be representative!

- When irrigation projects are successful, is this causal?
- Or did projects get placed in locations that were already dynamic?

Benefits are unevenly distributed.

- Land owners will gain; irrigation makes land more productive and more valuable.
- Wages and output prices are set by broader markets; irrigation projects may not be large enough to impact these prices.

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