The Role of Research and Technology in Agricultural Innovation Systems

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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 InnovationSystem

- 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

	Sub-Saharan Africa	India	United States
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 Reseach

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

Region	Expenditure (Million US $)	Percent Public Expenditure
Asia-Pacific	8,186	91.9
Latin America	2,578	95.2
Sub-Saharan Africa	1,486	98.3
Developing Country Sub-Total	13,682	93.7
High Income Countries	22,277	64.0

Source: Pardey, et al, 2006

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