

Farmer First or Still Last? Uneven Institutional Development in the Indian Agricultural Innovation System

V. Rasheed Sulaiman¹

Abstract

Institutional change and innovation are interdependent. This paper presents the recent developments in the Indian agricultural innovation system and illustrates how institutions in agricultural research and extension have been determining the pace and direction of innovation. Although the Indian agricultural innovation system has sufficient numbers of diverse actors with complementary expertise, lack of institutional changes within public sector research and extension has prevented interaction with other actors, and has, therefore, constrained innovation. The paper argues for greater collaboration among policy researchers (having systems perspectives on innovation) to facilitate the process of institutional change so that the Indian agricultural innovation system could effectively address rapidly-evolving challenges.

1. Introduction

Over the last two decades, the agricultural innovation system (AIS) in India has become increasingly diverse, complex and chaotic. With the liberalisation of the economy in the 1990s, there has been increased private sector participation in research and extension, an expansion of CSO (civil society organisations) interventions in agriculture and considerable weakening of public sector research and extension. At the same time Indian agriculture is facing greater challenges from the unsustainable use of natural resources and significant threats (as well as opportunities) from the opening of agricultural markets. The country's agricultural research and extension community has failed to respond effectively to these changes and this has contributed to the current crisis in Indian agriculture. Recent years have also witnessed a deceleration in the growth of agriculture. This paper analyses the recent changes in agriculture and the agricultural innovation system in India and suggests ways of strengthening the sector so that it can better enable innovation.

Although the Indian AIS has sufficient numbers of diverse actors with complementary expertise, weak patterns of interaction among these actors constrain knowledge flows, and thereby, innovation. Moreover, there is no effective mechanism for sector coordination. However, even under these difficult situations, CSOs in India have been relatively successful in providing broad-based support to farmers and promoting pro-poor innovation. However, the public sector, which still dominates the research and extension arrangement in India, does not seem either to be learning from these experiences or responding effectively to these new challenges. While the lack of institutional changes hinder the effective performance of agricultural research and extension activities and their contribution to agricultural innovation, reform strategies continue to be structured around calls for more resources (for R&D), improved priority setting and better research-extension linkages. Performance of the Indian AIS depends on two crucial aspects — its ability to bring in institutional change and the creation of effective mechanisms to co-ordinate its diverse actors.

This paper begins with an overview of the rapidly evolving character of Indian agriculture and the shifting nature of support required by farmers to respond effectively to these changes. The next section traces the evolution of agricultural research and extension arrangements in the country since the 1990s and the institutions determining their performance. Section 4 discusses why the major reforms in research and extension failed to make any significant institutional change. The paper ends with some introspection on what we, as a group of innovation policy researchers in India, have learned about ways to promote institutional change and discusses some potential ways forward.

¹ Regional Director, LINK South Asia and Director, Centre for Research on Innovation and Science Policy (CRISP), Hyderabad, India, rasheed.sulaiman@gmail.com

2. Changing Nature of Indian Agriculture

India's economic security is heavily dependent on agriculture. Agriculture and allied sectors accounted for 18.7% of the country's GDP in 2006-07. More than half of the rural population is still dependent on agriculture for most of its income. Although the Green Revolution increased production and productivity of food crops, improved food security and raised rural incomes, India still has a large poor (26% living below the poverty line in 1999-2000) and malnourished population. Areas with low and uncertain rainfall (arid and semi-arid regions) are yet to witness significant improvements in productivity and rural income. Producers in far-flung and interior areas and those regions that are less integrated with markets still suffer from lack of access to appropriate services (credit, inputs, market, extension etc). Indian agriculture is essentially small farm agriculture, with the majority of farmers owning less than 1 ha of land. The average farm size has been declining. "The slow growth of opportunities in the non-farm employment sector has led to the proliferation of tiny and economically non-viable holdings" (NCF, 2006). The land and water resource base for an average farm holding has declined over the last few decades and this essentially means producing more food from less land and water resources.

Although the annual growth rate in total GDP has accelerated from below 6 percent during the initial reform years (starting 1991) to more than 8 percent in recent years, agricultural growth has decelerated. While the non-agriculture sector has witnessed rapid growth, there has not been any significant decline in the labour force employed in agriculture and this has created a serious disparity between the agriculture and non-agriculture sectors and urban and rural India (ICAR, 2007). The output growth of the majority of commodities has decelerated after the mid-1990s. Indian agriculture is currently going through a crisis². The approach paper to the XIth Five Year Plan discusses the reasons for this crisis as follows:

"Agricultural growth has decelerated from 3.2%, observed between 1980 and 1996-97, to a trend average of around 2% subsequently and this deceleration has been identified as the root cause of the problem of rural distress that has surfaced in many parts of the country and reached crisis levels in some. Low farm incomes due to inadequate productivity growth have often combined with low prices of output and lack of credit at reasonable rates to push many farmers into crippling debt. Even otherwise uncertainties seem to have increased (regarding prices, quality of inputs and also weather and pests), which, coupled with unavailability of proper extension and risk insurance have led farmers to despair. This has also led to widespread distress migration, a rise in the number of female-headed households in rural areas and general increase in women's work burden and vulnerability" (Planning Commission, 2006).

The last few years have also witnessed the greater diversification of agriculture towards high value commodities such as fruits, vegetables and livestock products (Rao, *et al*, 2004). High value commodities account for a large share of the total value of agricultural production in a number of districts in India. Urbanisation has also resulted in the emergence and rapid expansion of super-markets for retailing agricultural goods. Increasing consumer awareness on quality aspects has led to the development of stringent standards that the producers are forced to comply with if they are to gain from these new markets. (However, quite often only the large farmers are able to integrate their production to suit demand cycles and quality standards and small and marginal farmers are left out of these arrangements). All these developments have led to the expansion of contract farming arrangements — most of which are led by agri-business companies. Experience of these arrangements has been generally mixed. "In order to make contract farming an effective development tool, strong mechanisms must be in place to monitor contracts and ensure that growers — the more vulnerable partners — are not exploited" (Singh, 2005). Increasing de-regulation of trade has added new challenges to Indian farmers, who are forced to compete on quality and prices on several products not only in the export market, but also in domestic markets.

Addressing these complex issues requires solutions which are beyond the decision-making capacities of individual farmers. Collective decisions on resource use and marketing would necessitate forming

² The National Commission of Farmers has identified five basic factors which are central to the present crisis. There are unfinished agenda in land reform; quantity and quality of water; technology fatigue; access, adequacy and timeliness of institutional credit; and opportunities for assured and remunerative marketing (NCF, 2004).

new forms of collaboration and this is particularly important as this sector is dominated by small farms — often with weak bargaining powers and limited political voice. There is considerable scope to increase rural incomes through increased productivity, enhanced competitiveness and the creation of an efficient marketing system. But this would only be possible through the development of an improved agricultural and rural innovation system that can respond quickly to current and future challenges, supported through adequate investments in rural infrastructure. While the Indian AIS is rich in terms of organisational diversity, it has not been able to successfully utilise this diversity to enable innovation due to a number of reasons. These are discussed in the next section.

3. Agricultural R&D and the Indian Agricultural Innovation System

A National Agricultural Innovation System has been defined as “a network of organisations, enterprises, and individuals focused on bringing new products, new processes, and new form of organisation into economic use, together with the institutions and policies that affect the way different agents interact, share, access, exchange and use knowledge (World Bank, 2006). One of the major attractions of the innovation systems framework has been its explicit recognition that innovation is not a research-driven process simply relying on technology transfer. Instead, it is a process of generating, accessing and putting knowledge into use (Hall *et al*, 2001, 2003, World Bank, 2006). Although the generation of new knowledge is important, it is not necessarily the starting point for innovation to happen. Central to the process are the *interactions* of different people and their ideas; the *institutions* (the attitudes, habits, practices and ways of working) that shape how individuals and organisations interact; and *learning* as a means of evolving new arrangements specific to local contexts.

Agricultural R&D represents only one of major domains within the AIS, and its ability to contribute to innovation depends on its interaction with several other actors. These include organisations and consumer groups that set the demand, intermediary actors critical for applying new knowledge, user groups, enterprises, and other support structures. This paper explores the evolution of agricultural R&D in India and its interaction with other actors in the AIS in the last 20 years.

Actors and institutions

India has an extensive National Agricultural Research System (NARS) comprising a network of 189 centres and coordinated projects funded and managed by the ICAR (Indian Council of Agricultural Research), including one Central University and 31 State Agricultural Universities, about 100 private and voluntary research and development organisations, and several rural and women’s universities. Each State Agricultural University has several research centres dealing with specific crops and agro-ecological zones. Each of these research centres has developed several technologies, some of which have been extensively adopted. However, there is increasing realisation that a significant number of technologies are remaining either on the shelves or in compendiums. While many blame a resource crunch for the disintegration of public systems of R&D, there are others who strongly believe that the unwillingness to reform institutions (rules, norms and working practices) within the agricultural R&D community is mainly responsible for the current crisis in agricultural R&D.

Private sector participation in agricultural R&D has been on an increase. Recent estimates reveal that the business funding (largely private) for agricultural R&D constituted about 11 percent of the total R&D funding (Pal and Jha, 2007). The largest private investment occurred in chemicals (pesticides and fertilisers) and food processing, followed by seed and machinery. More recently, growth has been in plant breeding and biotechnology, animal health and poultry (*ibid*). While this has added to improved flow of new technologies, there are concerns over the higher costs of these technologies and, therefore, the restricted access to them.

The last two decades have witnessed the increasing involvement of civil society — including research foundations, NGOs and producer associations — in agricultural research and extension. Many have been working with the poor and have a broader approach to innovation, thereby helping the poor access, adapt and apply new information, knowledge and technology. In the public sector, the extension machinery of the state Department of Agriculture (DoA) reaches down to the Block and village level. The village extension workers of the DoA continue to be important sources of information for farmers in India — even though information is clearly targeted at grain production, visits are irregular, and the service is preoccupied with the implementation of government schemes linked to subsidies and subsidised inputs. With external support drying up with the end of the Training and Visit

(T&V) system of extension in the early 1990s, states have been left to fund their extension machinery and this has led to considerable weakening of public sector extension. The number of Krishi Vigyan Kendras funded by ICAR has increased during this period, but the effective reach of these KVKs (one for 1-2 district) is marginal. Moreover, their main focus is restricted to imparting training to farmers on modern agricultural technologies.

While public sector extension arrangements have weakened, the number and diversity of private extension service providers have increased in the last two decades. These include NGOs, producers associations, input agencies, media and agri-business companies. Many provide better and improved services to farmers, but their effective reach is limited and many of the distant and remote areas and poor producers are neither served by the public nor the private sector. Considering the changing nature of agriculture, producers currently need a wider range of support, including organisational, marketing, technological, financial and entrepreneurial support. Unfortunately farmers are not able to get this kind of integrated support from either the public or private sector. According to the Planning Commission (2006), "low farm incomes due to inadequate productivity growth have often combined with low prices of output and lack of credit at reasonable rates to push several farmers into crippling debt. Even otherwise, uncertainties seem to have increased (regarding prices, quality of inputs and also weather and pests), which, coupled with unavailability of proper extension work and risk insurance, have led farmers to despair". Both public and private sector extension do not effectively service difficult, interior or remote regions that are far from district headquarters (Sulaiman, 2003).

It is quite astonishing to note that the farmers do not get adequate support in addressing their expanding and complex challenges, especially when there are several public, private and civil society actors who are capable of providing all kinds of support (technical, financial, organisational, marketing etc). Our analysis of the agricultural research and extension systems in India reveals that most of these organizations work in isolation and do not interact with each other. Some of the "institutions" (norms, rules and working practices) within these organisations are responsible for the weak patterns of interaction among the various actors.

Although research and extension systems were subject to several reforms during the last two decades, these have focused more on organisational issues and have not addressed institutional ones. Our analysis of partnerships and institutions in agricultural research and extension has revealed some of these critical institutions that continue to determine the way the public sector research and extension functions in India. (Hall et al, 2002, 2004, Sulaiman and Hall, 2002, 2004, Raina et al, 2006) These are as follows:

Norms of linear R&D: The development and diffusion of technologies in a linear fashion — from the science that generates it to the extension effort that disseminates it and down to the farmer who uses it — continue to be the major institution defining the functional boundaries for research and extension. Despite being invalidated in reality and discredited academically this linear model survives as it ensures enhanced funding and legitimisation through econometric estimation of returns to investment. Moreover, it also provides scope for selective attribution of failures. Steps taken to promote research-extension linkages have not yielded any success and farmer participation in research and extension remains restricted to token representations in planning meetings. This also leaves several other actors that are critical for innovation outside the knowledge generation and application process.

Narrow evaluation norms: While research is assessed mainly in terms of technologies developed and papers published, extension performance is assessed in terms of technologies adopted, trainings conducted or farmers contacted. This tradition of assessing performance has effectively stifled attempts at sharing expertise, adapting technologies to suit specific situations and generating collaborative activities for promoting innovation. This has further strengthened the linear mode of functioning, ensured compartmentalised accountabilities and prevented research and extension from interacting with and learning from others. While research blames extension for poor results in the field, extension blames research for developing irrelevant technologies, and both research and extension together blame policies for not creating the right conditions for the technology uptake.

Mistrust of other actors: This tradition of working independently — together with a mistrust of other agencies such as the private sector, NGOs and also other public agencies existing in different domains — has led to effective isolation of public sector agencies and prevented their interacting and working with others. Complementary knowledge and expertise necessary for innovation has thus remained blocked in many of these different agencies. Although some measures to promote public-private partnerships were initiated, these have not received continuous attention. Therefore,

coordinating the activities of different agencies and promoting joint efforts to develop sector competitiveness remains a major challenge.

History of only rewarding successes and reluctance to report and analyse failures: This has led to a situation where people are not willing to take any risk by experimenting with different approaches to technology development or promotion. Opportunities for learning and trying better ways of functioning, therefore, do not exist and this has resulted in the search and promotion of “models” for replication. Moreover, the research and extension community also does not learn from the experiences of others.

While these institutions have effectively prevented public-research and extension from moving out of the linear Research-Extension-Farmer paradigm, alternative paradigms have been abundant among CSOs and the private sector (Sulaiman and Hall, 2003). CSOs have created a space for trying out new ideas and ways of working that would often not be permissible in mainstream research and extension organisations³. Their interventions were also found to be pro-poor, mainly in the form of the development of pro-poor business models through a cluster of technical, organisational, and institutional innovations. Another promising approach is the provision of integrated sector support, which helps people cope with changing contexts in their sectors. The major institutions that have allowed these organisations to succeed in promoting innovation are:

- (i) Culture of experimentation and learning
- (ii) Partnering with a wide range of actors
- (iii) Ability to contextualise and continuously adapt technologies to suit varied user demands,
- (iv) Efforts at influencing the institutions and policies among other actors to promote innovation, and
- (v) Participation in wide sector-related networks and extensive use of networks⁴

4. Reforms and Institutional Change

Institutional reform became a catchword in the literature on agricultural research and extension organisations in India in the Nineties (Raina *et al*, 2006). While organisations are relatively easy to establish or change, the same is not true of the institutions that govern these. Analysis of agricultural research and extension reforms in India in the last two decades clearly reveals this.

By the early 1990s, ICAR was already facing severe financial and operational problems⁵ and in response it implemented a number of reforms to improve its efficiency and accountability, forge links with other partners and mobilise resources. Two key reforms specifically introduced for strengthening the relationship with the private sector include: the establishment of a mechanism (guidelines) to provide services on a consultancy and contractual basis; and making available germplasm and other technology products of ICAR to the private sector at nominal cost. The impact of these reforms has not been as great as initially anticipated (Paroda and Mruthyunjaya, 1999). During this period, the private sector R&D has been growing but in isolation, with limited interactions with public sector research. As a result, no major public-private collaborative programmes tackling issues in line with the national priorities have emerged (Jha and Pal, 1999). These efforts have been considerably weakened during recent years, as ICAR has not made further changes in working practices to make collaboration a reality. One major problem is the inordinate delay and uncertainty in response to the private sector’s request for partnership (Pal and Jha, 2007).

As part of the organisational and management reforms component of the National Agricultural Technology Project (NATP) that began in 1998 (with World Bank support) ICAR delegated several powers to lower administrative units, mainly at the level of Institute Directors and Principal Investigators of research projects. Implementation of these reforms has been uneven. Another significant reform for improving research programme performance was the establishment of PME (priority setting, monitoring and evaluation) cells at various institutes. Some of these initiated reforms

³ This is based on case studies covering the following sectors: (i) Natural resource management; (ii) Agro processing and enterprise development; (iii) Rural energy; (iv) Indigenous textile technology; and (v) Medicinal Plants, conducted for the UNU-MERIT led study. “New Insights in Promoting Rural Innovation: Learning from Civil Society Organizations” (2004-2006)

⁴ Project Brief. New insights in promoting rural innovation: Learning from Civil Society Organizations (http://www.innovationstudies.org/docs/pb_2.pdf)

⁵ These included unplanned growth, duplication or overlap of institutional mandates, loss of complementarity among institutions, lack of client focus, lack of funds for operating expenses, a need to modernise the research infrastructure, and the need for training and upgrading scientist skills in frontier science and management areas (Mruthyunjaya and Ranjitha, 1998).

are also being implemented in state agricultural universities. ICAR is currently implementing the second phase of NATP — the National Agricultural Innovation Project (NAIP). The project supports the development of research consortia with the participation of private and civil society actors. It may take some more time to evaluate its outcome.

In the case of extension, the major reform has been the establishment of a district level coordinating agency, the ATMA (Agricultural Technology Management Agency), in pilot districts in seven states, again with World Bank support. Though the performance has been mixed in the pilot districts, the Government has decided to expand the ATMA model across all the districts in the country. While it has brought in some additional resources for extension activities to be decided at the district level in consultation with farmer representatives, ATMA has not addressed any of the fundamental institutional problems constraining extension performance. Extension continues to be centrally-planned, implemented and evaluated without much operational freedom at the local level. While farmers require a wider range of support to address the emerging challenges, extension mainly functions as an agency for technology dissemination. Marketing extension has been a recent addition but is understood and implemented mostly as provision of output price information in various markets. This is highly inadequate when it comes to addressing challenges in marketing.

The usual policy recommendations include: increased investments for R&D (1-2 percent of agricultural GDP) and extension; better research priority setting, strengthening research-extension linkages, increased use of Information and Communication Technologies (ICTs); contracting extension services to NGOs and private sector; delegation of powers to decentralised units, etc. However, all these recommendations do not, unfortunately, change the way knowledge is produced, applied or utilised in society. Despite several conferences, workshops, research papers, policy briefs and policy consultations, little institutional reform has occurred in public sector agricultural research or extension that allows it to cater effectively to changing demands for agricultural innovation⁶. This relative unwillingness to reform the institutions is a feature that marks Indian agricultural research and extension (Lele and Goldsmith, 1989; Raina, 2003).

5. Where do we go from here?

Institutional development in the Indian AIS is uneven. While CSOs and the private sector have evolved better institutions for promoting innovation, there has not been any significant institutional reform of public sector research and extension. Both CSOs and the private sector have not been able to develop productive interactions with the public sector. Increasingly, the trend is to give up on the public sector and its role in agricultural development, although public sector research and extension can and should play an important role in ensuring equitable development and enhancing sector competitiveness.

From the beginning, we were clear that ensuring farmer participation in technology generation and promotion alone is not enough to bring about institutional changes needed for innovation, as innovation requires interaction among a large number of varied actors. Although several NGOs still employ farmer participatory research and extension methods, this has never become a part of the public sector research or extension paradigm in India. However, currently all research and extension committees have farmer representation, though most of these appointments are considered to be political nominations. Recent years have witnessed representation from the private sector, too. However, both farmer and private sector representation is mainly done to comply with administrative guidelines and this normally does not have any major influence on the way research or extension is organised.

Moreover, the farmer is only one of the many actors necessary for innovation and there is a need to examine the roles of various actors and their patterns of interaction if we are to understand innovation

⁶ The workshops conferences include (a) seminar on “Institutional Change for Greater Agricultural Technology Impact” at the National Centre for Agricultural Economics and Policy Research (NCAP, New Delhi 13-14 March 2001), (b) Workshops on Agricultural Policy: Redesigning R&D to Achieve the Objectives, sponsored by the National Academy of Agricultural Sciences, New Delhi, on 10-11 April, 2002, and (c) session on “Institutional reform in agriculture, at the Annual Conference of the Indian Society of Agricultural Economics, New Delhi on 19-21 December 2002. Important papers/official documents that demand institutional reforms are the National Agricultural Policy (Government of India, 2000), the National Agricultural Technology Project; Main Document (ICAR, 1998), the NAAS policy paper (NAAS, 2002), Jha (2002), Paroda and Mruthyunjaya (1999), Hall et al (2002, 2004) Sulaiman and Hall (2002, 2004), Raina (1999, 2003), Raina *et al* 2006), Raina and Sulaiman (2007).

and make meaningful interventions to promote innovation. Our analysis on patterns of interaction, institutions and policies in agriculture and other rural sectors, mainly by way of case studies, gave us several new insights on institutional changes and innovation and also ways of enabling institutional change. These have been published nationally and internationally. However, we soon realised that very few people read our publications. Moreover, we also should not assume that by reading our papers institutional reform would be initiated in these highly bureaucratic organisations that have a long tradition of maintaining the status quo.

We began experimenting with policy working groups, comprising senior Government policy-makers, among others, in order to share our findings and get other perspectives on the relevance of our work and how our policy research on innovation could better contribute to the policy-making process. This allowed us to address some of the questions bothering policy-makers through our work and facilitated better relations and continued interactions. We also organised capacity development workshops for senior and middle-level research managers to help them understand and apply systems perspectives on innovation. Although these have helped the managers see the system inter-relationships and the need for change, they alone will not be able to bring forth changes even though they could be useful allies in the process of change. Research and extension organisations need hand-holding support in the process of change and this would require slightly longer duration action learning projects with sufficient flexibility to respond to evolving needs.

Although our work and the policy insights coming out of it is increasingly appreciated and acknowledged, we have not been able to match the influence of policy researchers (mainly economists) and policy-makers who strongly believe and argue only for organisational changes. We believe that policy researchers (and practitioners) like us, who have similar systems perspectives on innovation, should collaborate and emerge as a “community of practice” if we are serious about bringing in continuous institutional changes and developing a stronger and vibrant AIS.

6. Conclusions

India's Agricultural Innovation System is currently unable to address the challenges and opportunities it currently faces due to uneven institutional development. Institutional changes are necessary not only in research and extension organisations but also in others involved in agricultural and rural development. Though growing in terms of numbers, policy researchers and policy-makers who recognise these issues and are willing to initiate changes are still few and far between. There is a need to create mechanisms to consolidate and support their efforts so that they could facilitate the institutional change process. Any further delay in addressing institutional bottlenecks would further marginalise public sector research and extension. This will have serious implications for India's ability to tackle agriculture and rural development challenges and its strategy for an inclusive growth.

References

- DAC (2000). Policy framework for agricultural extension (draft), Extension Division, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.
- Hall, A.J., M.V. K Sivamohan; N. Clark; S. Taylor; & G. Bockett; (2001). Why Research Partnerships Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor; *World Development*, 29 (5); 783-797.
- Hall, A.J., Rasheed Sulaiman V., Norman Clark, M.V.K. Sivamohan and B.Yoganand (2002). Public-private sector interaction in the Indian Agricultural Research System: An Innovation Systems Perspective on Institutional Reform, In Derek Byerlee and Ruben G.Echeverria (Eds.) *Agricultural Research Policy in an Era of Privatisation*, CABI Publishing, UK.
- Hall, Andy, Sulaiman, R., Clark, N. and Yoganand, B., 2003, From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research, *Agricultural Systems*, 78, pp. 213-241.
- Hall, A.J., B. Yoganand, Rasheed Sulaiman V., Raina, R., Prasad, S., Naik, G. and N.G. Clark. (Eds) (2004). *Innovations in Innovation: Reflections on Partnership and Learning*. ICRISAT, Patancheru, India and NCAP New Delhi, India, 238 pp.
- ICAR (1998). National Agricultural Technology Project Main Document, ICAR, New Delhi.

- ICAR (2007). Draft Report of the Sub Group on Adoption and Generation of Relevant Technologies and their dissemination to the Farmers (submitted to the Planning Commission, Government of India), Indian Council of Agricultural Research.
- Jha, D. (2002). Change is difficult: but change we must: O&M in agricultural research, paper presented at the Workshop on Agricultural Policy: Redesigning R&D to achieve its objectives organised by the National Academy of Agricultural Sciences, New Delhi, April 10-11, 2002, New Delhi.
- Jha, D. and Pal, S. (1999). Strengthening ICAR-private sector interface in agricultural research, in Pal, S. and Joshi, P.K. (eds.) *New Paradigms of Agricultural Research Management: Institutionalisation of Research Prioritisation, Monitoring and Evaluation and Partnership with the Private Sector*, Workshop Proceedings 6, National Centre for Agricultural Economics and Policy Research, New Delhi.
- Lele, U. and Goldsmith, O. (1989). The development of national agricultural research capacity: India's experience with the Rockefeller Foundation and its significance for Africa, *Economic Development and Cultural Change*, 37 (2), 305-343.
- Mruthyunjaya and Ranjitha. P. (1998). The Indian agricultural research system: Structure, current policy issues and future orientation, *World Development*, 26, 1089-1101.
- NAAS (2002). Agricultural Policy: Redesigning R&D to achieve its objectives, NAAS Policy Paper No, 18, National Academy of Agricultural Sciences, New Delhi, 12 pp.
- NCF (2004). Serving farmers and saving farming: First report of the National Commission on Farmers, New Delhi.
- NCF (2006). Serving farmers and saving farming: A draft national policy for farmers, Fourth report of the National Commission on Farmers, New Delhi.
- Pal, Suresh and Dayanatha Jha (2007). Public-private partnerships in Agricultural R&D: Challenges and Prospects, In Visawa Ballabh (ed.) *Institutional Alternatives and Governance of Agriculture*, Academic Foundation, New Delhi.
- Paroda, R.S. and Mruthyunjaya (1999). *NARS in the Asia Pacific Region: A perspective*, Asia Pacific Association of Agricultural Research Institutions, FAO, RAPA, Bangkok.
- Planning Commission (2006). Towards faster and more inclusive growth: An approach to the 11th Five Year Plan, Draft Approach Paper to the XI Plan, Government of India, New Delhi.
- Raina, Rajeswari (1999) Patronage and Evaluation in the Indian Council of Agricultural Research, *Evaluation*, Vol 5 (3), 278-302.
- Raina, Rajeswari (2003). Institutions and Organisations; Enabling reforms in Indian agricultural research and policy, *International Journal of Technology Management and Sustainable Development*, 2 (2), 97-116.
- Raina, Rajeswari, Sunita Sangar, Rasheed Sulaiman V. and Andrew J. Hall (2006). The soil sciences in India: Policy lessons for agricultural innovation, *Research Policy*, 35(2006) 691-714.
- Raina, Rajeswari and Rasheed Sulaiman V. (2007). From Technology Dissemination to Learning Approaches: Institutional Change for Rural Development. In Viswa Ballabh (ed.) *Institutional Alternatives and Governance of Agriculture*, Academic Foundation, New Delhi.
- Rao, P.P., P.S. BIRTHAL, P.K. JOSHI and D.KAR (2004). Agricultural Diversification in India and Role of Urbanisation, MTID Discussion Paper No 77, International Food Policy Research Institute (IFPRI) Washington.
- Singh, Sukhpal (2005). *Contract Farming for Agricultural Development: Review of Theory and Practice with special reference to India*, Centre for Trade and Development, New Delhi.
- Sulaiman, V.R. and Hall, A.J. (2002). Beyond Technology Dissemination: Reinventing agricultural extension, *Outlook on Agriculture*, Vol. 31, No. 4, pp. 225-233.
- Sulaiman, V.R. and Hall, A.J. (2003). India: The emergence of Extension-Plus: Future for extension beyond technology transfer? In Rivera, W.M. and Gary Alex (eds.) *Extension and Rural Development*, The World Bank, Washington, D.C.
- Sulaiman V.R (2003). Agriculture Extension: Involvement of Private Sector, Occasional Paper, 29, National Bank for Agriculture and Rural Development (NABARD), Mumbai.
- Sulaiman, V.R. and Hall, A.J. (2004). Towards Extension-Plus: Opportunities and Challenges, Policy Brief 17, National Centre for Agricultural Economics and Policy Research, New Delhi.
- World Bank (2006). *Enhancing Agricultural Innovation: How to go beyond the Strengthening of Research Systems*, World Bank, Washington, D.C.