Article

The Private Sector and India's Agricultural Transformation

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Marco Ferroni[1]
Yuan Zhou[2]

Abstract

There is often ambivalence about the private sector in agriculture. But successful agricultural growth and transformations are inconceivable without a dynamic private sector serving and driving agriculture, farming, and agri-food value chains. The private sector plays decisive roles in India's agricultural transformation today, fostering productivity improvements and creating jobs and value in supply chains "from farm to fork." This is a relatively new phenomenon, made possible by the economic reforms of the early 1990s and policy changes since then. There remains much to do. Government is challenged to offer the required enabling, regulatory, and institutional support.

Keywords

Agricultural transformation, food security, private sector, crop technology, food processing, job creation, enabling support

Successful models of agricultural development and growth rely on more than favorable weather and hard-working farmers. First, technology is fundamental, such as high-yielding seed. Second, value chains that absorb products and deliver inputs, services, and consumer goods to farmers are essential. Third, the policy environment is key—there can be no agricultural development without support through public goods. Fourth, the public and the private sectors both play vital roles. In India, the private sector's contribution is now especially dynamic, as this article shows, but this is a relatively new phenomenon.

For many years after independence, the public sector powered agricultural development and growth in India. Looming food shortages prompted government to back farming; an illiberal economic regime kept private initiative at bay. The Green Revolution 50 years ago was largely an achievement of the public sector. Food security was lastingly improved. Since then, agricultural performance has been mixed. This is partly because of periodic rainfall irregularity, but there are also two other main reasons. First, governmental support and public investment in agriculture have gone in cycles. Second, public agricultural research has lost steam. Its more recent innovations (such as new crop varieties) have brought

[1] Executive Director, Syngenta Foundation, Basel Switzerland.
[2] Head of Research and Policy Analysis, Syngenta Foundation, Basel Switzerland.

Corresponding author:
Marco Ferroni, Executive Director, Syngenta Foundation, Basel Switzerland.
E-mail: Marco.ferroni@syngenta.com

at best incremental improvements in farm productivity; earlier releases had made major differences (Das Gupta & Ferroni, 2012).[1]

The economic reforms of the early 1990s set the stage for an enhanced and growing role by the private sector. Economic growth accelerated, particularly after 2000, with major modernizing effects on agriculture, farming, and agri-food value chains. High levels of economic growth fueled the demand for food, and continue to do so, while also creating off-farm jobs in rural and urban areas. In rapidly expanding urban centers, a growing middle class with refrigerators demands more packaged and processed food. This development encourages the formalization and modernization of trading, storage, processing, wholesale, and retail in new value chains. Mobile telephony and the digital revolution support new ways of doing business and sharing data. They also make markets more transparent, for all participants from primary production to final consumption. Shaped and accelerated by these changes, agricultural transformations are in full swing across the country. Three trends, at least, are apparent:

- The farm sector is becoming more commercial and diversified. Cereals were the main driver of the Green Revolution. Their relative importance in the output value composition is declining as production shifts to higher value sectors including dairy, horticulture, fruit, fisheries, poultry farming, and aromatic and medicinal plants, among other lines of production. Large numbers of small farmers are known to benefit from this trend (Birthal, Joshi, Roy, & Thorat, 2012).
- The share of agricultural employment is coming down, from 60 percent of the total work force in 2000 to 49.7 percent in 2013, according to World Development Indicators.
- Rural poverty is declining, from 42 percent of the rural population in 2004 to 26 percent in 2011, according to World Development Indicators based on the headcount ratio at national poverty lines.

Government played a role in these achievements, but so did the private sector. Figure 1 displays public and private investment trends in agriculture (including agri-food value chains), approximated by gross capital formation relative to agricultural GDP at current prices.

Public investment amounted to close to 4 percent of agricultural GDP in 1981. It then declined, except for a period during the early 2000s when it recovered to a degree (Panel A). Private investment has been rising, particularly since 1994. It attained almost 16 percent of agricultural GDP in 2011 but declined to between 12 and 13 percent in 2013 in a context of rising inflation. In 2013, the private sector accounted for 83 percent of gross capital formation in agriculture, the public sector for 17 percent (Panel B). Private investment helps drive the transformation of agriculture referred to above. We elaborate on this in the next two sections with reference to crop technology, inputs, and agri-food value chains. The last section discusses "public-private interactions" and the role of government to enable the private sector to function and thrive.

The Private Sector in Agricultural Research, Input Delivery and Extension

Private agribusiness companies are at the forefront of heavy investment in agricultural R&D and technological innovation.[2] Private sector innovations are dominant in plant genetics and seed (particularly hybrids and biotech traits). They also lead in seed treatment, agricultural chemicals, biologicals, plant

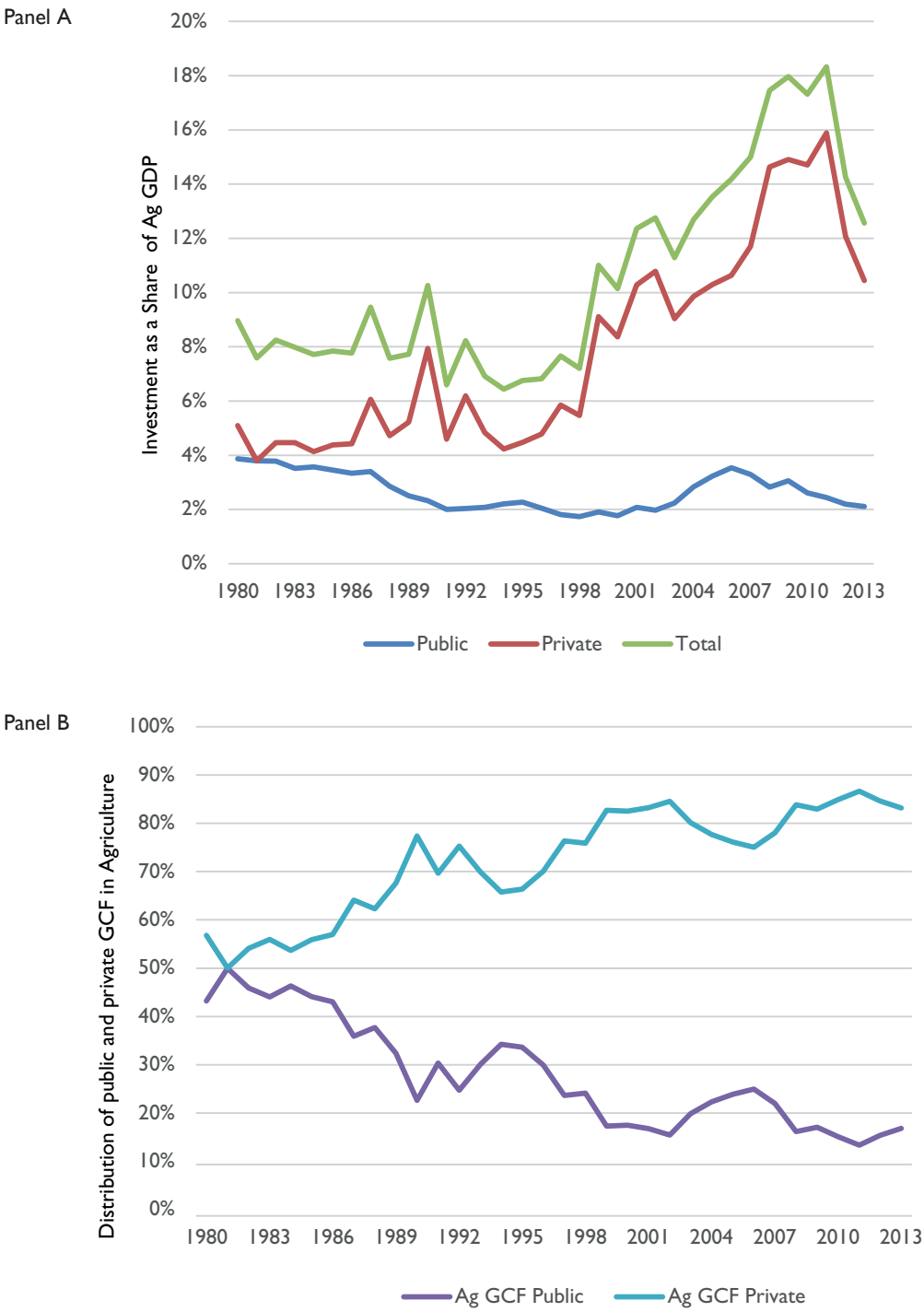

Figure 1. India—Gross Capital Formation in Agriculture as Percentage of Agricultural GDP (Current Prices)

Source: Central Statistical Organization, India, World Development Indicators, World Bank.

Table 1. India: Sectoral Private Investment in Agricultural R&D

			2008/09[b]		
	1984/85[a]	1994/95[a]	Total	Indian Firms	MNCs
Industry	*Millions of 2005 US$*				
Seed and biotechnology	1.3	4.9	88.6	49.3	39.3
Pesticides	9	17	35.7	24.4	11.3
Fertilizers [a]	6.8	6.7	7.9	4.9	0
Agricultural machinery	3.7	6.5	40.5	20.5	20
Biofertilizers and biopesticides	0	0	1.3	1.3	0
Poultry and feeds	–	3.5	7.8	7.8	0
Animal health	0.9	2.7	18.6	3.7	14.9
Sugar	0.9	2.5	10.8	10.8	0
Biofuels	0	0	13.1	13.1	0
Food, beverages, and plantations	1.3	10.3	27	16.2	10.7
Total	23.9	54.1	251.3	152	96.2

Sources: Pray and Nagarajan (2009, 2011), Ministry of Agriculture [MoA] (2010), National Seed Association of India [NSAI] (2010), Verma (2008), and Prabhakar (2008).

Notes: [a]Indicates area occupied by hybrid rice only. Does not include improved open-pollinated varieties.
[b]Estimates based on interviews, surveys, and annual reports.

Table 2. India: Cropping Changes and Impact of Agricultural R&D Private Sector R&D on Major Crops, 2008/2009

Impact Indicator	Millet	Sorghum	Rice	Cotton	Maize	Sunflower
Total area under cultivation (2008/09), million hectares	8.8	7.5	45.5	9.4	8.2	1.8
Percentage change in mean yield (1980/01 to 2008/09)	54.9	31.4	38.7	58.8	52	13.1
Percentage change in area under crop (1980/01 to 2008/09)	–33.3	–47.2	12	17	26.4	93.4
Percentage area under high-yielding varieties or hybrids (2008/09)	68.6	53.1	3.1[a]	80.8	58.8	41.7
No. of private firms with R&D focus (2008/09)[b]	30–35	20–25	24[a]	> 50	25–30	15–20
Proprietary hybrids as share in the supply of high-yielding varieties (%)	82	75	95[a]	95	> 90	> 95

Sources: Pray and Nagarajan (2009, 2011), Ministry of Agriculture [MoA] (2010), National Seed Association of India [NSAI] (2010), Verma (2008), and Prabhakar (2008).

Notes: [a]Indicates area occupied by hybrid rice only. Does not include improved open-pollinated varieties.
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growth regulation, animal genetics and health, biofuels, machinery, irrigation, soil analysis, and data-intensive precision farming tools. Table 1 illustrates the evolution to 2009 of private investment in agricultural R&D by sector in India. Total private investment grew by a factor of 10 in constant dollars during the 25-year period considered. Table 2 assesses the impact of private R&D on selected indicators related to major staple crops and cotton. By 2008/2009, proprietary hybrids had come to dominate the

Table 3. India: New Vegetable Hybrids, 1998–2005

Crop	Public	Private
Tomato	3	160
Eggplant	8	218
Chili	2	73
Capsicum	1	31
Cauliflower	1	35
Cabbage	–	20
Okra	2	32
Watermelon	2	25
Cucumber	2	10
Gourd	6	80

Source: Pray and Nagarajan (2012).

market as a share of the total supply of high-yielding varieties. Increase in yields during the period was reviewed. Table 3 documents the commanding position of the private sector in the development and marketing of vegetable hybrids.

The public sector (through the Indian Council on Agricultural Research, ICAR) continues to invest in the development of new varieties of self-pollinated crops including rice, wheat, many pulses, and oilseeds, as well as animal breeding and veterinary sciences. But in the eyes of many observers, the public agricultural research system "is under significant stress today with lack of clarity on focus and inefficient use of financial resources. Links among sister [research] institutions have weakened and accountability declined over time. There is a need for a rethink of the [public] R&D system" (NITI Aayog, Government of India, 2015).[3]

Private agricultural research, in turn, has flourished over the years. As it is funded from sales proceeds, the research naturally focuses on market opportunities and farmers' preferences. Surveys sponsored by the Syngenta Foundation in 2011 showed that at that time, 71 companies were active in research and agricultural product development in India, 22 in seeds, 19 in agrochemicals, 10 each in fertilizer solutions and mechanization (including irrigation), and 10 in other endeavors, including agronomic research on specific crops (Ramasamy, 2011).

Pray and Nagarajan (2012) summarize the effects and impact of R&D-based innovation by the private sector in Indian agriculture as follows (see also Das Gupta & Ferroni, 2012):

- Seed/biotech innovations have led to documented increases in yields in key field crops, vegetables, and fruits.
- Proprietary hybrids of pearl millet, sorghum, and maize lifted the productivity of these crops in semi-arid settings not well served by the Green Revolution.
- Proprietary hybrids cover at least 75 percent of the area planted to improved varieties and hybrids.
- Farmers captured substantial economic gains from yield increases in these settings and crops.
- Private research has helped India increase exports of crops, technology, and agricultural inputs such as agrochemicals and machinery.

- Private sector R&D has benefited not only the better-off but also poorer farmers. This is evidenced, for example, by the spread of improved, privately developed seeds to poor areas, the uptake of vegetable production by many marginal farmers using proprietary seed, and the creation of rural employment that accompanies agricultural intensification.

Despite these achievements, sizeable parts of Indian agriculture are underserved in terms of technology. Drought and heat-tolerant genetics for dry land conditions are in short supply, for example. Low profit margins limit the seed industry's incentives here. Recently introduced controls on seed prices may lead to reductions in research expenditure because of declining margins and perceived regulatory uncertainty going forward.[4] This is a matter of concern. Public research and extension efforts have not solved the problem. Joint public-private research and go-to-market strategies, including appropriate de-risking of private contributions, might help.

Agricultural extension plays a key role in technology dissemination, and the private sector is increasingly active in this domain. Public knowledge services for farmers have for many years been contending with problems such as budget limitations and staff renewal. Extension delivery has become more pluralistic in this context, with different types of non-profit and for-profit actors stepping in to address opportunities and fill gaps. The role of the private sector has increased through the direct participation of input suppliers and off-takers of commodities under contract farming arrangements.

A recent assessment of privately supplied farmer advisory services examined the situation in 10 countries; four of the case studies came from India. In these instances, the study identifies considerable benefits from extension by commercial actors. Their advice helped improve yield, natural resource management, consistency of produce quality, and net farm profits (Zhou & Babu, 2015). Nevertheless, the study's overall picture is mixed. Privately supplied agricultural advisory services offer choice and new options for farmers; in our view, they are here to stay. But this does not mean that "shared value balances" are always struck appropriately or fairly. Some farmers complain about high service charges built into the prices they pay or receive.

Agri-food Processing, Wholesale, and Retail

The private sector has transformed the agri-food landscape in the period since the early 1990s as India shifted from import substitution and protectionism to more open markets. The dairy sector illustrates this. The rapidly growing demand for milk and milk products "offers an opportunity for processors and organized retailers to expand their businesses by integrating their 'front end' activities of wholesaling, processing, logistics, and retailing with their 'back end' activities of production through institutional arrangements such as contract farming and producers' associations" (Birthal et al., 2016). The private sector's milk processing capacity grew steadily since deregulation, and in 2012–2013, it was 70 percent greater than that of cooperatives (Birthal et al., 2016). The progressive formalization of dairy value chains has also improved farmers' access to finance. Input suppliers, off-takers, and financial institutions are willing to lend to farmers against the prospect of steady incomes and loan repayment capacity linked to milk sales.

Food supply chains in general are undergoing profound change in India. This is true both in midstream segments (processing, wholesale, and logistics) and downstream (retail). According to Reardon and Minten (2012):

- Food retail transformations have come about in different waves, from government to cooperative retail chains in earlier periods to private ones in the past 15–20 years. In 2001–2010, modern food

retail is estimated to have grown at the astonishing annual rate of 49 percent (from a low basis). The potential for further growth remains enormous. Versions of modern retail are spreading to lower tier cities. Retailers' procurement and handling of fresh and processed/semi-processed products continues to evolve.

- The private sector is the main actor in the current transformation of food supply chains. As a direct buyer and seller, the government accounts for 7 percent of the national food economy (25 percent in grains).
- Sales of the private processing sector and food services industry are growing rapidly. Performance and market shares of the formal food processing industry exceed those of the more traditional "unorganized" sector. Midstream processing with various levels of value addition is a sizeable economic factor in such segments as oils and fats, grain milling, sugar, meat, poultry and fisheries, snack foods, beverages, animal feed, dairy, and ready-to-make items. There is a symbiosis between large processors and modern retail. Processed food consumption rises with income and urbanization, implying huge growth potential ahead.

The food processing, wholesale, and retail industries offer choice and convenience to consumers. It creates jobs, investment opportunities, intra-industry linkages, and opportunities to link farmers to markets. Its penetration in domestic markets is uneven. Where purchasing power is low, sales of processed products from organized brands are low, and modern retail may be missing entirely. Overall, the food processing, wholesale, and retail industries are important segments of the economy, growing much faster than primary agriculture, attracting foreign direct investment, and performing better than the manufacturing sector and the industrial sector as a whole in recent years (Government of India, 2016). This leads to opportunities for farmers and thus agricultural development and growth. Because there are many farmers, it will, however, take time to link most of them reliably to modern supply chains. New quality and traceability requirements are among the complications farmers face.

The industry confronts challenges, including infrastructure bottlenecks (leading to post-harvest wastage of produce) and differences in rules regarding contract farming across states. Raw material procurement constraints arise from the array of policies regulating the movement of agricultural commodities in the country, including differences in the operation of the Agricultural Produce Market Committees (APMC) Act in different states (Government of India, 2016).

To address these and other issues, the government and industry bodies have launched initiatives to promote food processing. Highlights include the reduction of excise duties on certain food processing and packaging machinery, special credit lines to designated food parks, the Reserve Bank of India's classification of loans to food and agri-based processing units and cold chains as "priority sector lending," and measures by the Ministry of Food Processing Industries, such as the creation of an "Investors' Portal" and "Food Maps of India" to facilitate sourcing (Government of India, 2016).

Along with new markets and consumer segments, these and other supportive endeavors suggest a prospect of continued evolution and growth for the industry with benefits for farmers through backward integration. Both parties should benefit: farmers from steady sources of income and the scope for modernization and diversification of their operations, and processors from supplies of the right kinds and quality of raw material at the right time (India Brand Equity Foundation [IBEF], 2015).

Workers benefit from employment growth in labor-intensive food processing industries—particularly in low-wage locations in poorer and relatively more agricultural states. This fosters poverty reduction and the agricultural transformation through non-farm jobs. The relative capital and labor intensity of agri-food processing, wholesale, and retail vary both spatially and across time, however, depending on

agglomeration effects, wage trends, the cost of finance, technological change and the degree of organization, and "formality" of firms. Organized agri-food manufacturing operates at different scales and is relatively more capital intensive than processing in the unorganized segment with its unregistered informal firms.

Public-Private Interactions

The private sector plays decisive roles in India's agricultural transformation today, driving productivity growth and creating value and jobs in supply chains "from farm to fork." These roles are, however, conditioned by government, which has the power to support or *in extremis* prevent the private sector from functioning.

Private investment responds to changes in the business climate, which is the consequence of many factors. They include governance and institutions, law and order, respect for property rights, a functioning regulatory system and financial sector, and public investment and policies of different kinds. How government manages these factors is absolutely crucial. The choices being made are political in nature and best interpreted in historical perspective. When it comes to implementation, there is a technocratic dimension as well. India's well-designed and well-intentioned policies in agriculture have sometimes not delivered the expected results because of shortfalls in their on-the-ground implementation (Kohli & Sood, 2012).

There is a strong need for appropriate regulation and well-administered enabling policies. Regulatory reform is in many respects succeeding at the center, but not yet backed up by coherent action in the states (Singh & Mitra, 2010). Competition for private investment in food value chains across states may prompt local measures such as tax breaks to counteract structural effects. But there is a wider reform agenda. In agricultural marketing, for example, this should foster agro-industrial linkages, farm productivity, and off-farm employment. Measures here include APMC Act reform, rationalization of taxes on agricultural commodities, e-trading, and disintermediation (Chand & Singh, 2016).

In addition, there would appear to be a case for public expenditure and investment reform. Public investment in agriculture is in decline, as we have shown. This is a source of concern, not only for farming itself, but for the broader rural economy. It is generally surmised that public investment in infrastructure, services, and public goods such as roads and broadband connectivity also crowds in private investment.

An important reason why public investment in agriculture is declining is that it is being displaced by rising subsidies in given budgets, in particular for fertilizer and power. These subsidies cater to special interests and outdated policy priorities at the expense of public goods. Since the mid-1980s, they have claimed a growing share of public expenditure in agriculture (Chand & Kumar, 2004). The public goods/subsidies imbalance is believed to interfere with the pace of additional private investment, implying rates of agricultural development, and growth below potential. It also encourages both wasteful uses of natural resources and agronomic choices with questionable effects on the environment and sustainability.

Where does this leave us at the end of this discussion? The private sector will continue to drive India's agricultural transformation. To do its job well—creating value innovatively, competitively, and profitably—it needs implicit governmental guidance and enabling support. The government's challenge is to supply this in the best possible way.

Notes

1. The public sector's target of 4 percent agricultural GDP growth per annum—proposed in 2000 as part of the then "New Agricultural Policy"—has not been consistently met so far. As calculated from World Development Indicators, agricultural GDP grew at an average annual rate of 3.05 percent, 3.35 percent, and 1.7 percent, respectively, during the five-year periods 2002–2006 and 2007–2011 and the four-year period 2012–2015. The last figure reflects severe and moderate drought in 2014 and 2015, respectively (El Niño years). Growth recovered in 2016 in conjunction with better monsoons.
2. Private research is undertaken in India by domestic and multinational companies. The relative effects of each on yield, farm profits, and agricultural growth are difficult to identify, because of spillovers from global research carried out by multinationals.
3. Agricultural research and extension do not figure explicitly among the seven priorities for the farm sector announced by the Indian government in February 2017 (http://pib.nic.in/newsite/PrintRelease.aspx?relid=158415).
4. http://www.thehindubusinessline.com/economy/agri-business/price-control-may-hurt-investment-in-seed-sector/article8381728.ece

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