# Technology, Food Security and Sustainable Development

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Presentation at the WIPO Seminar on

"How the Private and Public Sectors Use IP to Enhance Agricultural Productivity"

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# Objectives

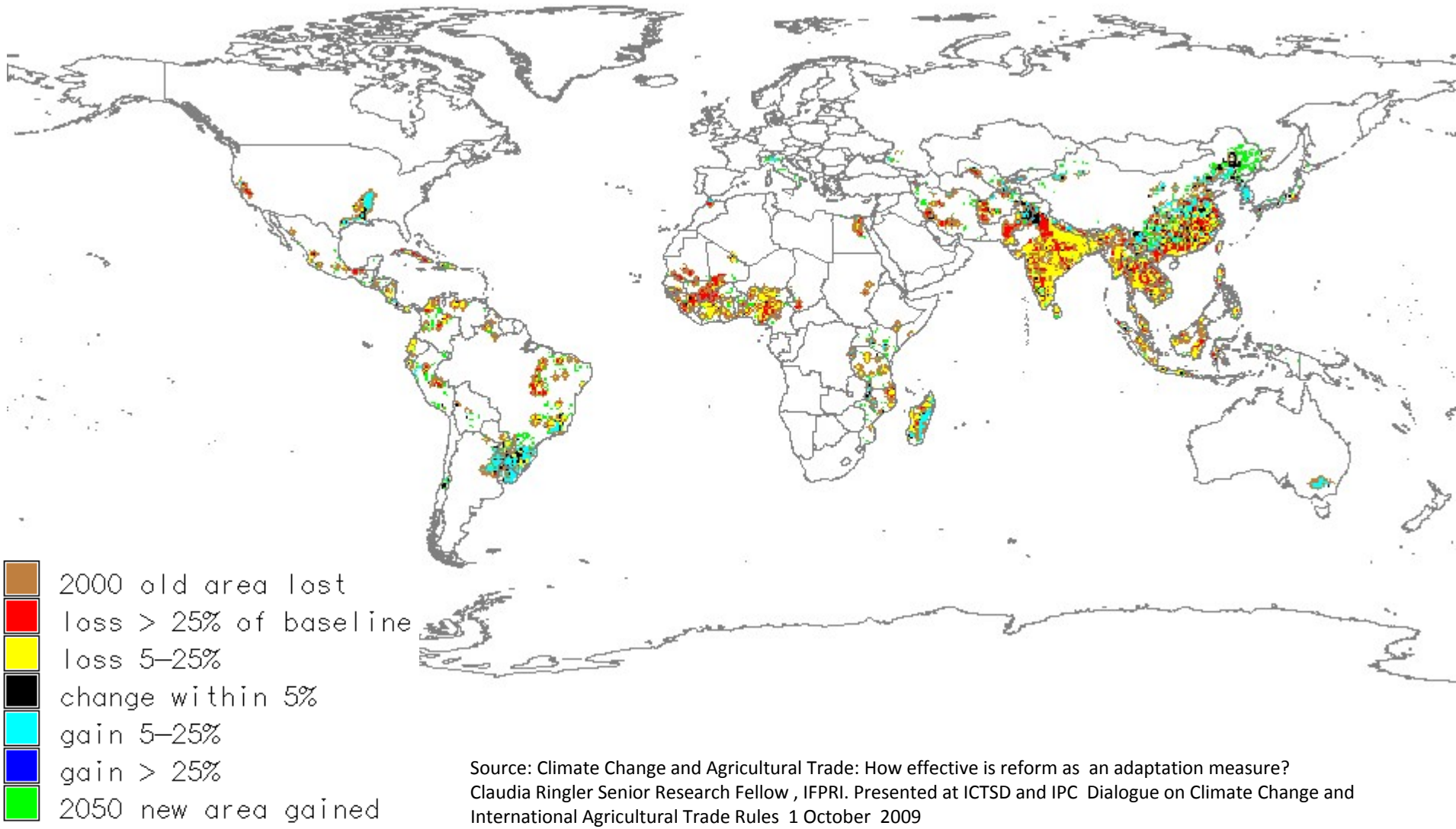
- Highlight the key policy issues related to IPRs in the debate on food security, technology transfer and development and sustainable development
- Making a distinction between different technology transfer and development mechanisms (private vs public) and agricultural systems (market-based vs. small-holder)
- Put IPRs in the broader context of development and technology needs in developing countries

# The food security challenges ahead

- Food price spikes in 2007-2008 and 2010-2011 have reversed recent progress in reducing hunger
- 70% increase in food production will be needed to feed 9 billion people by 2050 in a world of increased resource scarcity (land, water)
- Climate change induced variations in temperature, precipitation and the increased likelihood of extreme weather events, will alter crop and animal productivity, and ultimately global trade flows
- Long term increase in food prices as population and income growth surpass productivity and area growth further accentuated by the effect of climate change.
- Short term increased food price volatility & link with energy market.
- Yet, productivity is stagnating and growth in agricultural yield has almost halved since 1990

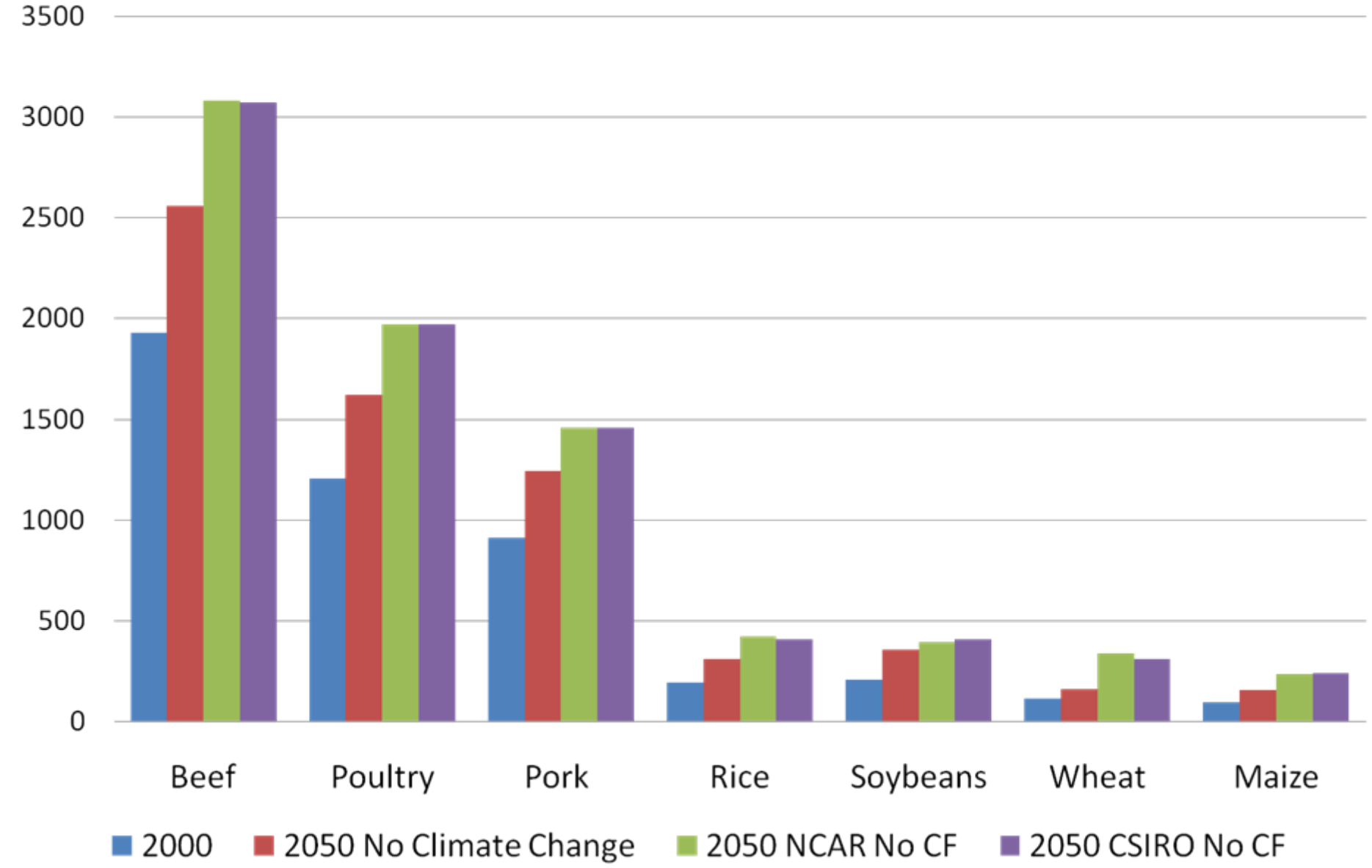
Repeated calls for investment and R&D in agriculture

# Climate induced percentage change in yields in 2050 : Irrigated Rice (NCAR A2)

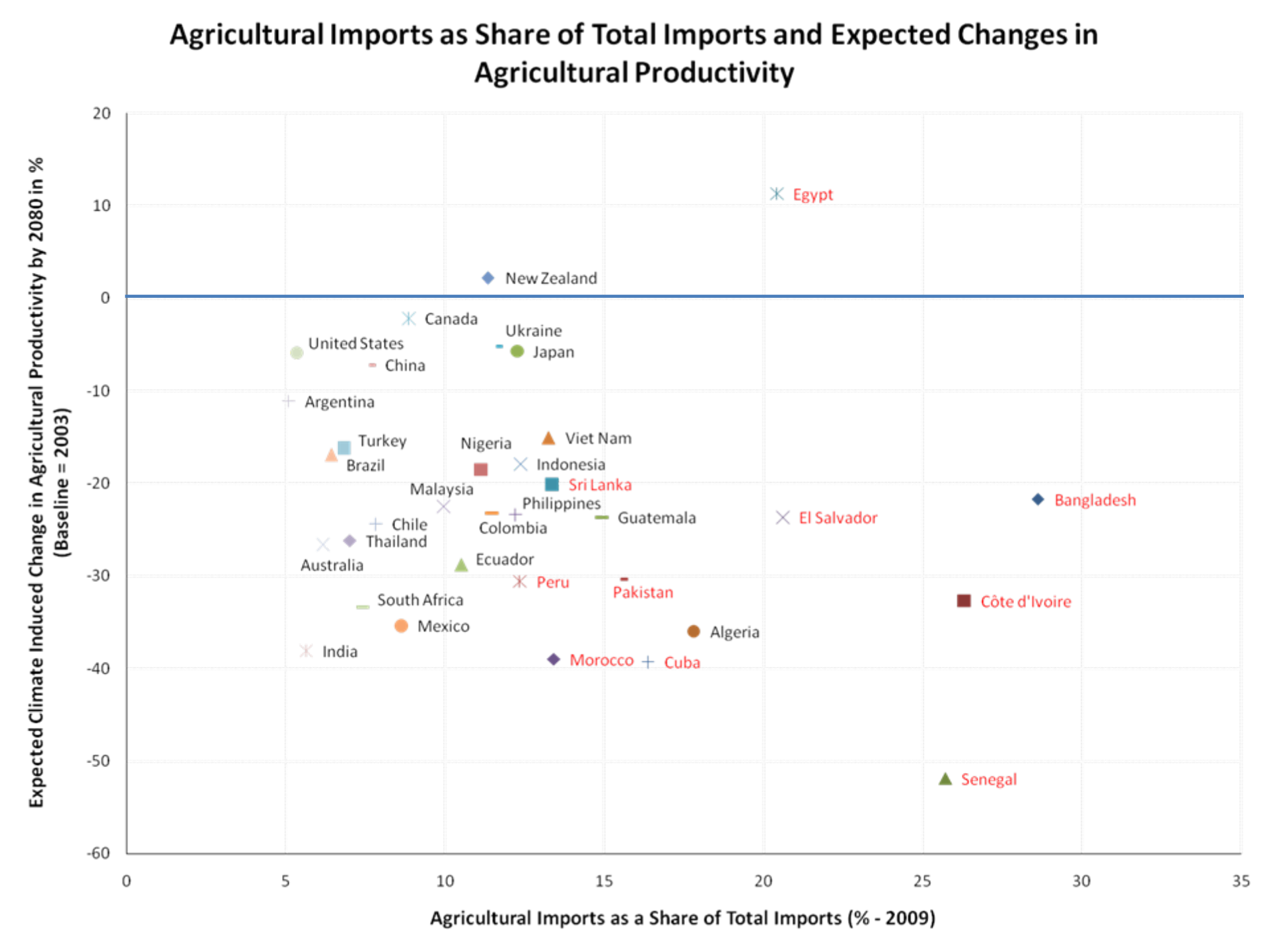



Source: Climate Change and Agricultural Trade: How effective is reform as an adaptation measure? Claudia Ringler Senior Research Fellow , IFPRI. Presented at ICTSD and IPC Dialogue on Climate Change and International Agricultural Trade Rules 1 October 2009

# World Prices of Selected Crops and Livestock Products under Different Climate Scenarios (constant 2000 US$/metric ton)




Source: The Role of International Trade in Climate Change Adaptation, by Gerald Nelson, Amanda Palazzo, Claudia Ringler, Mark Rosegrant, Timothy Sulser, and Miroslav Batka, Issue Brief No. 4, December 2009.


Agricultural Imports as Share of Total Imports and Expected Changes in Agricultural Productivity
Expected Climate Induced Change in Agricultural Productivity by 2080 in % (Baseline = 2003)
Agricultural Imports as a Share of Total Imports (% - 2009)
20
10
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25
30
35
Egypt
New Zealand
Canada
Ukraine
Japan
United States
China
Argentina
Turkey
Brazil
Nigeria
Viet Nam
Indonesia
Sri Lanka
Malaysia
Philippines
Colombia
Guatemala
Bangladesh
El Salvador
Chile
Thailand
Australia
Ecuador
Peru
Pakistan
South Africa
Mexico
Algeria
Côte d'Ivoire
India
Morocco
Cuba
Senegal

# Humans satisfy their nutrition needs in two fundamentally different ways

| Form of Agriculture | Technology Needs |
|---|---|
| **Small-holder economy:**<br>• Self-sufficient subsistence<br>• Small economic unit (family)<br>• Limited trade (fertilizers, seeds) | • Better seeds/livestock/feed<br>• Food processing capabilities<br>• Storage procedure<br>• Access to credit |
| **Market economy:**<br>•Production of food for a market<br>•Consumption of goods procured on the market | • Enhance production (through seeds or inputs)<br>• Transportation/storage facilities<br>• Packaging<br>• Value added processing<br>• Integration in global value chains |

# Two main mechanism of supporting the development and transfer of technology

| Form of technology transfer and development | Challenges and trends |
|---|---|
| **Public sector:**<br>Agriculture, food processing, seed and breeding research<br>E.g. CGIAR, but also national research (Brazil, China, India, Kenya) | • Major role during green revolution<br>• Highest benefit from public expenditure<br>• Public research remains under-developed in Africa<br>• Trend towards more research being done in the private sector |
| **Private sector:**<br>Since development of genetic engineering, seed industry plays critical role (traditional breeding + biotech) in both innovation and TOT in middle income countries | • Rarely reaches to poorest<br>• 95% taking place in the North<br>• Seed industry has become highly centralized and concentrated. |
| Development of large supermarket chains, large-scale food processing and vertically integrated production and operations | • higher quality of food and ToT to producers –e.g. quality control - but may displace farmers and affect the environment and market structure (oligopolies) |

# KEY POLICY ISSUES

| | | Form of Technology Transfer | |
|---|---|---|---|
| | | **Private** | **Public** |
| **Form of agriculture** | **Market** | **1** Private sector, market agriculture quadrant | **2** Public sector, market agriculture quadrant |
| | **Small-holder** | **3** Private sector, small-holder quadrant | **4** Public sector, small-holder quadrant |

# Quadrant 1. Market agriculture and private sector: key policy issues

- UPOV style system in minimum compliance with TRIPS vs. stronger biotechnology-oriented patent system?
  - Potential for national seed industry/technology adaptation. Often linked to level of economic development
  - Attitude towards biotechnology
- Addressing challenge of concentration in the seed/biotech industry while encouraging ToT
  - Level of private sector competition and need for making public sector varieties available
  - Need for adequate competition law in middle income DC
- Trade and macroeconomic policies
  - Tax regime, investment policies, market access conditions

# Quadrant 2. Market agriculture and public sector: key policy issues

- Limited need for public means of ToT in efficient market-based agriculture with strong private sector.
- Maintain availability of public sector varieties where there is limited competition
- In middle income countries consider arrangement for patenting by public research establishment and licensing out public sector invention to private sector
- Need for focused research policy (both int'l and national)
  - Subsistence farmer, climate change, water use
  - Move from downstream adaptation of technologies developed by private sector to longer term upstream research
  - Enhanced coordination at int'l level and closer cooperation with global private sector, developing new partnerships

# Quadrant 3. Small-holder agriculture and private sector: key policy issues

- Private sector research tends to be irrelevant to subsistence farmers unable to purchase research products
- Limited benefit from UPOV-style or regular patent protection for agriculture in poorest nations
- Seed law and plant breeders' right as a main challenge
  - UPOV 91 allows seed saving but not seed exchange, whereas this might be consistent with a *sui generis* system under TRIPS
- Potential for public-private licensing arrangements (humanitarian licenses, see golden rice experience)
  - Bring new tech to subsistence farmers at near the marginal cost of reproducing seeds.
  - Help small farmers enter the agro-industrial sector

# Quadrant 4. Small-holder agriculture and public sector: key policy issues

- Need to define the right research tasks
  - e.g. dwarfing gene in wheat and rice for efficient fertilizer use during green revolution
- Relation with private sector:
  - upstream vs downstream research ?
  - attitude towards biotechnology
- Challenge related to increasing patenting of “research tools” possibly causing researchers to be held liable for patent infringement.
  - How real is this concern in subsistence sector (?)
  - Maintain high non-obviousness/inventive step, application oriented utility/industrial applicability standard
  - Research exemption in patent system
  - Specific license

# Technology transfer and development beyond IPRs

- Differences in agro-ecological conditions
- Water management and irrigation
- Other production inputs: fertilizers, pesticides
- Marketing & supply chain (transport, storage)
- Information
- Access to credit
- Insurance

# Technology needs assessment in agriculture to address climate change

| Examples of Technology Needs for Mitigation in Agriculture | Examples of Technology Needs for Adaptation in Agriculture |
|---|---|
| • Crop waste gasification<br>• Improved cultivation methods<br>• Production and management of soil nutrients<br>• Rational application of fertilizer<br>• Drip irrigation<br>• Biodigesters (manure management using digesters)<br>• Better land management<br>• Solar (photovoltaic) and wind water pumps<br>• Solar energy for processing of agricultural products<br>• Modification of livestock feed | • Tolerant/resistant crop varieties (to drought/heat, salt, insects/pests, improved seeds)<br>• Efficient water utilization and improved irrigation systems (drip irrigation, creation of networks of reservoirs and water resource management)<br>• Low-density planting, adjustment of sowing dates and crop rotation<br>• Land management<br>• Improved drainage<br>• Integrated pest management<br>• Sustainable grazing and herd management<br>• Heat-tolerant livestock breeds<br>• Networks of early warning systems |