The Role of Research and Technology in Agricultural Innovation Systems

International Conference on Agricultural Innovation Systems

30 May-1 June 2012
Expanding Global Agendas and Increasing Demands on Agricultural Research

- Global food security under increasing land and water constraints
- Provision of ecosystem services and eco-efficiency of farming systems
- Adaptation and mitigation to climate change
- Agroecological intensification of smallholder agriculture and poverty
Changing Research Methods and Technology Design

- Production systems research
- Integrating ecological science
- Place-based research methods
- Research consortia
- Scaling up integrated into research design
- Flexible institutional arrangements
Agricultural Research within an Agricultural Innovation System

• Demand responsiveness rather than supply driven
• Flexible institutional arrangements and improved connectivity
• Shifting division of labor between public and private sector
• Adapting to a dynamic agricultural sector and organizational change management
Agricultural Research within the Three Worlds of Agriculture

Urban
- Agroprocessing and agricultural input industry well developed
- Differentiated demand and large scale supply of agricultural products
- Organizational matrix of trade, farmer, and agroprocessing associations

Research responds to agroprocessing and input firms linking supply/demand
Agricultural Research within the Three Worlds of Agriculture

Agrarian

- Large, undifferentiated smallholder sector
- Unintegrated output markets and incomplete input and service markets
- Nascent agroindustrial sector with large transaction costs in supply and input delivery
- Research dependent on public sector

Research responds to farmers demand but with lack of effective articulation
Agricultural Research within the Three Worlds of Agriculture

Transitional Economy

- Growing urban demand and differentiating agricultural sector
- Lagging agricultural regions dominated by semi-subsistence smallholders
- Dynamic commercial and lagging commodity sectors

Evolving public-private division of labor between commercial and lagging sectors
| Comparison of research systems in Sub-Saharan Africa, India, and the United States around 2000 |
|-------------------------------------------------------------|-----------------|-----------------|-----------------|
| Arable and permanent crop area (million hectares)            | 147             | 160             | 175             |
| Number of public agricultural research agencies              | 390             | 120             | 51              |
| Number of full-time equivalent scientists                    | 12,224          | 8,100           | 9,368           |
| Percentage of scientists with PhD                            | 25              | 63              | 100             |
| Annual spending on agric R&D (million 1999 international dollars) | 1,085           | 1,860           | 3,465           |
| Spending per scientist (thousand 1999 international dollars) | 89              | 230             | 370             |

*Sources: FAO (2006a), Pal and Byerlee (2006); Pardey and others (2007).*
Articulating the Demand and Supply of Agricultural Research

**Supply**
- Lag time in investment & technology release
- Scope & priorities
- Fixed disciplinary mix
- Integrating science

**Demand**
- Diffuse farmer voice and organization
- Farmer heterogeneity
- Asymmetric information
- Undeveloped markets
The Conundrum of Demand-Driven Research

- **Market driven**: efficient agricultural markets; agroprocessing and agricultural inputs as locus of market power

- **Farmer driven**: inefficient markets; farmers as focus of public sector research
Market Driven

- **Context:** quality price differentials, competitive input markets, commercial orientation of farmers

- **Approaches:**
  - Public-Private Partnerships
  - Research Clusters
  - Innovation Funds
Farmer Driven

- **Context:** farm heterogeneity, semi-subsistence, inefficient input and output markets; public sector research

- **Approaches**
  - Farmers in research governance
  - Competitive grants & farmer selection
  - Decentralization and systematic adaptive research
Integrating Supply and Demand for New Technology

Innovation platforms (value chains)

- Facilitated approaches with external actors
- Combining technical and organizational innovation
- Funding for organizational transaction costs
### Global Public and Private Agricultural R&D Investments, 2000

<table>
<thead>
<tr>
<th>Region</th>
<th>Expenditure (Million US $)</th>
<th>Percent Public Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia-Pacific</td>
<td>8,186</td>
<td>91.9</td>
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<tr>
<td>Latin America</td>
<td>2,578</td>
<td>95.2</td>
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<tr>
<td>Sub-Saharan Africa</td>
<td>1,486</td>
<td>98.3</td>
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<tr>
<td>Developing Country Sub-Total</td>
<td>13,682</td>
<td>93.7</td>
</tr>
<tr>
<td>High Income Countries</td>
<td>22,277</td>
<td>64.0</td>
</tr>
</tbody>
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Modalities of Public-Private Partnerships

- Agroprocessing: collaborative
- Pre-competitive ensuring commodity supply: finance
- Input research: competitive
- Crop and natural resource management: devolved to public sector
Managing Organizational Change
Balancing programmatic rigidity within a changing agricultural sector

- Structural rigidity
  - Critical mass and program continuity
  - Problem scope and priorities
  - Program and disciplinary specificity

- Dynamic agricultural sector
  - Changing policy and gov’t priorities
  - New scientific opportunities
  - Growth and changing market contexts
Trade-Offs in Managing Change

- Managing internal program change vs managing external connectivity
- Balancing market opportunities with public policy objectives
- Balancing upstream and adaptive research capacity
- Managing international, regional, & national (university) research linkages
Managing Downstream Processes and Programmatic Articulation

Innovation as Process
- Intersecting technical, organizational and market innovations

Programmatic Articulation
- Technology design, adaptive research, and dissemination
Agricultural Research and Systemic Change in an AIS

Agrarian Economies

- Facilitated: funds flow, capacity, and neutrality
- Adaptive research capacity, market efficiency, farmer organization

Urban Economies

- Unfacilitated: innovation funds
- Clusters in agr value chains
Organization of the Rest of the Session

- Building demand articulation and institutional interfaces
- Consortia and R&D partnerships in Chile
- Change management
- AIS implementation in Uruguay
- IAR4D and agricultural innovation in CORAF