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The Changing Landscape of Public Expenditure and Investments in Agriculture: Implications for Growth Trajectory

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I

INTRODUCTION

Despite a commendable growth in food production over the past half a century, one of the most important challenges facing the Indian agriculture today is ensuring food and nutritional security of a billion plus population in a way that is environmentally and socially sustainable. This challenge is amplified further in the midst of recent spike in global food and energy prices, degrading natural resources, decelerating growth in total factor productivity, climatic variability etc. At the same time, urbanisation coupled with higher purchasing power also demands a wider range of quality attributes from agriculture, not just of the products themselves but of the methods used in their production and value addition. Hence, the agriculture sector will need to respond in ways beyond the traditional focus on higher productivity, addressing the protection of environmental common goods, consumer concerns for food safety and quality, and the enhancement of rural livelihoods (FAO, 2004).

Indian agriculture grew significantly during the 1980s and early 1990s, as evidenced by the performance of the crops, livestock and fisheries sectors. The crop sector showed modest growth (3.1 per cent) during the early 1990s, but it consistently slowed down (2.5 per cent) thereafter. The rate of growth in livestock production also began to slow down in the mid-1990s but has remained higher than the corresponding rate of growth in food grains and oilseeds. There is a noticeable decline in growth rates after the mid-1990s across all agricultural sectors, with growth in some sectors (including oilseeds, livestock and fisheries) rebounding in recent years. However, a substantial cause for concern has been the ratcheting down in the pace of growth of cereals output in the recent decades (1.3 per cent during 2002-07), given the fact that the substantial share of agricultural output still derives from this sector and is the mainstay of India's food security (Singh and Pal, 2010). Consequently, achieving the target of 4 per cent growth in agricultural gross domestic product (AgGDP) has remained an elusive goal.

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The study has drawn heavily from NAIP Project "Policy and Institutional Options for Inclusive Agricultural Growth".

In the light of these demand and supply pressures, the agricultural sector has attracted renewed attention in the national developmental agenda with multi-pronged strategies. However, the strategies and policies alone will not be sufficient to push the agricultural sector on higher growth trajectory until they are backed by a range of technological and institutional innovations along with complementary investments across the broad spectrum of agricultural production systems from the most progressive to the marginal ones. Government expenditure in agriculture targeted to infrastructure and provision of farm services has been an important element of agricultural policy in the country. The experiences of green revolution have also confirmed that a strategy of strong public support for agriculture has paid rich dividends.

Due to the continuing underperformance of Indian agriculture relative to the targeted growth, questions are often raised about the level and appropriateness of different kinds of government expenditures made within the sector; and also the institutional environment in which investments are being made. Further, while the role of investments in promoting economic growth and poverty reduction is being widely recognised, it is all the more important to set right priorities in investments with improved efficiency to gear up the economy. Answering these policy questions require a deep understanding of the recent trends and composition of public and private investments in agriculture along with their interrelationships with changing growth scenario. This paper contributes to the knowledge gap by using recent data and seeks to achieve three major objectives, viz., (1) examine the recent trends in government expenditures and investments for agriculture and mapping the significant changes therein, (2) exploring sectoral and regional dimensions of agricultural investments and their linkages with growth; and (3) draw policy recommendations for improving the efficiency of public investments in agriculture. For this, the study has used data on government expenditure (Union government and all state governments) from Combined Finance and Revenue Accounts, Government of India. The time series data on various heads of expenditure impacting agricultural growth includes both revenue and capital account from 1991-92 to 2008-09. The expenditure heads under agriculture includes actual revenue and capital expenditures incurred on rural infrastructure (rural roads and electricity), irrigation (major and medium, minor and command area development), rural development and rural employment programmes including land reforms, expenditure on crop husbandry, soil and water conservation, animal and dairy husbandry and fishery sectors including agricultural research and education and extension and training. The expenditure made under the head capital account adds directly to the productive capacity of the economy, and hence termed as investments as against the revenue account which includes salaries, overheads and operational cost for delivering public goods. The real expenditure and investment series was prepared by deflating at 2004-05 prices by implicit price index of agricultural capital formation.

II

RESULTS AND DISCUSSION

2.1. *Government Expenditure for Agriculture and Allied Sectors: Trends and Composition*

Over the past one and half decades, the total government expenditure for agriculture and allied sectors in real terms (2004-05 prices) has increased from Rs.827 billion in the mid-nineties to Rs. 2202 billion in 2009, an annual growth rate of 7 per cent (Table 1). During 2000s, growth in government expenditure increased to 13 per cent as against 2.5 per cent during the nineties. Government expenditure on agriculture as a percentage of agricultural gross domestic product which measures the amount spent on the sector relative to its size, increased from 20 per cent in 1995 to 35 per cent in 2009. Agricultural expenditure as a share of total developmental expenditure indicate the level of priority a country gives to its agriculture sector. This share also showed an impressive increase from 23 per cent in early nineties to 33 per cent in 2009. In recent periods, the country has witnessed two noteworthy changes in funding and use of funds. Firstly, there has been a consistent rise in share of the Union government in total agricultural and allied sector expenditure, which rose from 26 per cent in 1995 to 49 per cent in 2009. Second, the proportion of capital expenditure out of total expenditure has also shown a remarkable increase over the years indicating higher priorities for capital formation in agriculture. Apart from the absolute level of expenditure, an equally important aspect is its composition which reflects the relative priorities placed across the sectors and regions. Out of the total expenditure, the highest share went to rural infrastructure (34 per cent), followed by agri-input support services (26 per cent), rural development (23 per cent), irrigation (15 per cent), and agricultural research, education and extension (2 per cent) during the triennium ending 2009. The expenditure items that grew most rapidly during the current decade were agri-input and support services, rural development and

TABLE 1. INTENSITY INDICATORS OF GOVERNMENT EXPENDITURE ON AGRICULTURE AND ALLIED SECTORS (ALL INDIA, 2004-05 PRICES)

Particulars	TE- 1995	TE – 2009
(1)	(2)	(3)
Government expenditure for agriculture (Rs. billion)	827	2202
Share of capital expenditure in agriculture expenditure (per cent)	17	23
Share of union government in agriculture expenditure (per cent)	26	49
Share of agriculture expenditure in Ag. GDP (per cent)	20	35
Share of agricultural expenditure in developmental expenditure (per cent)	23	33
Ag. expenditure per capita of rural population (Rs.)	1316	2966
Ag. expenditure per ha (NSA) (Rs.)	5794	15645
Share of agricultural research and education in AgGDP (per cent)	0.45	0.58
Share of agricultural extension in AgGDP (per cent)	0.14	0.15

Source: Computed by author from data compiled from Combined Finance and Revenue Accounts, Government of India (various issues).

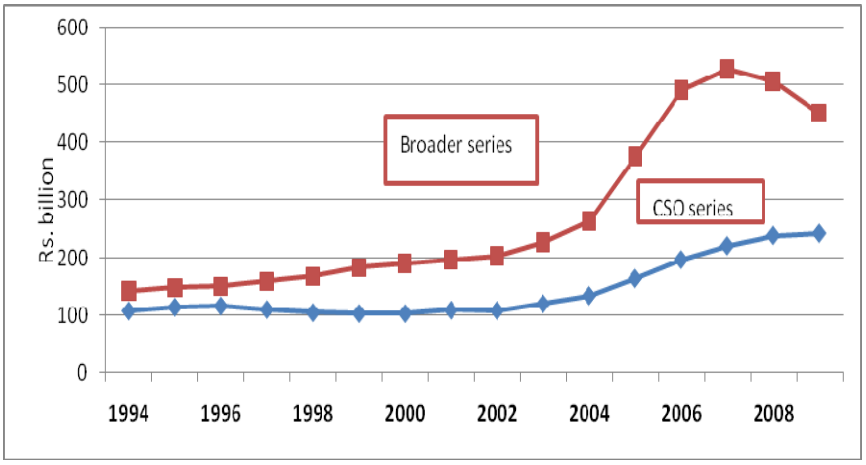
infrastructure including irrigation. The growth in agri-input and support services (consisting mainly of crop husbandry, animal husbandry, soil and water conservation etc.) was particularly rapid; it is one item that continued to grow at 22 per cent per annum, and includes input subsidies and other government schemes related to agriculture and allied sector. Other expenditure items which showed impressive growth during the current decade includes infrastructure (13 per cent) consisting mainly rural roads and rural electrification, rural development (13 per cent) and major and medium irrigation (11 per cent) at all India level revealing that government expenditure pattern has become broad-based over time.

Since agriculture is the state subject, the bulk of the capital expenditure is being made by various state governments. This includes expenditures financed from the states' own revenues as well as central government's fund channeled through the state governments. State-wise analysis shows wide disparity among the states in government expenditure for agriculture and allied sector. In absolute terms, among all the states, Andhra Pradesh (16 per cent) has the largest share in all India expenditure closely followed by Maharashtra (15 per cent), Uttar Pradesh (13 per cent) and Karnataka (9 per cent) during 2009. However, on per capita rural population basis, the north-eastern states like Arunachal Pradesh, Sikkim, Mizoram, and Maharashtra, Andhra Pradesh, etc., have relatively higher expenditures. Relatively agriculturally backward states like Assam, Bihar, Madhya Pradesh, Orissa, and West Bengal still spend far less than the progressive states. For example, on per capita basis, Maharashtra invests 6 times more than West Bengal in 2009. This is further supported by the fact that West Bengal spends on agriculture only 5 per cent of AgGDP as against that of 25 per cent by Maharashtra during the same period. The inability of these states to substantially raise the level of their agricultural expenditures may have serious implications for food security and poverty reduction.

2.2. *Recent Trends in Investment Growth in Agriculture*

A number of economists in the recent past have expressed concern about the decline in public sector capital expenditure (investment) in Indian agriculture during the eighties and nineties. They argue that it is not only detrimental in itself; but it also leads to pull down private investment in the agricultural sector.[1] Apart from major and medium irrigation, government expenditure on rural roads, rural electrification, minor irrigation, rural development, research, education and extension and agri-input supply and services also influence agricultural growth.[2] Considering the broader definition of investments for agriculture, government real investment (2004-05 prices) increased from Rs. 147 billion in the mid-nineties to Rs. 495 billion in TE 2009, showing annual growth rate of 10 per cent per annum. During this period real gross capital formation based on CSO series showed a 6 per cent growth. A perusal of broader series of real public investment (2004-05 prices), though confirms relatively slow pace in public investment for agriculture during the nineties.

However, an increasing gap between the two series is clearly witnessed indicating broad based investment strategy for agriculture. The government investment for agriculture grew at 5 per cent annual growth during the nineties which rose further to 15 per cent during the current decade. The private investments too on trend basis showed an upward momentum during the current decade enabling total investment to grow at the rate of 11 per cent.



Source: Same as Table 1.

Figure 1. Trends in Real Public Investment in Agriculture and Allied Sectors (All India, 2004-05 Prices)

Empirical evidences clearly support a positive correlation between public investments in irrigation and infrastructure creation and private investments in agriculture (Roy and Pal, 2002). The massive development of groundwater irrigation, on account of conscious policy shift towards rural infrastructure such as electrification and subsidised energy pricing has led to rapid growth in the adoption of groundwater irrigation. An analysis of the decennial All India Debt and Investment Survey data (2002-03) regarding the composition of farm household investment in agriculture also clearly depicts that investment in farm machinery, transport equipment and minor irrigation constitutes 70 per cent of the total farm business investment by rural households. The investment portfolio of rural households seems to be responding with public investment priorities, hence facilitating commercialisation of agriculture. The capital expenditure under wells and other minor irrigation equipments showed eight percentage points increase from 1991-92 to 2002-03 as against the equal decrease in agricultural machinery and transport equipments during the same period. Across states, the share of capital formation in wells and minor irrigation in total farm household investment was seen the highest in water scarce but agricultural based states like Tamil Nadu (65 per cent), Maharashtra

(53 per cent), Rajasthan (52 per cent), Haryana (49 per cent) and Karnataka (37 per cent). Investment in livestock also showed an impressive upward trend from 6 per cent to 14 per cent from 1991-92 to 2002-03 clearly indicating farmers' preference towards diversification and intensification. However, the investments in land improvement have shown a distinct decline from 13 per cent to only 6 per cent during the same period at the all India level. Since, private investment is largely dependent on several enabling factors such as access to the investible funds with farmers apart from public investments, the other noteworthy trend is increased access to institutional credit. The proportion of term-credit to private capital formation, which was one-third during the seventies, doubled during the eighties. After a temporary decline in the share to 45 per cent in the nineties, it again rose to 75 per cent of the private investment in agriculture after 2003-04. Therefore, it appears that government intervention in promoting access to agricultural finance and creation of improved infrastructure is rewarding in terms of bringing Indian agriculture to become a commercial venture.

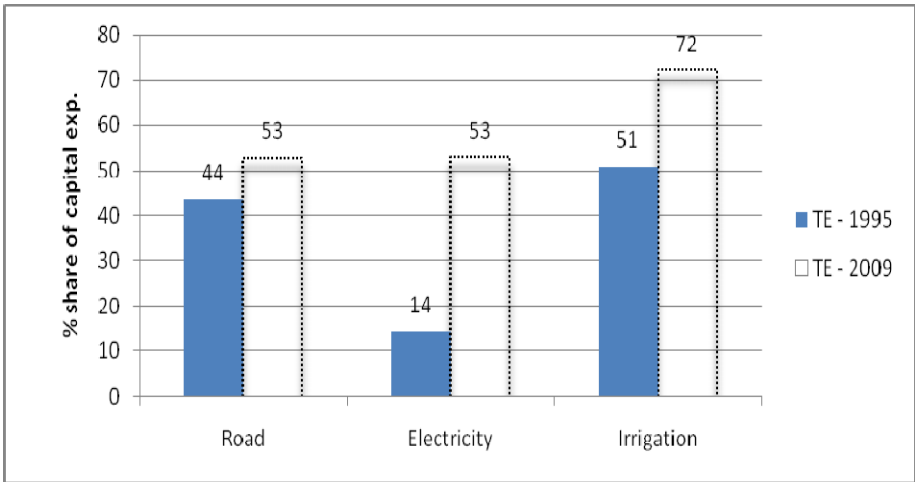
III

GROWTH DECELERATION AND SHIFTING COMPOSITION OF GOVERNMENT EXPENDITURE ON IRRIGATION AND RURAL INFRASTRUCTURE

Most of the public investment in agriculture has been for development of irrigation infrastructure, mainly surface irrigation. The real government expenditure (2004-05 prices) on major and medium irrigation including command area development grew from Rs. 89 billion in the early nineties to Rs. 191 billion in 2009 at an annual growth rate of 6 per cent. The total expenditure grew with slow pace during the nineties (1.3 per cent) as compared to the current decade (12 per cent). More so, government spent almost half of the entire expenditure for maintenance (revenue account) during the early nineties, thus limiting the funds for building of additional irrigation capacity. The poor maintenance of existing structures on one hand, and delays in new construction due to shortage of funds on the other, has resulted into only marginal increase in canal irrigated area, during the recent period. Thus, spurred by a slowdown in net irrigated area crucial for country's food security, the government once again stepped up its investment in irrigation, leading to a hike since beginning of this decade. However, the equally important issue is the optimal use of surface irrigation (canal and tank irrigation) and increased technical efficiency in water use, which is currently estimated at about 25 per cent to 35 per cent in most irrigation systems (Planning Commission, 2008). Substantial investment is further needed for upgradation of irrigation infrastructure to reduce water losses. In addition, better distribution of irrigation water and recovery of irrigation charges are envisaged through participation of farmers in water user associations. These associations, in partnership with irrigation departments, can effectively maintain irrigation channels, manage water distribution at the farm level, and recover costs from the member

farmers. Successful joint management has yet to materialise, especially in terms of cost recovery.

The other most noteworthy trend during the current decade is consistently higher capital expenditure not only on major and medium irrigation but also on rural roads and electrification too, thus reversing the previous trend which is expected to pay rich dividends in the near future (Figure 2).



Source: Same as above.

Figure 2. Trends in Share of Capital Expenditure on Irrigation and Rural Infrastructure

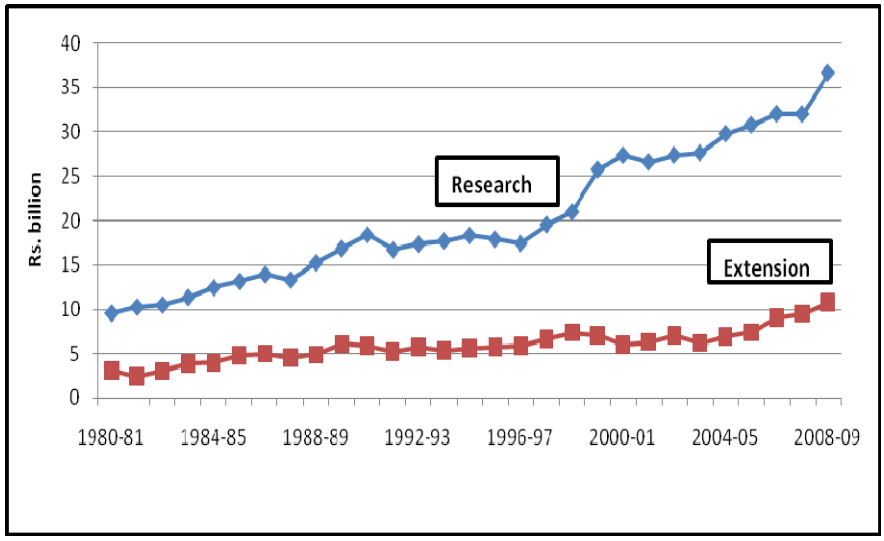
IV

TRANSFORMING AGRICULTURAL INNOVATION SYSTEM

4.1. *Trends and Composition in Public Sector Expenditures*

National level R&D expenditure is a good indicator of technological capabilities within the national innovation system. India's R&D spending is largely undertaken by the government sector rather than private enterprises as in case of many developed and few developing countries like Brazil. Government expenditure on agricultural research and education (both Union and all state government) in real terms (2004-05 prices) has continued to move upward from Rs. 20 billion in 1995 to Rs. 35 billion in 2009 (Figure 3). Agricultural research intensity—the share of agricultural research and education expenditures in agricultural gross domestic product (AgGDP) was estimated at 0.58 per cent in 2009 showing a moderate improvement since the early nineties (0.45) (Table 1). Ultimately, it is the overall efficiency of investment which is the most crucial factor in delivering the goods. However, these impressive figures

conceal large differences among different states/regions of the country. Regional allocation of research resource has revealed that the western and southern states account for 60 per cent of all research resources, while hill states and eastern states are relatively under-emphasised. Commodity orientation of research resources reveals still the predominance of crop husbandry (85 per cent) followed by animal husbandry (7 per cent), whereas soil and water conservation, dairy development and fisheries sectors receive less than 5 per cent each.



Source: Same as above.
Note: Expenditure figures represent triennium averages.

Figure 3. Trends in Real Government Exp on Agricultural Technology Generation and Delivery Systems (2004-05 prices)

The agricultural research spending grew at an impressive rate of 6 per cent during the eighties, slowed down to 3 per cent since the nineties (Table 2) seem to be a serious concern especially in view of increasingly capital intensive nature of agricultural R & D. Hence, relatively lower R & D intensity ratios as compared to other developed (2.35) and developing countries like Brazil (1.04) (Franco *et al.*, 2011) coupled with slowing down in growth of funding may pose serious challenges as there is a substantial gestation period between investment in technology generation and adoption of scalable technologies by its clients. There have also been growing concerns about the efficiency with which resources are being utilised. Imbalances in functional allocation, poor monitoring and evaluation, duplication and bureaucratic rigidities, etc., have been identified as the weaknesses of the public agricultural research system (Jha and Kumar, 2006). Besides that, Indian agricultural research and education system is growing continuously in terms of size, but the strength of manpower has not kept pace with the growth in the number of institutions,

TABLE 2. GROWTH RATE TRENDS IN REAL EXPENDITURE ON AGRICULTURAL RESEARCH AND EDUCATION IN INDIA

(*CAGR per cent*)

Period	Agricultural research and education	Agricultural extension
(1)	(2)	(3)
1980-90	5.96	9.54
1991-2000	3.38	2.76
2001-2009	3.48	6.23

Source: Same as above.

universities and colleges. The number of occupied faculty positions in several state agricultural universities have markedly dwindled, besides suffering from in-breeding, ageing and decline in skills. Agricultural extension plays an important role in bringing together research, farmers, and other players in the innovation system. Like research, the technology delivery is also the prime responsibility of the state governments. The overall government expenditure on extension grew more than three-fold in real terms from Rs. 3 billion in the nineties to Rs. 10 billion in 2009, with impressive growth (6 per cent) in recent years following a period of contraction during the nineties. However the share of extension expenditure in AgGDP consistently showed stagnancy since the last two decades (0.15 per cent) (Table 1). Apart from the size of extension system, the most important thing is that it should provide best-fit solution to the local needs and conditions to achieve the desired impact. Studies have repeatedly shown farmers' perceptions and complaints about the ineffectiveness of extension system and viewed as supply-driven. This necessitates institutional and organisation reforms in technology delivery system to make them more pluralistic in nature, demand responsive and cost-efficient.

4.2. *Agricultural R & D in Private Domains: Industry Structure and Investments*

The R&D effectiveness is considered to be higher when it is effectively linked to the market as in the case of private sector. Recent resilience in agribusiness is demanding value-adding processes and efficient production technologies to cater new and evolving demands for farm products with specific attributes. These developments have attracted lot of investments not only in infrastructure and facilities but also in R & D in sectors such as food, feed, energy and health sectors. Like any other expenditure, private spending in agricultural R&D, is largely influenced by the expected pay-offs from innovations reaped from the investment coupled with other incentives like effective provision and enforcement of intellectual property rights. Market size and the cost of servicing the market are other important dimensions attracting entry of private firms. Most private sector research in the country focuses on the provision of input technologies such as seeds, chemicals, machinery and food processing. Pal and Byrlee (2006) estimated private research funding in seeds, machinery, food processing, fertilisers and chemicals (at 1995 prices) as Rs. 1.7

billion accounting for 11 per cent of the total funding of agricultural research in 2000. Recently the fastest growing sector is agri-biotechnology, which attracted large resources for R & D through small and medium enterprises. The size of the Indian biotechnology industry has grown impressively since during the recent period and estimated to be around Rs.140 billion in 2009-10 (Biospectrum, 2010). Of this, the agri-biotech market is valued around Rs. 18 billion constituting 14 per cent of the total biotech turnover in the country. Approximately 706 firms are engaged in various biotechnology related activities ranging from R & D, production, marketing and consultancy etc. Out of these, a quarter is engaged in agricultural based activities ranging from tissue culture, bio-pesticides and biofertilisers, transgenics, hybrid seeds and diagnostics. Almost an equal number of firms are also observed to be engaged in healthcare related biotech activities and services (equipments, contract research, etc.) sector respectively. Bioinformatics and environment biotechnology seem to be playing smaller roles. Industrial biotechnology which largely includes marine and animal biotechnology witnessed two and half times increase in growth during the period.

A perusal of business asset value, annual turnover and employment capacity in agri-biotech industry indicates significant variability within the agri-biotech industry. It is interesting to note that the agri-biotech industry depicts an asset turnover ratio of about 0.35:1(Table 3) which seems to be low implying the presence of relatively new and not so established firms that are not able to yet utilise their assets efficiently. The firm level data also shows substantial cases of cross participation in different market segments which makes it difficult to characterise firms into unique application. This also implies that firms are following a portfolio approach rather than specialised in a single market segment, thereby following a risk diversification approach. On an average, 12 per cent of the annual turnover is reported to be allocated for R & D purposes which seems to be quite reasonable in view of the growing domestic market. Another important thing which emerged from the analysis is that the agri-biotech sector has a pre-dominance of small firms measured in terms of turnover and total business assets. In 2007, the share of small and medium sized firms in the total number of firms was 62 per cent. These are largely firms dealing with bio-fertilisers, bio-pesticides and tissue culture as against the presence of relatively large sized firms in transgenic and hybrid seeds. However, there are very few firms in the business of transgenic. As regards expenditure on R & D in this sector, this was estimated as Rs.2.16 billion[3] in 2009 accounting for 6 per cent of the government expenditure on agricultural research and education. Another interesting feature about Indian agri-biotech industry is that it has grown more as an outward looking industry with a growing number of external alliances especially in tissue culture of floricultural plants, transgenic and hybrid seeds.

TABLE 3. ECONOMIC INDICATORS OF AGRI-BIOTECH INDUSTRY IN INDIA (2007)

Particulars (1)	Highest (2)	Lowest (3)	Median (4)	Average (5)
Total asset value (Rs. million)	17389	0.50	20	339
Total annual turnover (Rs. million)	28959	0.38	53	969
Per cent of R & D to total turnover*	26	3	8	12
Number of employees	4307	6	51	237

Source: Compiled from BCIL, 2007.
*Based on primary survey of selected tissue culture firms.

Policy Recommendations for Higher Growth Trajectory

The quantitative evidence presented in this paper shows that, following a period of stagnation in the 1990s, total public investments in agriculture have stepped up in recent years and most of the investment growth has occurred towards infrastructure development in the agricultural sector. Studies (Fan *et al.*, 2008) have shown that the biggest pay-offs for reducing rural poverty and increasing growth came from investments in agricultural R & D, education and rural infrastructure especially roads. These investments must, therefore, be treated as a composite strategy for rural development and a sustained step-up in public investments in key areas should be maintained in order to benefit agriculture in future given that the benefits from these investments tend to materialise after a considerable time lag. This conscious policy shift towards raising capital expenditure in rural infrastructure and irrigation would translate into economic gains only, if it is duly supported by responsive institutions. Hence, to push the Indian agriculture on higher growth trajectory, a proper mix of polices relating to investment, innovations, incentives and regulatory framework will provide much needed steam.

Given that relevant and science based technology is the engine of economic growth, the government-led agricultural innovation system should aggressively move away from traditional linear research and development model to a system which emphasises the demand-driven technology supplies to its wide range of clients such as farmers, private sector, policy-makers, entrepreneurs and other intermediary organisations. They should increasingly fill the technology gaps where private sectors' presence is weak due to market failures, as the rents from investing in them can not be easily captured. For example, investing in productivity growth of self pollinated crops, research related to natural resource management and marginal production environments, etc., will not be seen as profitable ventures by the private sector. As a result, the private sector is becoming increasingly active in more commercially amenable crops, such as hybrids of maize, pearl millet, sorghum and vegetables, tissue cultured plantlets, transgenics etc. An enabling policy environment with effective IPRs and bio-safety arrangements may incentivise the growing private sector's presence in pro-poor crops and regions. Hence, a revamping of public research agenda is called for, which also allows space for public-private research

partnerships without losing focus on basic and strategic research where core competency of the former lies. The other major responsibility of NARS is manpower assessment and planning, thereby a futuristic human resource development programme in cutting edge science and technology may be developed. Besides this, the reorientation of extension services which should be demand driven and goes beyond technology transfer to capacity building activities is the need of the hour. New methods of advisory services which make better use of new advances in communication technologies should aggressively be tapped. Delivery of farm inputs and services is another area which needs attention. Apart from government direct interventions, private sector role in many facets of agri-input and services supply has expanded, from supplying inputs (seeds, fertilisers, pesticides, animal feed, etc.), to product marketing and value chain development, to commercialisation of technologies. Some promising models of private sector participation are emerging and expected to better integrate smallholders into high value markets. Given the right incentives and regulatory framework, the private sector can provide effective and sustainable investments and innovations in the input and output markets. This may enhance government's role more as a facilitator and some part of input subsidies could also be diverted to productive investment which would further encourage private investment and thereby contribute to higher growth.

NOTES

1. Based on CSO data of public investments which largely includes major and medium irrigation and considered as narrow definition of agricultural investments.

2. This broader definition of agricultural investments covers many other investments directed towards agriculture and impact directly or indirectly agricultural growth. Few economists have constructed broader series (Chand, 2000; Roy and Pal, 2002; Fan *et al.*, 1997) with varying definition and time periods.

3. The figure was arrived at using 12 per cent share of R & D in annual turnover of agri-biotech industry in 2009.

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