



Agricultural Transformation in India is the Need of Hour Today

KEYWORDS

Agricultural inputs industry; Agribusiness R&D; India

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ABSTRACT Indian agricultural input industries have gone through a major transformation in the last 40 years. State owned firms grew during the Green Revolution and then stagnated or declined. Indian corporations that were protected from foreign competition are now exporters of agricultural tractors and pesticides. Foreign multinational corporations are rapidly increasing their role in the seed, pesticide, and tractor industries. Entry by large Indian firms and multinationals has increased competition in the input industries. Private agribusiness R&D in India grew from \$23 million in 1985 to \$250 million in 2009 in 2005 US dollars. This is the same time period as a transformation in the agricultural input industry, rapid growth in demand for agricultural inputs, breakthroughs in information technology and biotechnology, and changes in intellectual property rights. An econometric model was used to test whether the transformation of agricultural input industry was a major factor in the growth of R&D expenditure or not. This article analyzes a unique, firm level sales and R&D data set from the seed, pesticide, tractor, and fertilizer industries in 2000–2009. The estimated model indicates that agribusiness firms' R&D expenditures from 2000 to 2009 were positively related to variables associated with industry transformation such as firm size, ownership by multinationals, and declining industry concentration. The model also indicates that strengthening patent policy as well as growth in the size of research-intensive industries like the seed industry contributed to the growth of agribusiness R&D in India.

Introduction

Agricultural sector in India has moved from a traditional agriculture in the 1950s to the modern technologically dynamic high capital intensive agriculture, in which along with food and non-food crops, horticulture and other allied activities have also expanded.

A study of the economic framework within which traditionally low productivity agriculture is transformed into high productivity modern agriculture is important in policy-formulation and planning for growth. Productivity here refers to productivity of agricultural land, labour and capital resources; and this involves the larger use of scarce resources like capital, foreign exchange and expert personnel. An absolute criterion cannot be laid down about the content and chronological order of such compositions, since agriculture varies vastly from area to area in terms of physical conditions (i.e. soil moisture, cropping pattern, responses, availability of labour, etc.), cultural factors (education, receptivity to innovations, consumption pattern, etc.), economic factors (prices of input and outputs) and institutional factors (nature of research, extension, marketing supply and other institutions).

Historically, agriculture has played a key role in kick-starting economic growth and reducing poverty and hunger in many developing countries. Moreover, most of the countries that have failed to launch an agricultural revolution remain trapped in poverty, hunger, and economic stagnation. But the conventional conclusion that developing countries should continue to invest in their agricultural development, and particularly in food staples and small farms, is being challenged. In an era of globalization, trade liberalization, changing market structures and demand, and ample world food supplies, a new breed of agricultural skeptics argue that poor countries should now downplay the importance of food staples and small farms and focus instead on com-

mercial farms, higher-value agriculture, and rural income diversification through migration and nonagricultural development (e.g. Maxwell et al., 2001; Ellis and Harris, 2004). Some even advocate that poor countries take advantage of the global glut in food staples to leap frog agricultural development altogether. Yet others note that rapid growth in urban-rural linkages and rural income diversification are making agriculture largely irrelevant for the rural poor. These arguments have merit, but they can also trigger simplistic and generalized conclusions that overlook the diverse needs and opportunities facing developing countries today. Not only are there still many viable opportunities for small farms, but the kinds of state withdrawal from agriculture being promoted by some could lead to a massive and premature exodus of small farms that could overwhelm the capacity of many developing countries to cope.

Nevertheless, in the context of Indian agriculture, three distinct phases of growth can be distinguished as follows:

Phase I: Traditional Agriculture

This is a technologically stagnant phase in which a larger farm production becomes generally possible only through increased application of all three traditional inputs, viz. land, labour and capital. The rate of increase of output is normally smaller than the rate of increase in inputs-revealing diminishing productivity of inputs, even at a low yield.

Even if some elements of dynamic agriculture like application of fertiliser, improved seeds and land reform are introduced, the increase in productivity is smaller.

Further, given their resources and knowledge, the traditional farmers cannot become any more efficient as both these factors strongly limit their participating actively in contributing to higher production. Till mid-1960s, the Indian agriculture was typically embodied within the frame-

work of traditional agriculture outlined above.

The period 1950- 51 to 1966-67 can be easily divided into two sub-periods as follows:

i. First sub-period (1951-61):

This period lasted over the first decade of economic planning spread over the period covered by the first and second Five Year Plans. The primary characteristic of this period was that production of agricultural crops consistently maintained an upward trend, except for small dips in two years, 1957-58 and 1959-60. The index number of production of all crops went up from 45.6 in 1950-51 to 66.8 in 1960-61 (Base: 1981- 82=100).'

ii. Second sub-period (1961-67):

During this period (i.e. 1960-61 to 1966-67) production either declined or remained stagnant in the case of a number of major crops, especially food grains, as can be seen from Table 1.1:

Table 1.1
Production of Food Grains in India

Year	Output
1%1	60.9
1%2	61.8
1963	60.2
1964	61.8
1965	67.3
1966	54.6

This led to a serious crisis in the Indian economy prompting a reappraisal of the growth strategy pursued in the agricultural sector. This reappraisal of policies and strategies brought about a transformation in Indian agriculture, leading to what can be marked as phase II of Indian agriculture.

Phase II: Technologically Dynamic Agriculture with Low Capital Intensity:

The Indian agriculture entered the next phase after 1960s. This is described as phase II marked for technologically dynamic agriculture with low capital intensity. This is the beginning of the process of transformation from traditional agriculture to modernisation. In this phase, agriculture still represents a large portion of the total economy.

But population and incomes would be rising, increasing the demand for agricultural products while the size of the average holding would be coming down. There is scarcity of capital both in industry and agriculture. The farm sector tends to use more labour than capital, since labour, owned or hired, would be still, relatively cheaper than mechanisation.

The distinguishing feature of phase II is the application of science and technology, evolved by research institutions, in a progressively large measure. This increases the productivity of farms when small capital additions are made in the form of improved seeds, fertilisers and pesticides. The profitable innovations are accepted by the farmers despite imperfections in land tenure, marketing and input supply system.

The stagnancy that had marked the agricultural sector during the early-1960s, had largely been overcome around the end of the decade. In the wake of the new agricultural strategy of growth (called the Borlaug seed-fertiliser-tech-

nology) that had been adopted, agricultural production especially food grains, began to increase sharply Table 1.2.

Table 1.2
Production of Major crops

Crop	1960-61	1970-71	1980-81	1990-91
Food grains	82.0	108.4	129.6	176.4
Oil seeds	7.0	9.6	9.4	18.6
Sugarcane	110.0	126.4	154.2	241.0
Cotton	5.6	4.8	7.0	9.8
Jute	5.3	6.2	6.5	7.9

This fact is brought out more clearly by the index numbers of agricultural production presented in Table 1.3.

Table 1.3
Index Numbers of Agricultural Production

Year	Index No.
1960-61	66.8
1970-71	85.9
1980-81	104.1
1990-91	148.4

Increase in agricultural production can be attributed either:

- (i) To increase in area under cultivation (i.e. horizontal expansion), or
- (ii) To an improvement in yield per hectare (i.e. vertical expansion), or
- (iii) To both an increase in area under cultivation and an improvement in yield per hectare.

During this phase of transformation, significant contribution to improved agricultural output was achieved by way of improvement in agricultural productivity with little change in area under cultivation. Index number of area under cultivation changed marginally from 96.3 in 1970-71 to 105.2 in 1990-91.

On the hand, the index number of agricultural production increased from 85.9 in 1970-71 to 148.4 in 1990-91 (Base: 1981-82 = 100). This phase of agriculture transformation came to be known as the period of Green Revolution. The green revolution was, however, confined to a few crops-wheat and rice, and to few regions.

Phase III: Technologically Dynamic Agriculture with High Capital Intensity:

As phase II advances, more and more innovations giving small returns singly, but large returns jointly would be accepted leading to higher productivity. In order to expedite progress, there should be an extensive utilisation of available abundant factors. At the same time, relatively scarce infrastructural facilities like research, extension, marketing, etc. should be utilised optimally with efforts directed towards expanding the infrastructural resources.

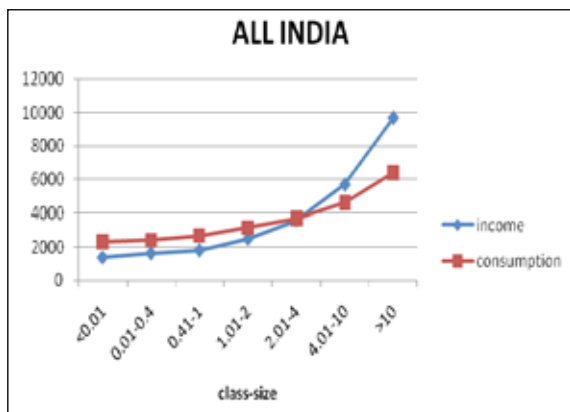
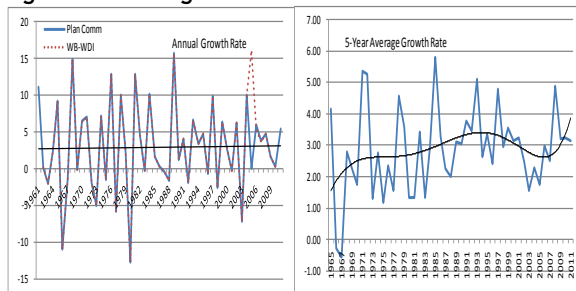
Indian agriculture entered the third phase of technologically dynamic agriculture with high capital intensity towards the end of the decade of 1980s. This was precisely the period when the non-agricultural sectors also began their march towards modernisation.

Non-agricultural sectors were facilitated in their move towards aggressive modernisation by the new policies of liberalisation, privatisation and globalisation. This phase of agricultural transformation is thus characterised by the substitution of labour by capital by way of large-scale farm machinery, and considerable competition between the sectors for capital.

With a majority of its population living in villages, rural poverty is a major problem in India. The disparity between the urban and rural incomes is also on the rise. This leads to migration to urban areas resulting in urban blight as well. Therefore addressing the problem of rural poverty assumes urgency. On my last trip to India, I witnessed an innovation experiment, National Agro Foundation (NAF), that addresses this wicked problem.

Since its inception in 2000, NAF has been involved in a range of interventions—infusion of technology, soil enrichment, efficient farm and water management, improved cattle development, functional literacy, rural sanitation and public health, human resource development, establishment of self-help groups particularly among women, self-employment opportunities and facilitating institutional credit—to address the problem of farm productivity in India. Founded by Mr. C Subramaniam on his 90th birthday as a parting gift to his country, the NAF focuses on the poor and marginal farmers, women, unemployed youth, and depressed communities. (Mr. Subramaniam is widely acclaimed as the Father of the Green Revolution in India, because in the mid-1960s, as the Minister for Food and Agriculture, he successfully handled a major food crisis).

Agriculture GDP growth



NAF works in about 250 villages in Tamilnadu and has reached 30,000 rural families. A large part of NAF's effort with farmers is to help break their initial emotional barriers to new technologies. This has provided the platform to launch into other initiatives. The success of these measures has had a demonstrative impact on the farmers' willingness to adopt and internalize new technologies. This may be considered an attitudinal breakthrough.

Another initiative, the Center for rural development (CFRD), a training cum village knowledge center, has been established in Illedu Village of Kancheepuram district with classrooms, computer lab with internet facilities, input and product handling center, farm machinery workshop, model

experimental farm, residential complex for trainees and an open air theatre to cater to the needs of various sections of rural community. NAF has also established a Research and Development Center in Chennai housing a comprehensive soil testing laboratory, food safety and standards laboratory and a plant tissue culture lab to provide agriculture support services.

Here are some highlights of the outcomes as a result of these NAF interventions:

Agriculture productivity improvements through resource conserving "Lean Farming": Paddy (55%), Groundnut (113%), Vegetables (116%), Sugarcane (40%), and Corn (150%). Through successful lead farmers, technology transfer has been effected over an area of 10,000 acres with a "Lead Farmer—Lead Village" concept. Addressing the agriculture value chain—soil testing, facilitation of inputs and credit, market linkage, and field advisory services—is part and parcel of agriculture development initiatives. Promotion of climate resilient agriculture, resource conserving technologies and promotion of use of Information Communication Technology (ICT) in agriculture are being attempted too.

Watershed and natural resource management initiatives have resulted in increase in water table ranging from 3.5 meters to 5 meters in the project area of over 6,000 hectares. Cropping intensity has been doubled (two crop cultivation in a year instead of one crop) and about 20% additional area which had been left fallow has also been brought under cultivation. Soil erosion, nutrient loss, damage due to flooding during rainy seasons have reduced significantly.

Over 6,500 high yielding cross bred cattle with a milk yield improvement to the extent of 300% has also been achieved through NAF's animal husbandry initiatives.

To sustain the benefits derived, the Social Development initiatives of NAF have helped village communities in establishing community-based institutions like Farmers Clubs (160), Self Help Groups and Joint Liability Groups (900), Farmers Producer Organizations (6), Watershed committees (25) etc for collective decision and action. Over 6,000 people have been made functionally literate through adult literacy program. Over 1,900 beneficiaries have established micro-enterprises for which microfinance has been facilitated. 30 children are passing through every year through its play school for the past six years. The children are provided nutritious food in order to ensure nutritional security to the underprivileged. Over 1,400 toilets have been built with people participation under sanitation initiatives.

Training is imparted on "technology-oriented" and "participation-oriented" modes to various stakeholders of agriculture and rural development like farmers, youth, women, socially excluded, functionaries of NGOs, water users, producer groups, input suppliers, bankers, students etc. Over 50,000 people have benefited in the past decade.

Need for integrated assistance

A profound challenge facing those who would intervene to support agriculture and small farms is how to integrate various needs and approaches into holistic packages of intervention. For example, if small farms are to exploit growth opportunities in food staples, then they not only need access to markets but also access to key inputs and technologies to increase their productivity and to meet required quality standards. Interventions that seek to help

farm households as farmers also need to be integrated with interventions that seek to enhance their nonfarm employment opportunities or to protect them in emergency situations. Different interventions can have positive cross-impacts on each other. For example, safety net programs that enhance a farmer's assets or ability to manage or cope with risk could enhance their opportunities as farmers as well as consumers. On the negative side, safety net programs might crowd out more market based alternatives (e.g. drought relief vs. insurance). Many past government-led attempts to assemble integrated packages to assist small farms (e.g. the integrated rural development projects (IRDPs) of the 1970s and 1980s) did not fare well. Key lessons are that they were top down approaches that overreached in terms of coordinating many different agents and oversimplified in the face of considerable diversity in local agroclimatic and socio-economic conditions. They also gave too little attention to the problems of the poor and the inherent weaknesses of many public institutions. There have since been important changes in the kinds of agents contributing to the development of agriculture and small farms, with the restructuring and decentralizing of government agencies and the emergence of civil society (including non-governmental organizations (NGOs) and community and voluntary producer based organizations (CBOs)) and large private firms (e.g. agro-processing firms, supermarkets, and tourism promoters) as important players. This has opened up new opportunities for more participatory, multi-agency, decentralized and market oriented approaches that build on local knowledge of needs, opportunities and constraints that are far more relevant for coping with diversity and changing economic conditions. The challenge for rural development experts is how to build on this new landscape and create new kinds of approaches towards the agricultural and rural sector.

Conclusion

In many poor countries, small farm development offers a viable and pro-poor option for agricultural development. However, small farms are seriously challenged today in ways that make their future precarious. International trade and rising per capita incomes in many countries are changing the nature and composition of demand for agricultural products. At the same time, marketing chains are changing and are becoming more integrated and more demanding of quality and food safety. This is creating new opportunities for higher value production for farmers who can compete and link to these markets, but for many other small farms the risk is that they will simply be left behind. In developing countries, small farmers also face unfair competition from rich country farmers in many of their export and domestic markets, and they no longer have adequate support in terms of basic services and farm inputs. And the spread of HIV/AIDS is further eroding the number of productive farm family workers, and leaving many children as orphans with limited knowledge about how to farm. Left to themselves, these forces will curtail opportunities for small farms, overly favor large farms, and lead to a premature and rapid exit of many small farms.

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