

2 THE NATIONAL AGRICULTURAL RESEARCH AND EXTENSION SYSTEMS

2.1 Historical Perspectives

Historically, agricultural research, extension and education in India have been in the public domain. The theory of public goods holds true for research and therefore, agricultural research was conducted in the research organisations which were administered and funded by the state. Besides this, lack of capital in private sector and low appropriability of technologies did not attract significant private investment in agricultural research in the country. The research and extension policies and regulations also were framed in the context of public institutions. However, research environment has gone a sea change over time and therefore, funding and execution of agricultural research and extension have changed accordingly. This chapter reviews the major developments in the Indian NARES.

2.1.1 Agricultural research and education system (This section is largely based on the information available in Randhawa (1979, 1983 and 1986))

In the early stage of education system in India, agricultural science was in the domain of public funded general universities, as a part of natural sciences. With advancements in science, agriculture, mainly crop science, was separated from natural sciences, but was still taught in the general universities. Crop research to some extent was also conducted.

The development of independent agricultural research and education institutions can be traced back to the late 19th century. The process started with the pioneering efforts of Lord Mayo, the then Governor General of India, leading to the establishment of Department of Revenue, Agriculture and Commerce in the Imperial and Provincial Governments in 1871. The Department was strengthened by adding staff after the report of Famine Commission (1880). Main functions of the Department of Agriculture, as defined in the resolution of 1881, were agricultural enquiry, improvement and famine relief. During the last decade of the 19th century, experts were recruited in the Department of Agriculture, and research and teaching in agriculture and forestry was started at few places. The foundation of the Imperial Bacteriological Laboratory (now Indian Veterinary Research Institute, Bareilly) was laid at Pune in 1890, to start organised livestock research. It was subsequently shifted to Mukteswar in the Kumaon hills in 1893. The Civil Veterinary Department was created in 1889 and five veterinary colleges were also established at Babugarh (1877), Lahore (1882), Bombay (1886), and Madras and Calcutta (both in 1893).

Agricultural research and education got major support in the first decade of the 20th century when Lord Curzon was the Viceroy of India. The most significant milestone was the establishment of the Imperial (now Indian) Agricultural Research Institute (IARI) at Pusa in Bihar in 1905. The 'Pusa' institute suffered from a devastating earthquake in 1934 and was therefore, shifted to New Delhi, a central place, in 1936. The development of research work at the IARI over time led to the origin of a number of research institutions. Also in 1905, six agricultural colleges were established in important provinces at Pune (Maharashtra), Kanpur (Uttar Pradesh), Sabour (Bihar), Nagpur (Maharashtra), Faisalabad (now in Pakistan) and Coimbatore (Tamil Nadu) with an annual grant of Rs 2 million from the Government of India. These colleges were adequately equipped with staff and laboratories and were charged with the responsibility of research and teaching.

Another significant development was the establishment of the Imperial (now Indian) Council of Agricultural Research (ICAR) in 1929, an autonomous body, on the recommendation of the Royal Commission on Agriculture (1926). The ICAR was mandated to promote, guide and coordinate agricultural research in the country. With a non-lapsing fund of Rs 5 million, the ICAR was expected to supplement research activities of provinces and train scientific manpower. However, the ICAR had no administrative control over research institutions in the provinces. The establishment of the ICAR, in a way, was empowerment of agricultural research in India. Concomitantly, a number of central commodity committees were constituted, mainly for commercial crops (cotton, 1921; lac, 1931; jute, 1936; sugarcane, 1944; coconut, 1945; tobacco, 1945; oilseeds, 1947; arecanut, 1949; and spices and cashewnut, 1958). These committees were semi-autonomous bodies financed by grants from the

Government of India and/or by income from cesses and were expected to promote overall commodity development, including research. In fact, many committees established research stations. These committees had representation of various stakeholders like producers, trade and industry, agricultural department, etc., and Vice-President of the ICAR was ex-officio President of the committee. The funding of these committees from cesses was the first attempt to link research funding with the beneficiaries.

The commodity approach to research lacked coordination between commodities and neglected research areas applicable across commodities like soil management. The need was, therefore, recognised to initiate research on cross-commodity basis. Also, the idea of regionalisation research was getting momentum. These forces led to the establishment of Composite Regional Stations for research on cotton, oilseeds millets in 17 regions in 1956. These stations were under the administrative control of the ICAR and research progress was monitored by the regional coordination committees. The research expenditure was shared by Indian Central Cotton Committee, the Indian Central Oilseeds Committee and the ICAR.

Although the ICAR was established as a coordinating body, effective research coordination was missing because the ICAR did not have administrative control over many of the central or any of the provincial research stations. In order to provide effective coordination to commodity research, the concept of coordinated research project for improvement was introduced. In 1957, the first All India Coordinated Project on maize was started with the technical support from Rockefeller Foundation. The project was multidisciplinary in nature pooled staff working in different regions. This was the beginning research planning on the basis of agro-climatic zones, cutting across political boundaries. The project was extremely successful and paved way for establishment of a series of all India coordinated research projects.

On the recommendation of the Agricultural Research Review T (1964), the ICAR was reorganised in 1965 for coordinating, directing promoting agricultural research in the country. All the commodity committees were abolished and research institutes under these committees and Central Department of Agriculture and Food gradually transferred to the ICAR. This led to centralisation of funding execution and management of agricultural research with greater autonomy and empowerment to the ICAR. A Department of Agricultural Research and Education (DARE) was created in 1973 in the central Ministry Agriculture to establish direct linkages of the ICAR with central and state governments, and international organisations. The Director General of ICAR, a scientist, was concurrently designated as Secretary to the DARE For centre-state coordination, eight regional committees were formed. Several new research institutions under the ICAR came into existence However, major expansion under the ICAR took place on the line commodity research. Funds for these research institutes were channelled through the ICAR from the central government. Research stations under the administrative control of the state governments continued to be funded by state governments.

Although a number of agricultural and veterinary colleges were functioning under the Department of Agriculture in the states, agricultural education maintained a low profile. These colleges were crippled with administrative and financial constraints. There was virtually no coordination between agricultural and veterinary colleges. The University Education Commission (1949) felt the need for establishing rural (agricultural) universities in the states. Subsequently, the two Joint Indo-American Teams (1955 and 1960) endorsed the establishment of state agricultural universities (SAUs). The SAUs were set up on land-grant pattern of the American universities. The first one was started in 1960 at Pantnagar in Uttar Pradesh. The SAUs were given autonomous status and direct funding from the state governments. These universities imparted education on all aspects of agriculture on the same residential campus and integrated teaching with research and extension. The US Agency for International Development (USAID) and the American land-grant universities helped development of SAUs in India. Subsequently, implementation of the recommendations of the Education Commission (1964-66) and Review Committee on Agricultural Universities (1977/78) streamlined their functioning and all matters related to agricultural research in the states were transferred to the universities.

The regional research capacity in the states was further strengthened by establishing the regional agricultural research stations under the National Agricultural Research Project (NATP) in 1979 with assistance from the World Bank. These research stations, in different agro-climatic zones of the states, were under the administrative control of SAUs. Addressing zonal research needs and fostering linkages between research, extension and farmers were the main responsibilities of these research stations (Ghosh, 1991).

Meanwhile, there has been tremendous growth in non-agricultural universities and other scientific organisations, notably, Council of Scientific and Industrial Research (CSIR), Department of Biotechnology (DBT), Defence Research and Development Organisation (DRDO) and Department of Science and Technology (DST). These organisations also continued to strengthen, directly or indirectly, agricultural research and education.

The participation of industries both in public and private sectors in agricultural research was absent until 1950s. With the adoption of new seed-fertilizer technology in the mid-sixties, there was phenomenal growth in the industrial sector for the production of inputs. However, research activities in these industries were at the margin. The entry of private sector in seed research started in the 1970s with the popularisation hybrids. The passage of new policy on seed development in 'streamed seed research in the private sector, allowing participation transnational seed companies.

2.1.2 Agricultural extension system

The national agricultural extension system also evolved with establishment of the Department of Agriculture in the Imperial provincial governments. Efforts to strengthen this Department continued up to the time of Independence. Agricultural extension was one of activities of the Department and no special attention was paid accelerate transfer of technology efforts. However, some isolated attempts were made to start special rural development programmes, including improvement of agriculture (Prasad, 1989). Soon it was realised sporadic and adhoc programmes might not be effective and that there was a need for sustained rural (including agricultural) development programmes. A nationwide, multi-purpose extension network backed with professionals became indispensable. Consequently, 55 Comma Development Projects were started in 1952. Each project covered villages with a village level worker for a group of 10 villages. For e project, extension officers-technical persons in agriculture, animal husbandry, cooperation, village industries and rural engineering-w provided. The programme was based on the philosophy of integrated rural development. In 1953, the National Extension Service Program identical to the community development programme but with less resource intensity, was launched with a view to cover the entire country 1960/61. The programme aimed to accelerate the pace of rural development, including increased employment and production by application of scientific methods in agriculture. The programme greatly emphasised the principle of development through self-help and peoples participation. The central government largely bore the cost of programme.

Front-line extension work also was initiated as agricultural research system grew in the ICAR and SAUs. A department or directorate extension was established in the ICAR institutes and SAUs. The basic objective of these departments was to conduct extension research demonstrate latest technologies, provide feedback to scientists, a provide training support to State Department of Agriculture. Besides, the ICAR started three major front-line extension projects, viz. National Demonstration Project (1965), Operational Research Project (1972) and Lab-to-Land Project (1979). Another significant development in front-line extension was the establishment of Krishi Vigyan Kendras (KVKs) and Trainers' Training Centres (TTCs) in 1974. These KVKs and TTCs were aimed to improve technical literacy of farmers including rural women on the principle of 'teaching by doing and learning by doing'. These KVKs are currently managed by the ICAR institutes, SAUs and nongovernmental organisations (NGOs) with financial support from the ICAR.

The central government also launched several schemes to achieve self-sufficiency in food production. The important programmes were: Intensive Agricultural District Programme (1961) and Intensive Agricultural Areas Programme (1964). These programmes concentrated on the transfer of 'package of practices' and supply of critical inputs to farmers. In other words, extension strategy combined technical information with the supply of inputs. However, this strategy was discontinued with the reorganisation of the extension system under the Training and Visit (T&V) System in 1974-75. The T&V system emphasised single-purpose professional extension workers, regular training of extension personnel and transfer of technology through personal contact with farmers. This concept was further strengthened through establishing research-extension-farmer linkages under the National Agricultural Extension Project (NAEP) in 1979.

Another significant component of the extension system is the input industry, both in the public and private sectors. As noted earlier the industrial sector entered in a big way in the dissemination of chemical and mechanical technologies in the 1960s. The late 1980s marked real beginning of private sector in seed business. Input industry promotes the use of modern inputs through mass media and

linking information with the supply of inputs. Several NGOs also got involved in agriculture and rural development activities during the period.

2.2 Contemporary Institutional Structure of the NARES

2.2.1 Agricultural research and education system

The national agricultural research and education system (NARS), as evident from the historical developments reviewed above, is dominated by the public sector. Although agriculture is a state subject in the constitution of India, major components of the research system were initiated and funded by the Union Government. The NARS has three main institutional set up with different mandates. These are: ICAR institutes to cater to upstream research needs, SAUs engaged in teaching and research for respective states, and ZARSSs to undertake zonal-specific research. A structural diagram depicting these institutions and their linkages with other actors like public research organisations, international research centres and private sector is shown in Figure 2.1. The direction of research linkages is shown with arrows. The ICAR is the apex body at the centre to promote, undertake and coordinate research in all fields of agriculture in the country. The ICAR is linked with the Union Ministry of Agriculture through the DARE. The Council also coordinates directly with state governments and international organisations through the DARE. The Governing Body consisting of eminent agricultural scientists, academicians, legislators and farmers' representatives as its members, is the chief executive and policy making authority and the General Body is the supreme body of the ICAR.

By the end of the Eighth Plan, the ICAR had established a network of 45 research institutes, 10 project directorates (PDs), 30 national research centres (NRCs), 4 national bureaux (NB) and 86 all India coordinated research projects (AICRPs), etc. Four research institutes have the status of national institute and the rest are named as central institutes. The major research activities of these ICAR institutions are given in Table 2.1.

A large number of the ICAR research institutes conduct basic/strategic, and applied research in discipline-based divisional set-up (Table 2.1). IARI, NDRI, IVRI, CIFE with the status of 'deemed university' also undertake post-graduate teaching in agriculture. The AICRPs have their research centres at the SAUs and are engaged in applied research. Some AICRPs are elevated to the status of project directorate to provide backstopping research. The NRCs conduct research on specific problems in mission mode, non-divisional set-up. Although ICAR institutes are mandated to do basic and strategic research, a good deal of applied research is also conducted due to low research intensity in the SAUs. All the ICAR research institutions are managed by the management committee and research advisory committee. The management committee has wide representation, while research committee is a body of research professionals. Most of the ICAR institutions are organised on commodity pattern and very few are resource or discipline based.

The SAUs are autonomous institutions for meeting educational and research needs of the states and these are managed by the board of management and academic council. All the states have at least one SAU. The ZARSSs under the SAUs are mandated to cater to research needs of the zones. The SAUs are largely funded by state governments, but they also get regular grant from the ICAR. One Central Agricultural University with funding from the Union Government is also established for northeastern states.

Figure 2.1
Institutional structure of the Indian agricultural research and educational system

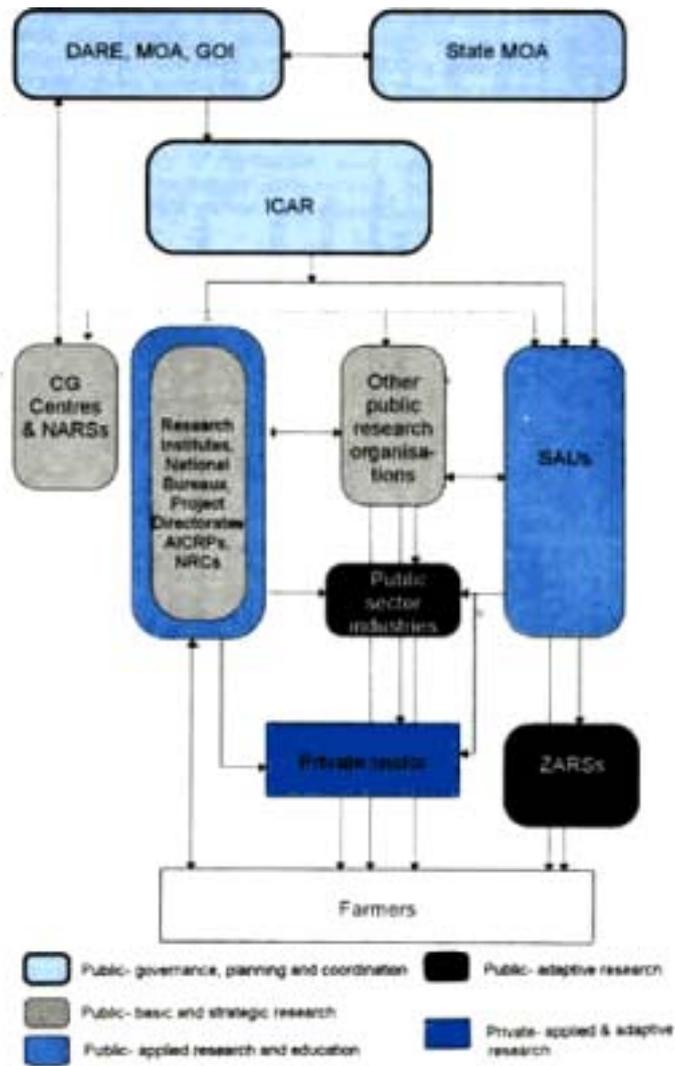


Table 2.1
Major activities of the ICAR and SAUs research system

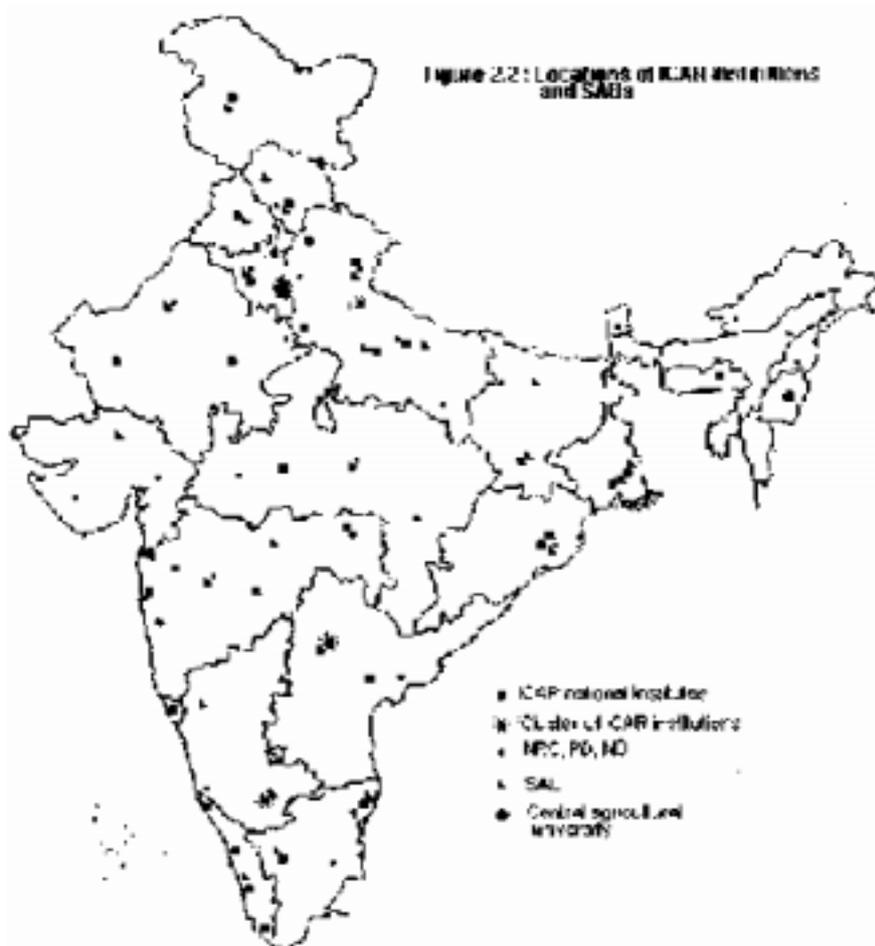
Institution	Number	Main activities	Budget (1994/95)* (Rs, million)
ICAR			
National research institute	4	Basic and strategic research of national importance, education, man-power training	827
Central research institutes	41	Commodity/resource specific basic and strategic research with divisional set-up, education	1526
National bureaux	4	Conservation and exchange of germplasm, soil survey	113
Project directorates	10	To fill critical research gap in All India Coordinated Research Projects, research coordination	319
National research centres	30	Commodity/resource/discipline based strategic research in mission mode	228
All India coordinated research projects	86	Coordination of commodity/resource specific research in different zones of the country	861
Agricultural universities			5327
Central agric. university	1	Applied research and education for north eastern states	
SAUs	28	Applied research for the state and education	
Zonal research stations**	120	Adaptive research for the zone	

Source: ICAR (1996/97),

** Ghosh (1991);

* ICAR (1995/96)

Figure 2.2 shows geographical spread of ICAR institutions and SAUs in the country. All important states have at least one SAU and most of the SAUs are multi-campus. Some states have established new SAUs by elevating old campus to university. Although efforts were made to establish ICAR institutions in the major producing state of the mandated commodity, there appear to be some influence of political-economic factors. For example, a large number of institutions were established in the northern and southern states- the states having larger representation in the Union Ministry of Agriculture, while western and north-eastern states were given low priority. Only recently, one agricultural university with the central assistance has been established.



A large number of non-agricultural universities, government organisations and public sector undertakings are also involved directly or indirectly in agricultural research. Some universities like Banaras Hindu University, have independent faculty for agricultural research and education, while government departments or scientific organisations like DST, DBT, CSIR, DRDO, etc. conduct or support agricultural research directly or indirectly. The public sector industrial units are also involved in agricultural research, mainly on inputs, to some extent.

Private sector undertakes research for the development of embodied technologies, viz. chemical, mechanical and biological (only hybrids). However, private sector research so far is adaptive in nature and is expected to intensify in the years to come with the adoption of favourable industrial and regulatory policies. Several private foundations, both national and international, also conduct and/or invest in agricultural research in the country.

Research linkages and coordination

Considering the size and multi-institutional set-up of the NARS, developing research linkages and coordination is a formidable challenge. The task is further complicated by the fact that the responsibility of agricultural research and development lies with state governments. The ICAR as an apex body, coordinates research and promotes inter-institutional research linkages. Since the ICAR supports SAUs through regular grants, it has direct participation in the management of the SAUs. Besides, regional committees were formed in 1975 to assess the status of research, extension and education in the ICAR institutes and SAUs in the eight regions of the country. These committees also make recommendations to undertake research on immediate problems of the region. Officials from the ICAR, ICAR institutes, SAUs, state line department, NGOs, members of parliament and farmers representatives are members of these committees. The geographical coverage of these regions is given in Appendix I.

Another informal but effective link between various research institutions is the cross-nomination of members in various committees and scientific panels. As noted above, these committees and

scientific panels have major say in planning and management of research. Efforts are made to ensure effective use of research resources and to avoid duplication of research efforts.

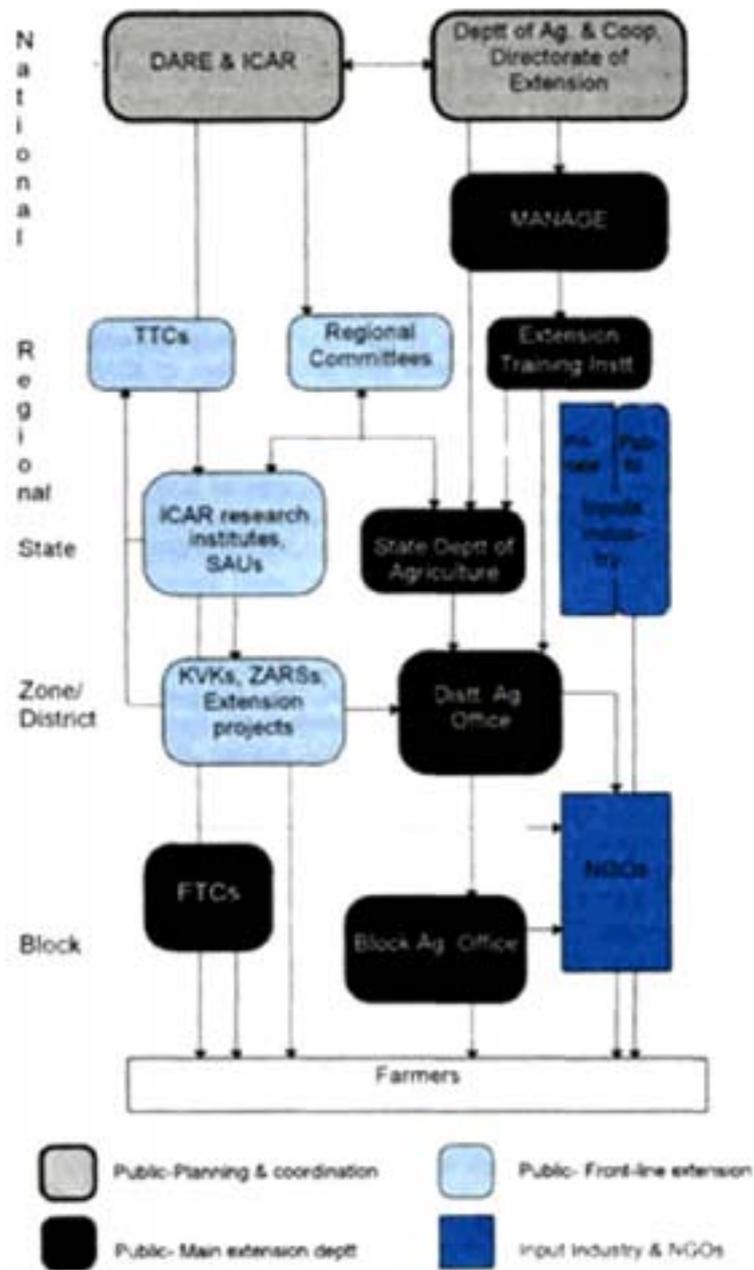
Research collaboration with the CGIAR system, NARSs and research foundations overseas, etc. is operationalised by the ICAR through the DARE. However, SAUs can also directly collaborate with these international organisations. Linkages with the national private research organisations are direct. Public research institutions extend support such as supply of germplasm and training facilities to the private sector. Also, private research companies can collaborate directly with multinational companies or private research foundations abroad under the existing regulations which recently have been liberalised to a great extent (for detailed discussion, see Singh et al., 1995).

2.2.2 Agricultural extension system

Broadly, there are four major components of the Indian extension or transfer of technology system: (i) agricultural extension service with the state governments, (ii) extension education system of ICAR and SAD system, (iii) extension programme of input industries in public and private sectors and NGOs, and (iv), special rural development programmes of the central and state governments. However, main responsibility of transfer of technology rests with the state governments as agriculture is a state subject. The central government also implements several schemes having transfer of technology component, through the state governments.

Institutional structure of the Indian extension system is shown in Figure 2.3. The main extension system comprises the Directorate of Extension in the Union Ministry of Agriculture at the centre and T&V system under the state Department of Agriculture. In the T&V system, professional extension workers work with contact farmers for the transfer of information and skill. Training support to the T&V system is provided by the ICAR/SAU system (for details of T&V system, see Misra, 1990). The Directorate of Extension plans extension activities at national level and disseminates information through mass media and publication of literature. For training of extension staff, there is a three-tier training system. At the national level for training of senior and middle level staff, an autonomous institute, namely, National Institute of Agricultural Extension Management (MANAGE) was established. There are four regional extension training institutes and several state training institutes for training of extension workers. Several development programmes like integrated rural development programme, watershed development programme, operation flood, technology mission for crops, etc. sponsored by other government departments contain transfer of technology component. In 1994, the scope of extension was widened under the broadbased agricultural extension' in farming system approach to include all landbased activities.

Figure 2.3
Institutional structure of the Indian agricultural extension system



The ICAR/SAU front-line extension system plays a catalytic and supportive role. It develops extension methodology, refines and transfers front-line technologies, and provides feedback to scientists. This system has three approaches. First is the special transfer of technology programmes like National Demonstration (ND), Operation Research Project (ORP), and Lab-to-land Programme (LLP). Most recent in the series is the Institute-Village Linkage Programme started in 1995/96 for technology assessment and refinement. The second approach comprises the transfer of technology and training by the KVKs and TTCs on the principle of 'learning by doing'. There are 261 KVKs functioning in the country under the ICAR institutes, SAUs and NGOs. Front-line extension programmes (ND, ORP, LLP) are presently merged with the KVKs. Eight TTCs provide training to the KVK staff. In the third approach, ICAR/SAU system provide training to the master trainers (subject matter specialists) working in the state line department through monthly workshops.

Private input companies are involved only in the transfer of chemical (fertilizers, pesticides), mechanical and biological (hybrid seeds) technologies developed/produced by them. Public sector companies and seed corporations also undertake transfer of technology activities related to the sale of their products i.e., farm inputs. Commodity groups/boards also promote commodity specific

extension activities. Many NGOs also undertake extension activities as part of their development programmes. Some NGOs are also managing ICAR-supported KVKs.

Research-extension linkages

Efforts have been made to institutionalise research-extension linkages at national, regional, state and zonal levels. At the national level, under the ICAR-DAC interface joint meetings of the senior officers from the ICAR and Department of Agriculture and Cooperation (DAC) are organised twice a year to discuss critical research and development issues. At the regional level, eight regional committees were constituted to review research and development status in the ICAR institutes and SAUs located in the region. These committees represented by the senior research and extension officers, farmers representatives and NGOs meet once in two years. The Zonal Agricultural Research and Extension Advisory Committee meetings and seasonal workshops at the zonal level facilitate close interaction between researchers, extension workers and farmers. In the T&V system, research-extension linkages are institutionalised through monthly/bimonthly workshops for the training of master trainers or subject matter specialists in state line department by the researchers.

To sum up, it may be concluded that although the Indian NARES have grown in size and efforts, they are still dominated by government funded and administered institutions. There have been some initiatives like provision of contract research, rationalisation of seed regulations and entry of trans-nationals, in the recent past to diversify the NARES by encouraging private sector and NGOs. These efforts should be strengthened in future for efficient provision of research and extension services to farmers through diversified institutional arrangements.