Sustainably Closing the Agricultural Productivity Gap
THE GLOBAL AGRICULTURAL IMPERATIVE

50-70% of total population

protein-rich animal foods doubling output

37% land

70% fresh water used

1/3 edible food lost or wasted

CLIMATE CHANGE

decreased rainfall

extreme weather patterns

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HOW CAN WE MEET THE COMING DEMAND?

**EXPANSION** – expanding land and extending irrigation for crop and livestock production

**INTENSIFICATION** – increasing input application

**EFFICIENCY** – obtaining more output from existing resources, measured by total factor productivity (TFP)
MEASURING EFFICIENCY: TFP

THE RATIO
OF AGRICULTURAL OUTPUTS

GROSS CROP AND LIVESTOCK OUTPUT

TO INPUTS

LAND    LABOR    FERTILIZER    MACHINERY    LIVESTOCK

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IMPORTANCE OF TFP

TOTAL FACTOR PRODUCTIVITY

THE RATIO
OF AGRICULTURAL OUTPUTS
TO INPUTS

TFP INCREASES WHEN
OUTPUTS RISE AND
INPUTS REMAIN CONSTANT.

WITH FINITE RESOURCES,
TFP MUST INCREASE
TO SUSTAINABLY PROVIDE FOR
9 BILLION PEOPLE IN 2050.
MEETINGGLOBALDEMAND

Sources of Growth in Agricultural Output (1961-2010)

- TFP — gross amount of crop and livestock outputs per inputs (labor, capital and materials)
- Inputs/Land — gross amount of fertilizer, machinery, labor and other inputs per hectares of agricultural land
- Irrigation — extension of irrigation to agricultural land
- Land Expansion

Source: Fuglie (2013)
GLOBALLY ON TRACK, but …

Source: Fuglie (2013)
Food Demand GAP: Sub-Saharan Africa

25% of total SSA demand would be met by maintaining the current regional TFP growth rate.

Source: Fuglie (2013)
Sub-Saharan Africa GAP
TFP: THE SOLE SOURCE OF GROWTH in high-income countries

Sources of Growth in Agricultural Output: High-Income Countries (1961-2010)

Source: Fuglie (2013)
TFP: THE NEW SOURCE OF GROWTH in low-income countries

Sources of Growth in Agricultural Output: Low-Income Countries (1961-2010)

Source: Fuglie (2013)
THE BRAZIL-CHINA AGRICULTURAL CONNECTION

GLOBAL DYNAMICS: SUPPLY & DEMAND
CHINA’S BOOMING MIDDLE CLASS

China Population (1990-2030)


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CHINA’S CHANGING DIETS

Meat & Animal Protein Consumption in China (1990-2010)


Grain Consumption in China (1990-2010)

## PUBLIC INVESTMENT IN AG R&D

### USA
- U.S. TFP growth has averaged about 1.5% since the 1980s
- Much of this stagnation has been due to a slowing of the investments in AG R&D in the USA since the 1980s

### CHINA
- China increased investment in AG R&D 4%-5% growth per year from 1986-2000, then accelerated to 10% per year from 2001-2007
- China TFP averaged about 2.83% growth since the 1990s

AN EMERGING GAP

Food Demand GAP: China

72% of demand can be met by maintaining the current TFP growth rate

Source: Fuglie (2013)
A GROWING AGRICULTURAL SURPLUS

Food Demand GAP: Brazil

Demand can be met by maintaining the current TFP growth rate.

Source: Fuglie (2013)
WHAT ACCOUNTS FOR BRAZIL’S GROWTH?

- COUNTRY LEADERSHIP & INVESTMENT IN R&D
- ECONOMIC REFORM
- INFRASTRUCTURE IMPROVEMENT
Soybean Production and Exports, Brazil (1991-2012)


Productivity to meet global demand
AG Output from TFP Grows in LAC

Food Demand Compared to Agricultural Output from TFP Growth in Latin America & Caribbean (2000-2030)

- Food Demand Index
- Agricultural Output from TFP Growth
- Projected Agricultural Output from TFP Growth

Source: Fuglie (2013)

166% of total demand can be met by maintaining the current TFP growth rate.
IMPROVING AGRICULTURAL PRODUCTIVITY, FOOD & NUTRITION SECURITY

5 KEY POLICY AREAS
AVC image w/ titles w/o white box text

FARMERS/PRODUCERS

AGGREGATORS/SERVICE PROVIDERS

AGRO-PROCESSORS

FIVE POLICY AREAS THAT IMPROVE PRODUCTIVITY ALONG THE AGRICULTURAL VALUE CHAIN

CONSUMERS

RETAILERS

RISK MANAGEMENT

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PARTNERSHIPS FOR PRODUCTIVE VALUE CHAINS

Conserve  Adapt  Improve

Photo: Land O'Lakes
Poultry Value Chain - Mozambique

• How to build a local industry for safe, nutritious food?
Investing in Research, Science and Technology
Goal:
To increase yield stability and reduce risk under drought conditions through breeding and biotech

First conventional hybrid launched in 2013

Know-how and technology royalty-free for all seed companies in Africa

Maize is critical for more than 300 million African farmers often stricken by drought

Water Efficient Maize for Africa (WEMA)
A Public-Private Partnership started in 2008
http://wema.aatf-africa.org/
India - Gujarat PPP Project

An unique, innovative project to empower poor tribal farmers, reduce drudgery & make farming a remunerative business

Assisting in upgrading from traditional to modern methods of farming
Issues to explore more deeply

Increasing global demand for fish

By 2020, we will need an extra 18 million tons of fish
For food and livelihoods~

Aquaculture offers more than food

- A driver of rural development
- A source of employment and livelihood

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As global economies become more interconnected, trade and open markets hold tremendous potential to unlock economic opportunity, spur development, and increase food security. Effective global value chains improve the world’s ability to move food from where it is produced and processed to where it is consumed.

Approaching trade as an interconnected system will produce significant gains. Well-functioning markets enable faster and more reliable delivery of food and give rise to multiple opportunities for value creation and off-farm economic activity.

Trade is an integral aspect of increasing agricultural productivity in order to address:

- **Urbanization**: 75% of the world’s population will be urban by 2050.
- **Population growth**: 9 billion by 2050.
- **Changing demand for food**: 3 billion people will add animal protein to their diets by 2050.
- **Climate change**: More storms, flooding, drought, and other weather events.
- **Interconnected global agricultural market**: Local decisions impact far-away markets; distant policies impact local production.
Harnessing Trade Opportunities
Dig Deeper

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