

# **Biotechnology Statistics and Policy Priorities: Where are the Gaps?**

*Sachin Chaturvedi*

**Workshop on Measuring the Outputs and Impacts of  
Biotechnology**

OECD, Paris

*December 11, 2006*



**RIS**

**Research and Information System  
for Developing Countries**

## **Structure of the Presentation**

- Rosy World of Biotechnology
- Nature of Policy Inputs on Innovation
- Learning from ICT Experience
- Identifying the Policy Objectives
- Recommendations

# Rosy World of Biotechnology

ECONOMIC TIMES NEW DELHI  
SATURDAY 10 JULY 1999

## Watch that cotton bloom

After bountiful harvest for two decades, production and productivity of Indian cotton appear to have plateaued. All hopes are now on the Cotton Technology Mission

## Transgene Opens Shop In Andhra Biotech Park

By MAHALAKSHMI  
Hyderabad

The second biotech centre being set up by the department of horticulture, Pradesh, has occupied

green house, shade house and potting sheds, the added.

**Biotech Industry in India: Its Perspectives**

Biotechnology is a fast emerging area of science, which has diversified activities such as healthcare, agriculture, food processing, aquaculture and engineering. Recent developments in biotechnology in India offer vast opportunities for biotech products in pharmaceuticals, agriculture, food and agriculture.

The pharmaceutical biotech based product-biodrugs, vaccines and biologics are the largest market share nowadays. Economic liberalization and globalisation has led to the establishment of wholly-owned new subsidiaries, shareholding and joint venture companies or through alliance marketing. Companies like Piramal, Wockhardt, Ranbaxy, Lupin, Cipla, Cadila and RPG life sciences are involved in biotech research and development in India. Several MNCs like Glaxo Wellcome, Novartis and Aventis are also investing in the country.

## The Biotech Advantage

A WORLD OF BIOTECHNOLOGY BENEFITS

March 12, 2003

GM Crops Could Help Improve World Economy

New Biotech Corn Battles the 'Billion-Dollar Bug'

A worldwide increase in gross domestic production in countries, ranging from 1.2 to 3.1 percent for

## Biotech Revenues To Touch \$1 B

OUR BUREAU  
Bangalore

India's biotechnology sec-

12 August 04

Company	Sales in Rs crore	Company	Sales in Rs crore
1. Biocon	502.0	11. Novozymes	65.0
2. Serum Institute of India	491.0	12. Quintiles Spectral	62.6
3. Panacea Biotech	149.0	13. Krebs Biochemicals	56.9
4. Nicholas Piramal	130.0	14. Indian Immunologicals	56.7
5. Novo Nordisk	110.0	15. Zydus Cadila	55.0
6. Venkateshwara Hatcheries	88.0	16. Mahyco Monsanto	54.0
7. Wockhardt	84.0	17. Shantha Biotechnics	40.0

Rs 2,345 crore the previous year.

Biopharma has shown the highest growth, crossing Rs 2,480 crore in revenues. Biopharma accounts for 76 per cent of the biotech revenues, followed by bioservices at Rs 275 crore; bioindustrial sector with Rs 250 crore; biogri at Rs 180 crore and bioinformatics Rs 80 crore.

The biosupply segment (which supplies equipment to the biotech industry and there-

### BIOTECH BIODATA

COMPANY	TURNOVER IN 1999-2000	AREA OF RESEARCH
Biocon	Rs 100 cr	Novel fermentation methods for making recombinant DNA
Shanta Biotech	Rs 33 cr	Hepatitis B vaccine, interferon, streptokinase
Bharat Biotech	Rs 18 cr	Hepatitis B vaccine, insulin, epidermal growth factor
Bangalore Genei	Rs 5.5 cr	Tools for recombinant DNA research
Wockhardt	N.A.	Hepatitis B vaccine, Erythropoietin
DSQ Biotech	N.A.	Genomics
Nagarjuna Biotech	N.A.	Genomics

N.A. Not available

Workforce needs of biotechnology industry are growing

Biotechnology companies are entering an era of expansion in both research and development.

# Differing Perspectives on Biotechnology in India (2001)

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	<b>CII</b>	<b>DBT</b>	<b>The Economist<sup>iiii</sup></b>
Biotech Market	\$ 2.5 billion <sup>i</sup>	\$ 1,849 million	\$ 1,475 Million
Agri/Seed Market	\$ 500 million <sup>ii</sup>		\$ 450 million
Bioinformatics Market	\$ 2.2 million <sup>iii</sup>		
Diagnostic/Vaccine Market	\$. 420 million	\$ 150 million	\$ 375 million

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**Source:** RIS, 2005.

## What Policy Inputs!

- \* Statistics: Integrated analysis of policy to analyse impact on regulatory and market-related factors relevant to technological innovation both product and processes.
- \* Interest in workforce skills in biotechnology.
- \* Socio-economic effects of biotechnology: Overestimated or underestimated.
- \* Organizational and economic integration.
- \* Impact on farmers, industry and trade.
- \* Pace of innovation.

# Learning from ICT Experience

## Theoretical Framework for Measuring ICT Development

Index	UNCTAD 2002	Economist (EIU) (2001, 2000)	Harvard University	ITU
Item Measured	ICT Diffusion	E-Readiness	Networked Readiness	Intervers Access
1. Connectivity (Physical Capacity; Infrastructure)				
2. Access (Wider determinants of Access)				
3. Policy Environment				
4. Usage				
Additional				

# Considerations for Policy Thrusts

**Relevance:** does the concept measured correspond to the concept required

**Timeliness:** the period between the time of the observations and the time used, vital to users if timely decisions need to be taken based on estimates.

**Accuracy:** the deviation between the target value determined by a perfect process (true parameter) and the value determined by the imperfect process (estimate).

**Accessibility:** whether the user can easily make use of the data.

**Comparability:** reliable comparison possible over space and time.

**Coherence:** are different sources based on common definitions, methods.

**Completeness:** reflect the available statistics all user needs and priorities.

## Accessibility / Completeness

### **Wider Socio-Economic Needs and R&D Priorities**

- Economic Advantages and Disadvantages by Crops and by traits
- Innovation and Economic Priorities
- Biotechnology Traits (Economic Cost)
- Productivity Improvement
- Pest Resistance
- Drought Resistance
- Enhancing Shelf Life Value
- Reducing Post Harvest Losses
- Nutritional Improvement
- PPP



# Considerations for Policy Thrusts

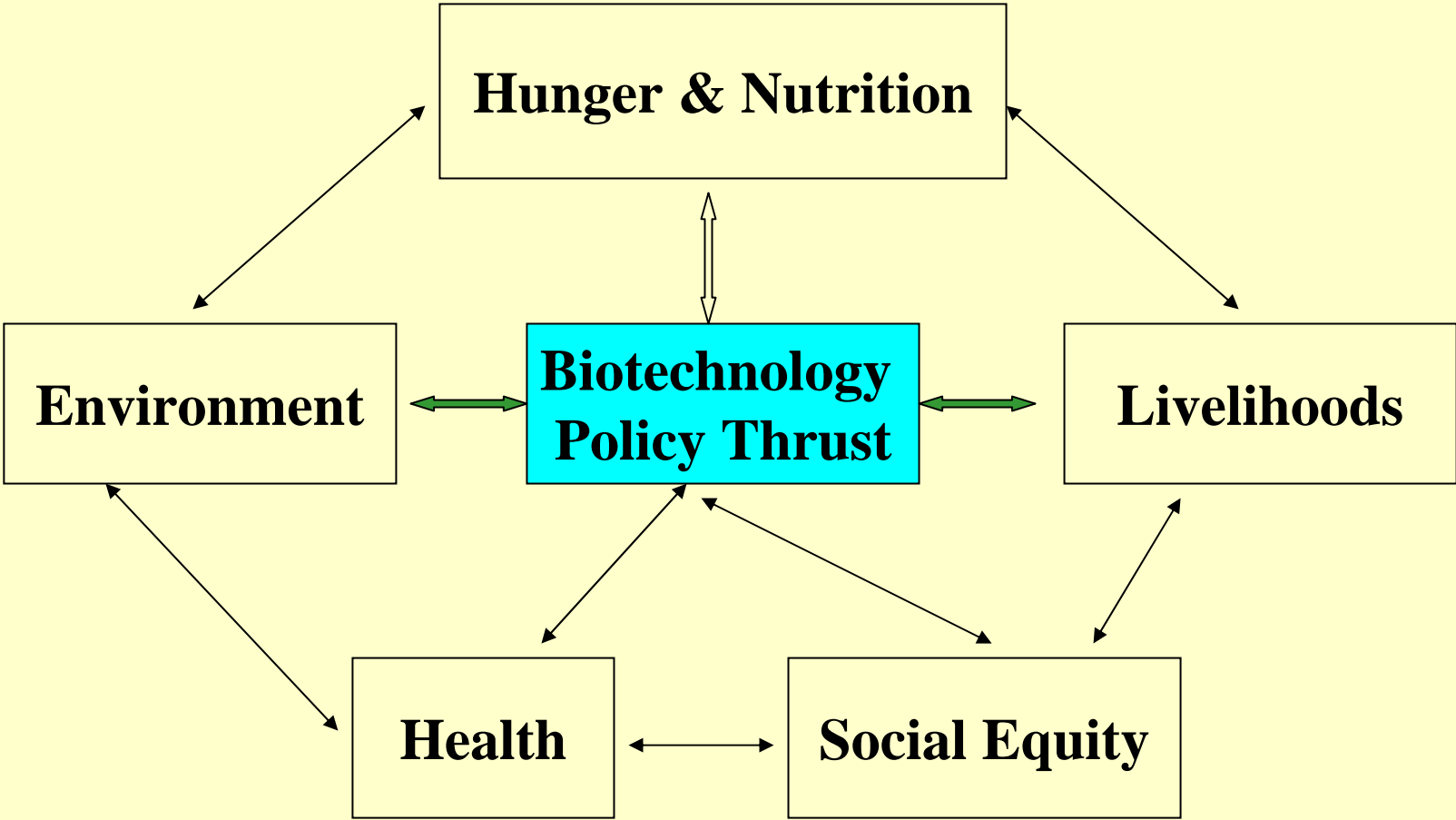
## Biotechnology in Developing Countries: Matrix for assessing Technology Direction & Cost of Adoption

	Productivity Improvement (RPBIDH)	Pest Resistance (RPBIDH)	Drought Resistance (RPBIDH)	Enhancing Shelf Life Value (RPBIDH)	Reducing Post Harvest Losses (RPBIDH)	Nutritional Improvement (RPBIDH)
<b>Food Grains</b>						
<b>Cereals</b>						
<b>Rice</b>						
<b>Wheat</b>						
<b>Coarse cereals</b>						
<b>Pulses</b>						
<b>Gram</b>						
<b>Non-Foodgrains</b>						
<b>Oilseeds</b>						
<b>Groundnut</b>						
<b>Rapeseed</b>						
<b>Fibers</b>						
<b>Cotton</b>						

Note: Economic Cost constitutes RPBIDH.

R: R & D Allocation; P: Patent (IPR) Protection; B: Biosafety Enforcement; I: Infrastructure; D: Distribution Cost; H: Human Resource Development

# Cobweb of Policy Directions



# Relevance

## Impact Assessment and Public Policy

- Economic Welfare of growers, consumers and others in the supply chain
- Market Conditions
- Government's Own Policies: Econometric analysis and NIS
- Variability of Production Environment
- Impact of IPR regime: Options with Open Licensing.

# Harmonizing Governments Policies

## Biotechnology Priorities of Different States

<b>States</b> <b>Areas</b>	
<b>Policy Announcement</b>	
<b>Tax Incentive</b>	
<b>Venture Fund</b>	
<b>Biotech Park</b>	
<b>Path Dependency</b>	
<b>Strengths</b>	
<b>Awareness</b>	
<b>Academic Linkage</b>	
<b>Cluster Policy</b>	

Source: RIS 2005

# Accuracy

## Where do we stand in Economic Studies!!

Melinda et al (2006)

Agricultural biotechnology 3,477!!

Global 09

Industrialized Countries 04

Developing Countries 12

# Coherence

## Count of articles assessing the economic impact of genetically engineered crops in developing economies, by research question and country

	Farm	Farm/ Industry	Consumer	Consumer Industry	Industry	Trade	Total
China	13	1	13		1	4	32
India	16				2		18
South Africa	16						16
Others	8	5	6	1	9	17	46
<b>Total</b>	<b>53</b>	<b>6</b>	<b>19</b>	<b>1</b>	<b>12</b>	<b>21</b>	<b>112</b>

Melinda et.al. 2006.

# Comparability

## Methodologies Used and Policy Objectives

- Impact on Farmers
- Impact on Consumers
- Impact on Industry
- Impact on Trade

**Farmers:** Factors affecting variations in output per hectare (partial productivity)

Input use per hectare (cost saving)

Output per unit of input (efficiency)

**Industry:** Price elasticity of supply and demand for the crops

Whether exporting country is large or small producer

Nature of innovative changes introduced by the technology

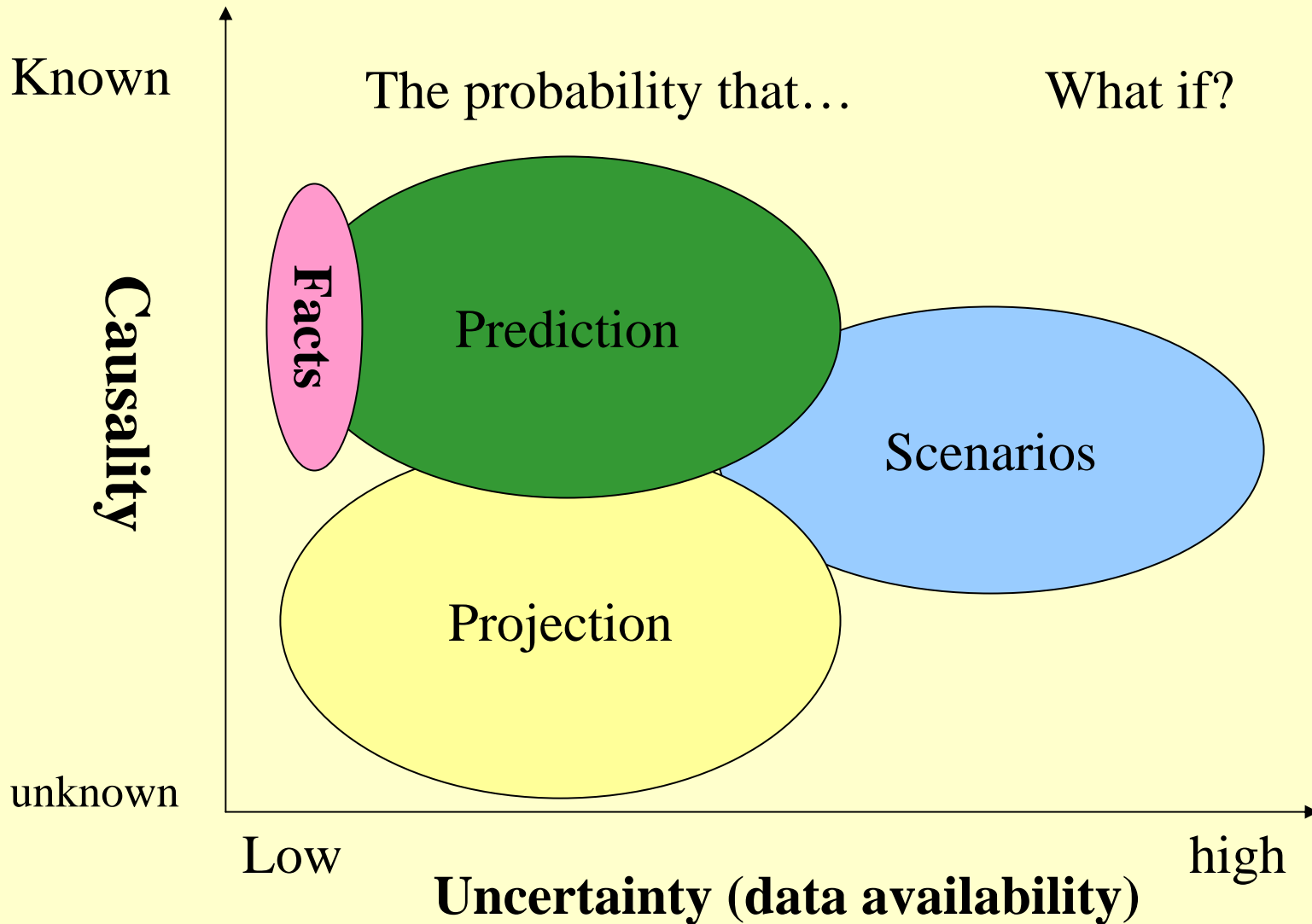
Nature of incentives in a monopoly situation

**Trade:** Realistic field and regulatory data

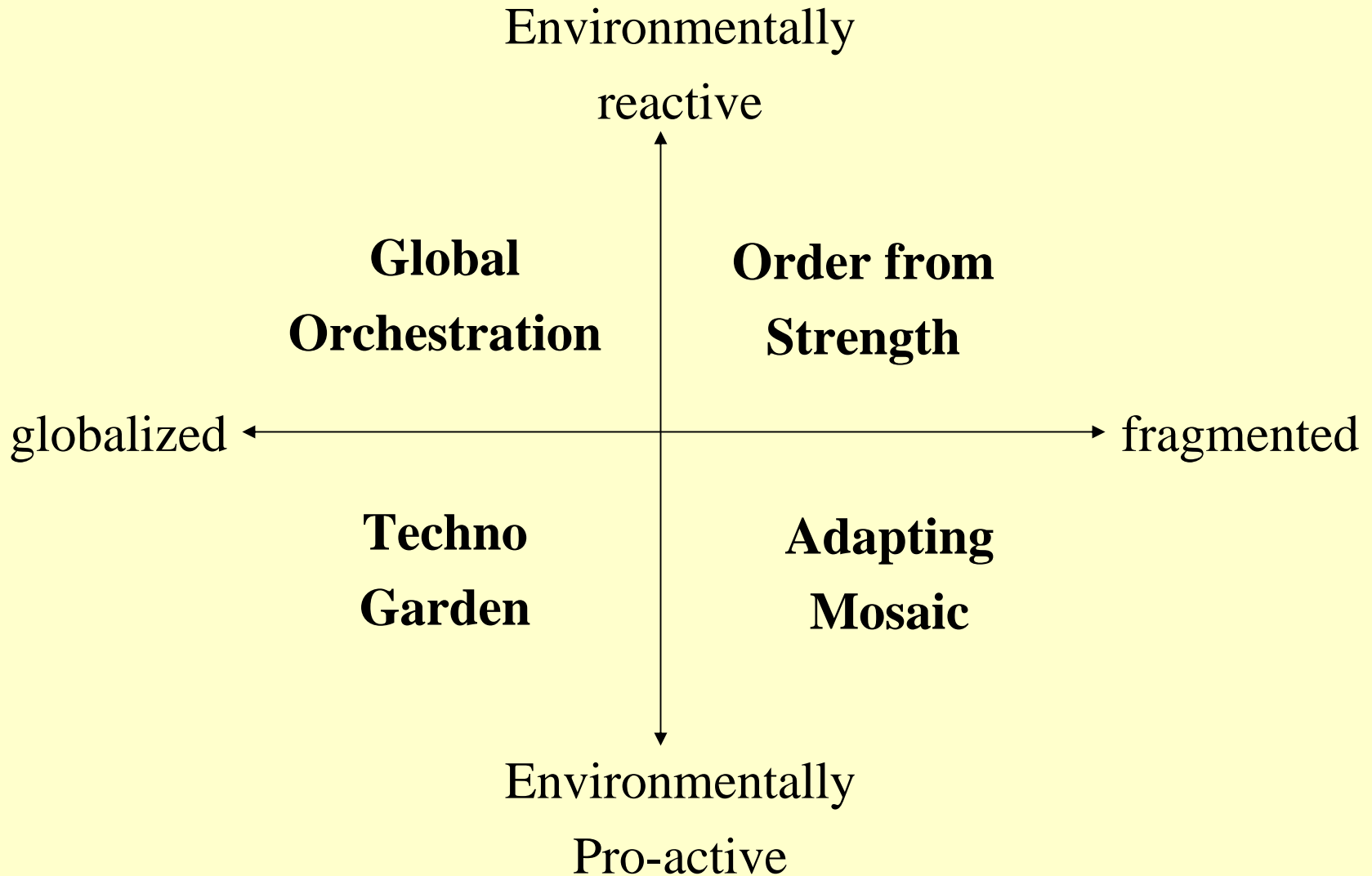
Partial equilibrium models that model one or several sectors of the economy in a few countries and on vertical or horizontal linkages.



# Scenarios, predictions and policy directions



# Four forward-looking scenarios



	<b>Economic Approach</b>	<b>Social Policy Focus</b>
<b>Global Orchestration</b>	<ul style="list-style-type: none"> <li>- Redefinition of PPP</li> <li>- Improving Market Performance</li> <li>- Focus on Public Goods</li> </ul>	<ul style="list-style-type: none"> <li>- Inc. Global Equity</li> <li>- Public Health</li> <li>- Global Education</li> </ul>
<b>Order from Strength</b>	<ul style="list-style-type: none"> <li>- Regional Trade Blocks</li> <li>- Mercantilism</li> <li>- Self Sufficiency</li> </ul>	<ul style="list-style-type: none"> <li>- Security</li> <li>-Protection</li> </ul>
<b>Adapting Mosaic</b>	<ul style="list-style-type: none"> <li>- Focus on local development</li> <li>- Trade rules allow flexibility</li> <li>- Local non market rights</li> </ul>	<ul style="list-style-type: none"> <li>- Local communities linked to global communities</li> <li>- Local Equities</li> </ul>
<b>Techno Garden</b>	<ul style="list-style-type: none"> <li>- Global reduction of tariff boundaries</li> <li>- Fairly free movement of Goods, Capital, People</li> <li>- Global markets in ecological property</li> </ul>	<ul style="list-style-type: none"> <li>- Improving individual and community expertise</li> <li>- Policies follow opportunities</li> </ul>

## **Future Focus needs to address requirements as follows (Accuracy and Timeliness)**

- **Innovation and Enterprise Development** along with SE Priorities; Stock and Flow of Knowledge; Causal Relation.
- **Impact on Labour**: Skills supply and demand
- **Equity/Poverty**: Data on monopolies / consolidation
- **Agronomic**: Disease Resistance/Sustained High Growth/Affordability
- **Regulatory Process**: Risk Assessment/Cost of Risk Assessment/Analysis of regulatory frameworks across countries
- Lastly on indicators for assessing **impact on health and environment.**