

***Pulling innovation into practice:***  
***Financial incentives for agriculture***

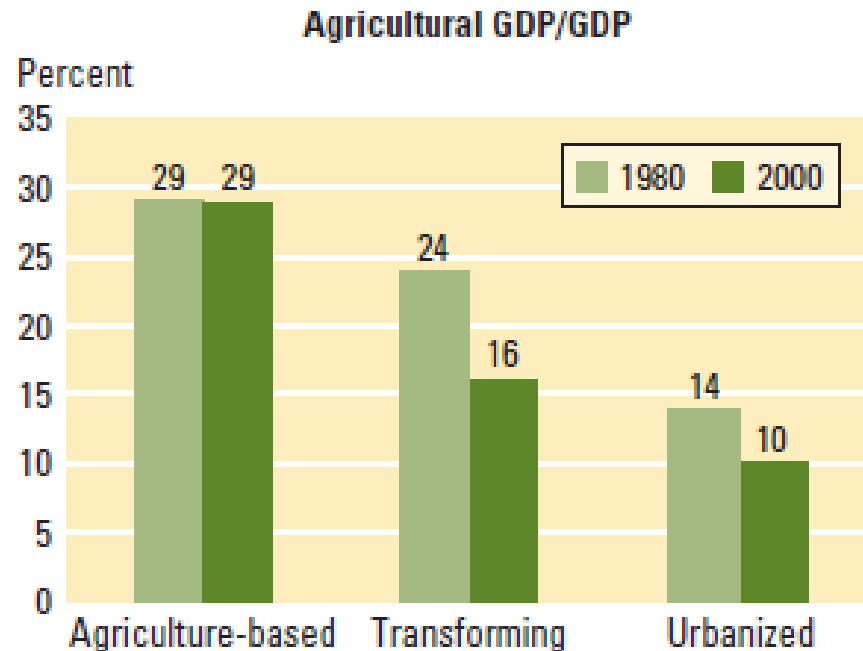
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# Importance of agriculture

Three quarters of the world's poorest people live in rural areas. Most disproportionately rely on agriculture for:

- Subsistence
- Livelihoods
- Economic development
- Environmental services



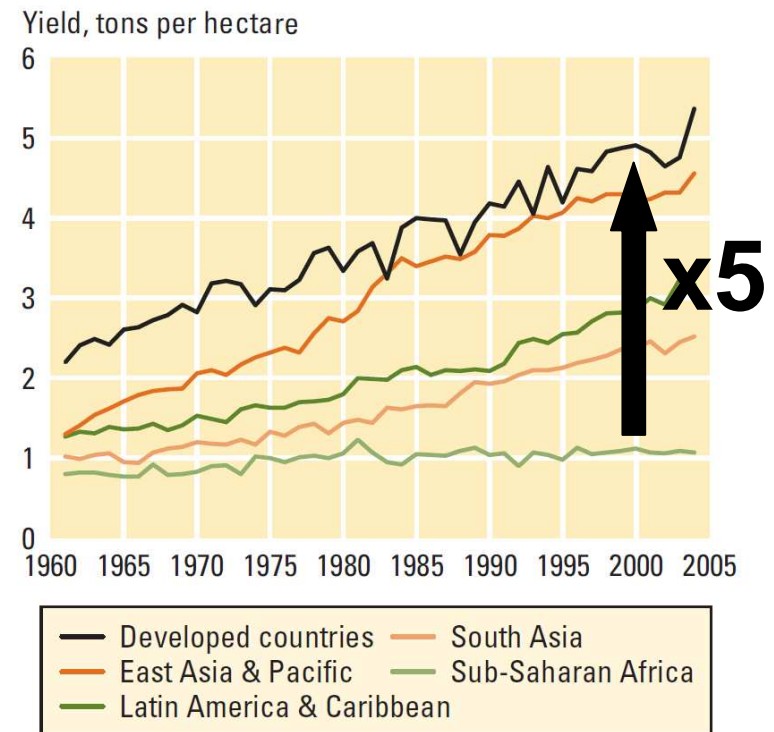
Source: World Development Report 2008



# The Challenge

- Productivity growth declining
- Yield gap widening
- Limited scope for expansion

**Yield gap for cereals by region**



Source: World Development Report 2008

# **The Potential – *unlocking innovation***

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- **Higher crop yields**
  - Maize: 2.5x
  - Rice: 3x
- **Higher “effective” crop yields**
  - Reduce crop losses by 50%
- **Higher nutritional value per unit of food**
  - Reduce incidence of “hidden hunger” by 50%



# Agriculture R&D - a public good

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- Every \$1 invested potential to return \$9 social value
- Yet...
  - Decades of underinvestment in basic R&D
    - Of \$36B on ag research (2000), only \$1.5B (4%) in SSA
  - Virtually no private sector investment
    - 98% of SSA funding from public sector
    - Little or no funding on food crops of the poor



# Market failures

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- Externalities
  - Value capture difficult for private sector
    - Lack of IP protection
    - Informality of markets (ex. seed saving and barter practices)
    - Decentralisation of markets (ex. 98% of farmers <2 ha)
- Information asymmetries
  - *Government* ↔ *researcher*: “picking the winners”
    - Fragmented research (ex. 400+ centres in Africa vs x4 India, x8 US)
  - *Researcher* ↔ *farmer*: products that address preferences and constraints
  - *Firm* ↔ *farmer*: uncertainty of market ability-to-pay



## **Layered on top of distinct needs**

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- Different agro-ecological conditions (climate, soil, and eco-zone specific weeds, pests)
- Different staple products (millet, sorghum, cassava, rather than wheat, rice)
- Different farming technologies, practices
  - Mostly rain-fed
  - Low fertilizer use because of costs due to small scale, transportation

**→ *Very little spillover from dev'd country R&D***



## **Catalyze and accelerate the development, adaptation and/or adoption of needed innovations in smallholder agricultural environments**

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- Externalities 
  - “Create” market to reduce uncertainty and attract private sector
- Information asymmetries 
  - Ex-post award, pay-on-results
  - Incentivise alignment with farmer preferences and constraints





# AMC for agriculture

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A financial commitment by donors

to subsidize a “product”

if it meets a specified product profile

at a set “price” for a set period

and is demanded farmers /  
markets in developing countries.



# What is the “product”?

	Areas for innovation	
Goals of innovation	<i>Improved products</i>	<i>Improved inputs or farming practices</i>
<b><i>More nutrition per unit of food</i></b>	AMC for higher nutrient content. Examples: Vitamin A-enhanced sweet potato, rice, etc. Protein-enhanced maize or other grain	
<b><i>Higher yields</i></b>	AMC for drought-, pest-, or disease-resistant varieties?	AMC for more efficient (lower cost) fertilizer AMC for replacement for phosphate-based fertilizer? AMC for irrigation technology Proportional prize for a particular crop or for a particular area
<b><i>Higher “effective” yields</i></b>		Appropriate storage, processing technologies (given energy, geographic constraints), eg: Post-harvest drier Micro pasteurizer



# Criteria for selecting target?

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- Magnitude of identified problem (i.e. potential economic and welfare gains)
- Stage of technological development of solution (i.e. close to commercial stage)
- Investment gap in crop R&D
- Crop yield gap in developing country (from average developed country)
- Relative or absolute volume of crop in defined region



## Illustrative examples – higher yields

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- AMC for drought-, pest-, or disease-resistant varieties:
  1. Blast-resistant finger millet
    - Crop losses about 20% (but up to 90%) due to a fungal blast in Eastern and Southern Africa
    - Value of blast-resistant variety ~ \$130M/year (US\$33/ha)
  2. Fungal resistant banana and plantain
    - Yield losses about 30% in developing countries
    - Value of black Sigatoka resistance banana in Africa to be around US\$1B (\$600/ha).
  3. Stem-rust (Ug99) resistant wheat
    - Threatens up to 95% of global wheat production
    - Even 10% crop losses would represent losses of more than US\$45B/yr



## **Illustrative examples – higher effective yields**

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- Post-harvest storage
  - Crop losses up to 40%
  - Post harvest loss in Africa estimated ~US\$1.6B/yr



# What is the “price”?

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- Price, volume or value?
  - Defined product, defined price (i.e. AMC vaccine)
  - Defined product, defined value (i.e. X-Prize)
  - Defined outcome, defined “value” (i.e. proportional prize concept – W. Masters, Purdue)



# Other design considerations

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- Encourage developing country participation as either innovators and/or disseminators
- Leverage existing institutions, networks, knowledge, and investments
- Trigger reward based on adoption and/or significant milestones
- Demonstrate a measurable impact on economic and social welfare
- Encourage cooperation, beyond winner-take-all
- *Yet, keeping it simple...*



## **Next steps**

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- Elaborate ideas for pilot
- Engage others
- Seek synergies across AMC work

