



Private Agricultural R&D and Innovation in Brazil, China and India: Lessons & Opportunities

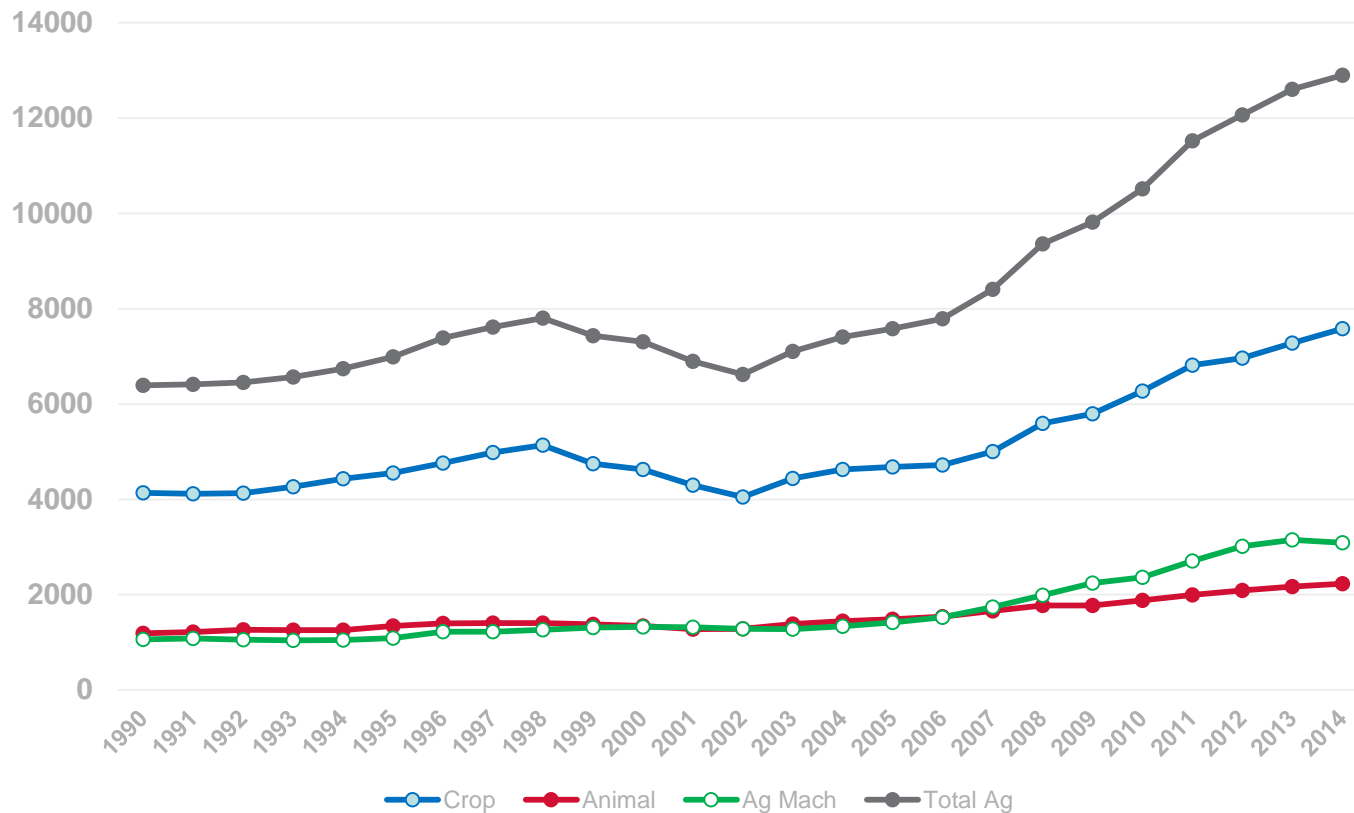
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Outline

- Trends in research expenditure in globally and in China, India and Brazil
- Lessons from studies of private research China, India and Brazil
- Opportunities for US farmers, agribusiness and scientists

Global private agricultural input R&D



- Fuglie 2016

Findings on global trends in R&D

- Demand - little change in intensity
- Technological opportunity – biotech in crops and IT in machinery
- Concentration has little impact

Private research in India by Industry (US\$ Million)

Industry	1984/85	1994/95	2008/09	2014/15
	Million US\$ 2005			US\$ Mill (@InRs55/\$)
Seed & Biotech	1.3	4.9	88.6	171.5*
Pesticides	9	17	35.7	42.1**
Fertilizers	6.8	6.9	7.9	17.9
Agri Machinery	3.7	6.5	40.5	106.6
Total	20.8	35.1	174 (74)	338.1 (54)

* Only 17 firms – in progress (Total firms ~ with R&D is > 40)

** Dupont/Dow not included

Figures in brackets denote # of firms surveyed

Brazilian Private R&D up, led by MNCs in seed

(Millions of 2012 US \$s)

	1996	2012	MNCs % of RD
Chem	na	45	50%
Seed	na	280	80%
Machinery	na	48	50%
Animal health	na	4	0%
Total	50	377	72%

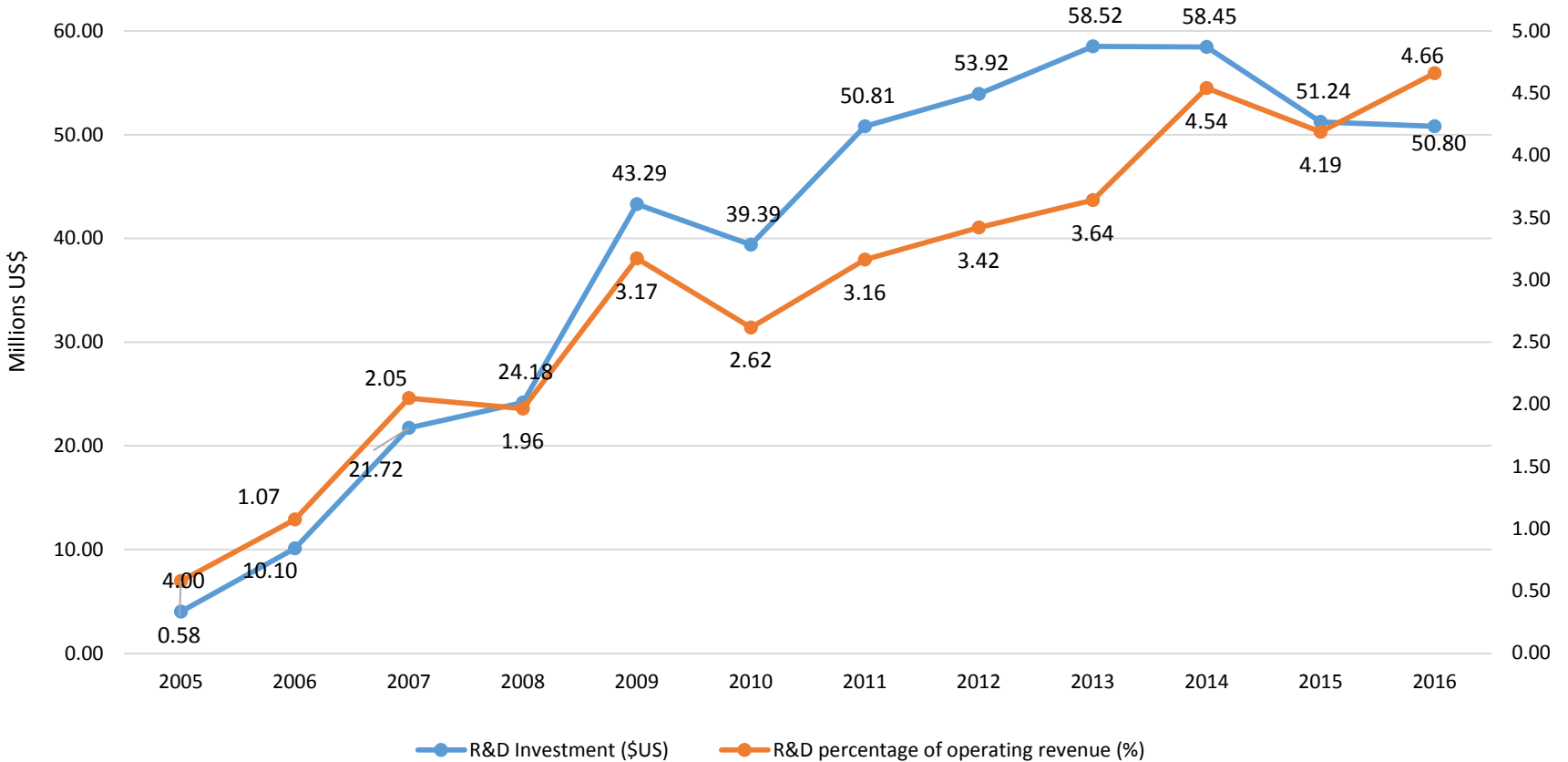
Source: Jose' Maria da Silveira & and Jaim da Silva

Chinese private R&D 2000 – 2006 by industry

	2000		2006	
	Mil 2006 US\$s	% total	Mil 2006 US\$s	% total
Crop	19	18	76	17
Livestock & veterinary	39	37	133	30
Fisheries	13	13	44	10
Processing	34	32	185	42
Total	105	100	438	100
No data from ag pesticide and ag machinery				
Source:Hu et al 2011				

Research by commercial companies has grown rapidly since 2006 – are working on the totals

YTO (First Tractor) R&D Investment & R&D Intensity



Factors determining growth of private R&D China, India, and Brazil

- Economic factors
 - Tremendous growth in demand for modern inputs
 - Increasing prices of farm labor
- Industrial Policy - Growth of private sector -
 - China - officially private firms allowed in 2000; shifting government research institutes to SOEs.
- Technological opportunity
 - Public sector research
 - Breakthroughs in biotech – particularly important in Brazil and India

Major policy in government agricultural research expenditure

	China	USA	Brazil	India
R&D Expenditure Million US\$ converted from local currency using 2009 PPP exchange rates				
1960	294	1,254	345	220
2011	4,723	4,403	1839	3771
2011/1960	16	3.5	5	17
Rank 2011	1	2	5	3

Philip G. Pardey, Connie Chan-Kang, Steven P. Dehmer and Jason M. Beddow Agricultural R&D is on the move *Nature* September 14, 2016,

Public creates technological opportunities

- Fuglie review suggests 0.6 to 0.9 private \$ for 1 public \$
- India econometric study – public breeding stimulates private seed research
- China econometric - basic and applied research stimulate private research but development adaptive research crowded out private research

Brazil private R&D led by MNCs in seed; India MNCs play a major role; China buys MNCs

		India MNC R&D%			Brazil MNCs %
Chem		32			50
Seed		44			80
Machinery		49			50
Animal health		Na			0
Total		41			72

Chinese companies buying MNCs with technology

- Seeds – CITIC Ag VCs buy Dow corn seed business, COFCO bought Nidera including their seed firms
- Ag Machinery –
 - First Tractor US \$51 million and 1,500 R&D personnel buying French and Israeli companies
- Ag Chemicals
 - ChemChina – ADAMA R&D \$33 million + Syngenta \$1.38 billion R&D
- Livestock
 - Shuanghui Group (Smithfield purchase 2013) \$10 million+ R&D

Determinants and lessons?

- Growth of agricultural markets the main driver
 - Fuglie et al 2011
 - India and China econometric studies
- Industrial policy plays an important role
 - Privatization
 - Role of state owned enterprises??
 - Competition policy
 - Controls on FDI and Trade (Brazil different??)
- Public sector research investments and breakthroughs in biotech have played a key role.
- Ability to patent important in India and Chinese studies

Spillovers - Opportunities for US scientists

- Knowledge –
 - Brazil sugarcane and soybeans, China and India rice
 - Biological research
- Scientists and students for collaboration with US agricultural research system
- Also money for University research ---
 - Kansas State University and Mahindra tractors 2016 collaborative research on agricultural machinery research and technology
- Research tools - BGI and spinoff Novogene provide genome sequencing

BGI – formerly Beijing Genetics Institute

- Started 1999 as lab to work on human genome project
- Evolved into a public-private non profit company, now 5000 employees, offices in Boston and Seattle in US.
- Bought U.S. Complete Genomics 2015 . Already was no.1 globally in gene sequencing with about 10% of market share before deal.
- Agriculture
 - Arcadia Biosciences and BGI to Create Global Non-GM Genetic Resource for Rice
 - [African Orphan Crops Consortium \(AOCC\)](http://africanorphancrops.org/).
<http://africanorphancrops.org/>

Opportunities for farmers

- Early example: hybrid rice technology from China up to 50% of US rice acreage
- Glyphosate from China
- Tractors and drip irrigation system from India

Jain Irrigation Ltd. No.2 in micro irrigation globally – 45% of revenue from outside India



30 factories around the world. Investing in IT in India & acquisitions in Israel, Australia, Switzerland and California

Opportunities for U.S. agribusiness

- Markets
- Research centers for global research
 - Dupont Hyderabad lab
 - Monsanto's lab in Bangalore
 - John Deere innovation centers and engineering research in Pune India and China
- Sources of capital