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Global priorities for agricultural science, technology, and innovation

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Key messages

- Achieving the SDGs will require greater contributions from agricultural science to society, economy, and the environment

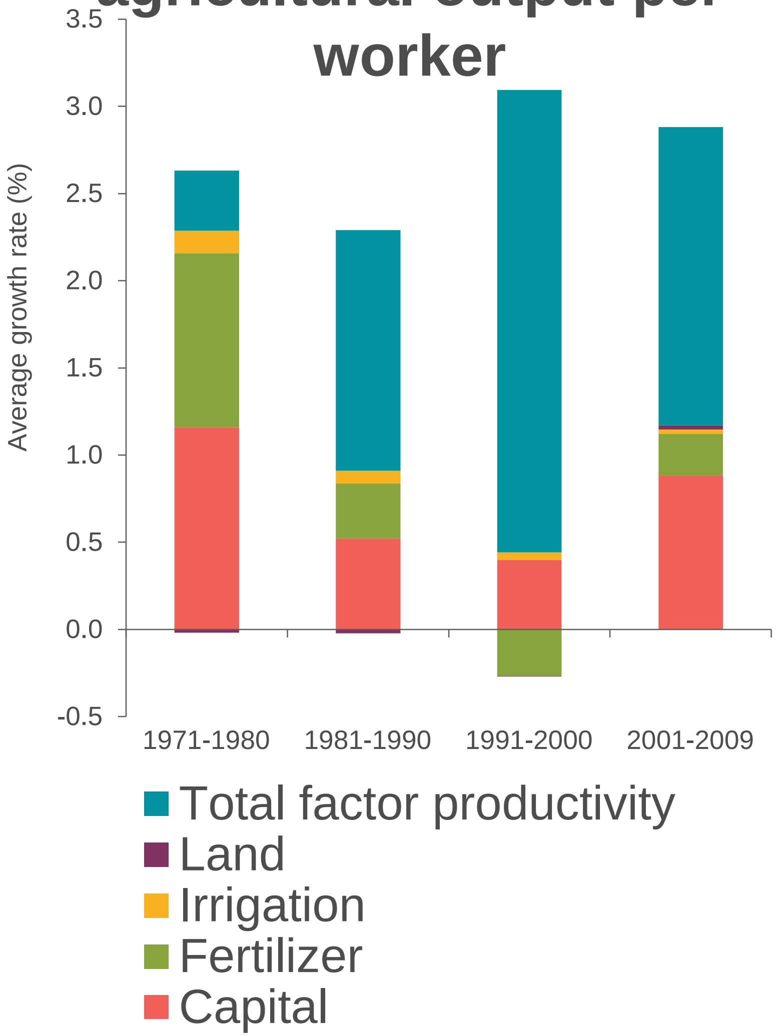
- Agricultural science operates in an increasingly contested space in the global food and agriculture system

- Enabling policy environments and novel incentive mechanisms can accelerate the contribution of science

- But only with due attention to the gender, health and nutrition dimensions of hunger

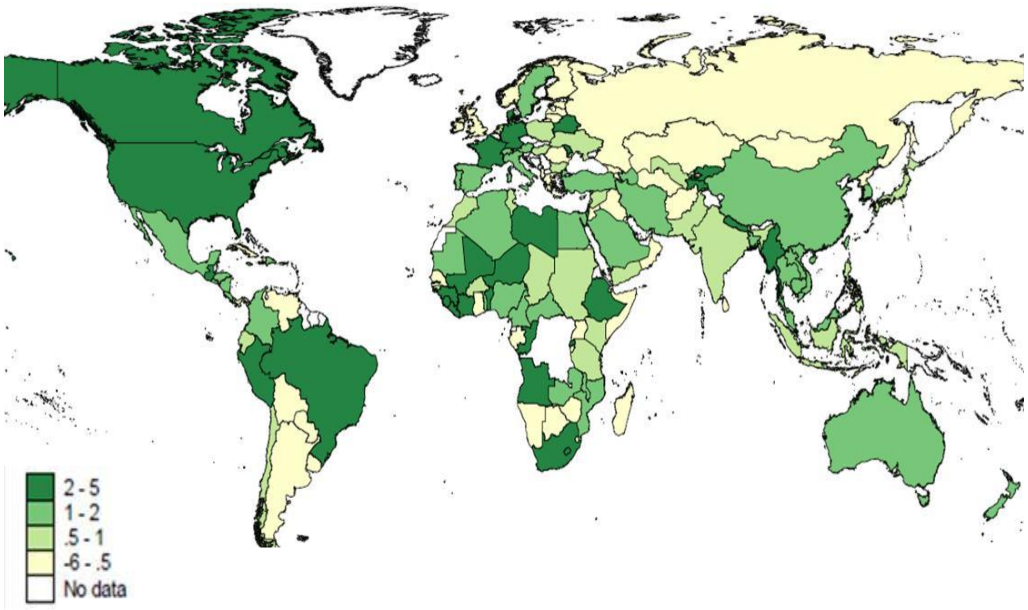
Global agricultural growth has been broadly driven by increased productivity

Growth in global agricultural output per worker



BUT total factor productivity growth varies across countries

Average annual agricultural total factor productivity growth, 1995-2009 (%)



Source: Nin Pratt and Yu 2012

The global food system is still vulnerable to long-term pressures, short-term shocks

Population growth, rising incomes, urbanization

Climate change, extreme weather events

Agriculture-related risks, food safety risks

Growing land, water constraints

Persistent conflicts

The global food system is needed to play bigger role in economic and social development

Picture sources: Ngo Trung; USDA; Goyette; UNDP; Niehaus

The global food system is expected to deliver on multiple SDGs

The global food system of tomorrow

Inclusive

Nutritious and healthy

Climate-smart

Business-friendly

Sustainable

Productive

Over half of the SDGs relate to food security and nutrition

Science in today's food system is built around narrow principles and objectives

Technology is the first-best solution to today's problems

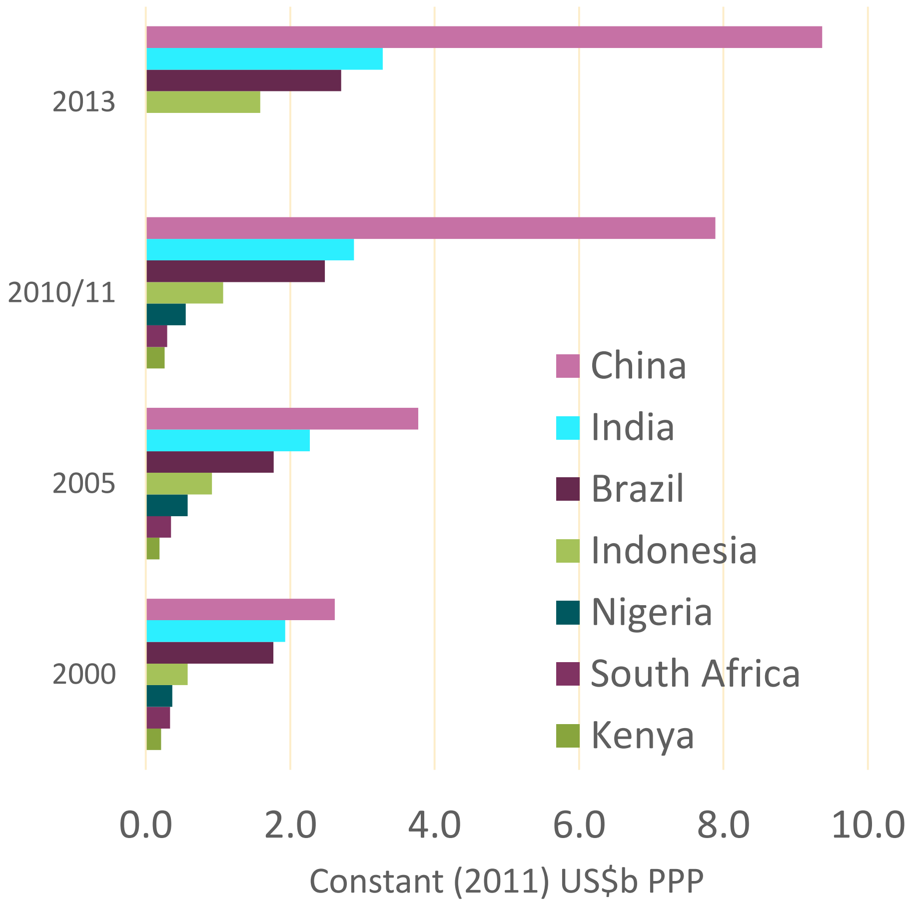
Technology transfers alone will advance local science

Increased yields from crop improvement will end hunger

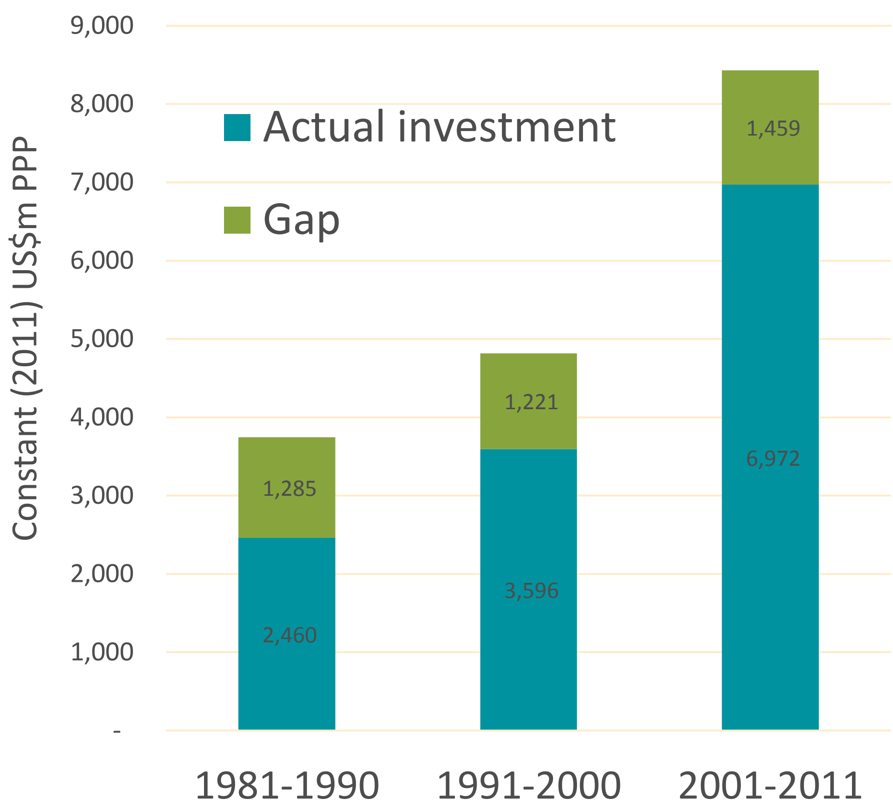
Agricultural science is scale-neutral and gender-neutral

Public resources allocated to agricultural R&D still fall short

Public R&D investment, 2000 to 2013 for selected countries



Actual public R&D investment in all developing countries and gaps in potential investment



Sources: Beintema and Stads; Nin-Pratt; ASTI

There is no shortage of novel ideas in the agricultural and life sciences

Super hybrid rice

"Prescription" agriculture

High-iron and high-zinc rice

Laser land leveling

Apomixis in field crops

Gene editing

C4 rice

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Novel investment mechanisms that advance pro-poor science

Push mechanisms:

incentives that reduce the costs of R&D and promote basic research to encourage spillovers

GENOME VALLEY
HYDERABAD

AATF
AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
FONDATION AFRICAINE POUR LES TECHNOLOGIES AGRICOLES

Legume Innovation Lab

Pull mechanisms:

incentives that increase the expected returns to R&D by improving or creating favorable market conditions

XPRIZE
MAKING THE IMPOSSIBLE POSSIBLE

AgResults
INNOVATION IN RESEARCH AND DELIVERY

PIPRA

2

Policy environments that enable science and innovation

Legal frameworks for resource rights

- **China, Vietnam:** Land-use rights
- **India:** Land rental market operations
- **Nepal:** Water, forest, and natural resource management rules
- **Ethiopia:** Family laws governing productive asset ownership, inheritance

Regulations to encourage scientific inquiry and exchange

- Genetic resources policies that encourage more open use and exchange
- Biosafety regulations that credibly protect human, environmental safety

Markets and trade regimes that are more open, transparent, and fair

- Elimination of distortionary trade policies
- Improved subsidy targeting

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Strategies that close the gender gap

Reform institutions to strengthen resource rights

- **Vietnam**: Land titling for women improved reallocation of household expenditures toward food, among others (Menon et al. 2014)

Improve access to inputs and credit

- **Ghana**: Women’s ability to make credit decisions significantly improved dietary diversity for women and girls (Malapit and Quisumbing 2015)

Provide gender-relevant training and information

- **Bangladesh**: Livelihood assistance and training increased savings for productive assets (Meinzen-Dick and Quisumbing 2012)

Picture source: Farming First and FAO 2014

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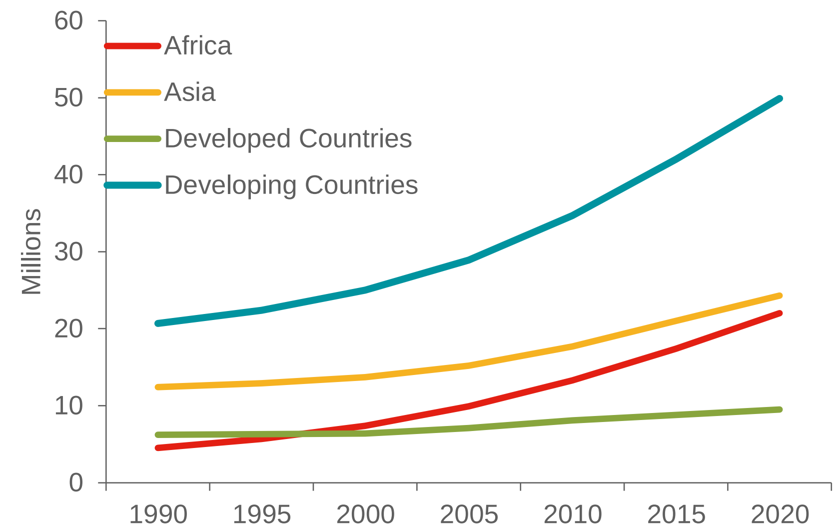
Investments that link agriculture to health and nutrition

Reductions in undernourishment (%)

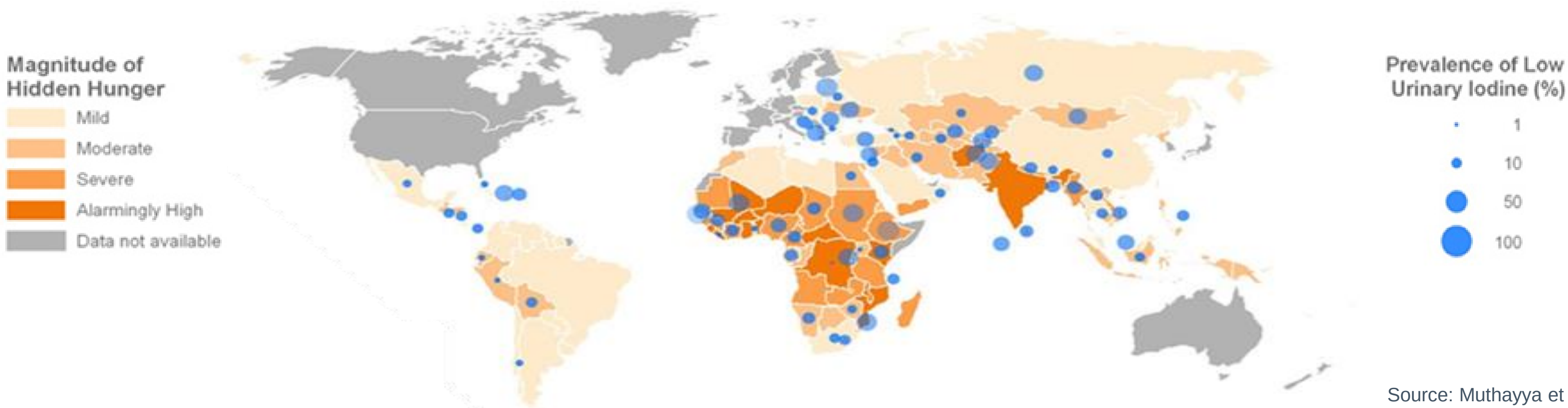
Source: FAO 2015

Number of child overweight & obesity (millions)



Source: de Onis, et al. 2010; Note: Asia excl. Japan; Developed countries incl. Japan

Hidden Hunger Index (micronutrient deficiencies)



Source: Muthayya et al. 2014

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Policies that shift agricultural production toward greater sustainability

Agriculture has significant environmental footprint

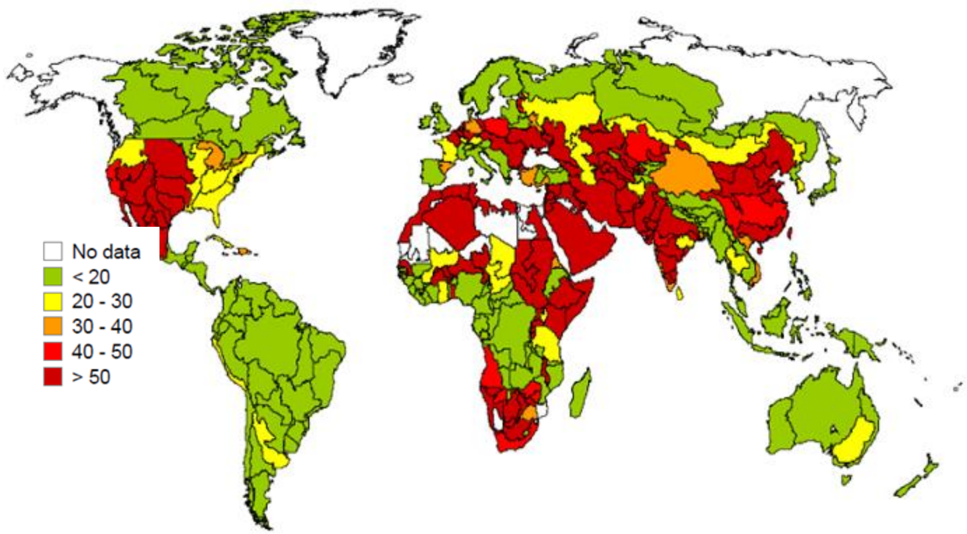
70% of **WATER** CONSUMPTION

34.3% of **LAND** AREA

17-30% of **GHG** EMISSIONS

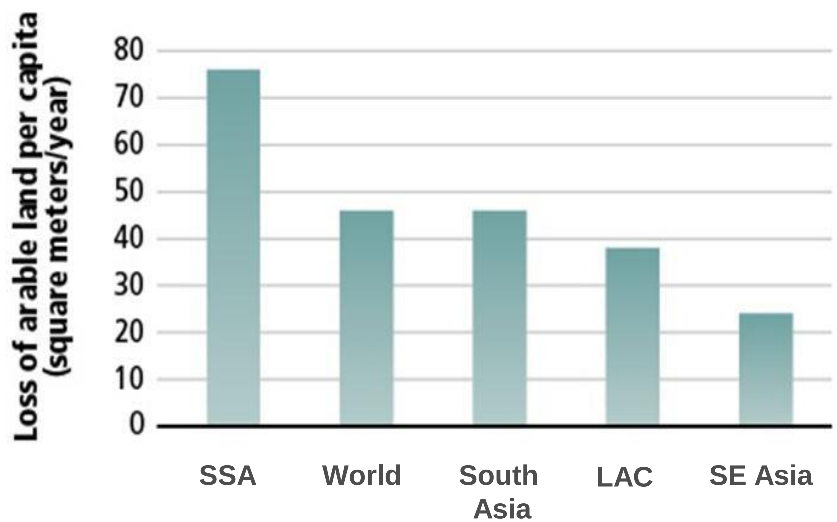
Source: Farming First 2012

Water stress
Total renewable water withdrawn, BAU, 2050 (%)



Source: Veolia Water and IFPRI 2011

Annual loss of per capita arable land in developing countries, 1961–2009



Source: FAO 2011

In conclusion:
A new, knowledge-based global food system

- **Advancing scientific frontiers**—investing in R&D
- **Designing better policies**—evidence-based decision-making
- **Integrating gender**—in both policy and technology design
- **Linking to health and nutrition**—yield gain is not enough
- **Ensuring sustainability**—synergies in agriculture and environment