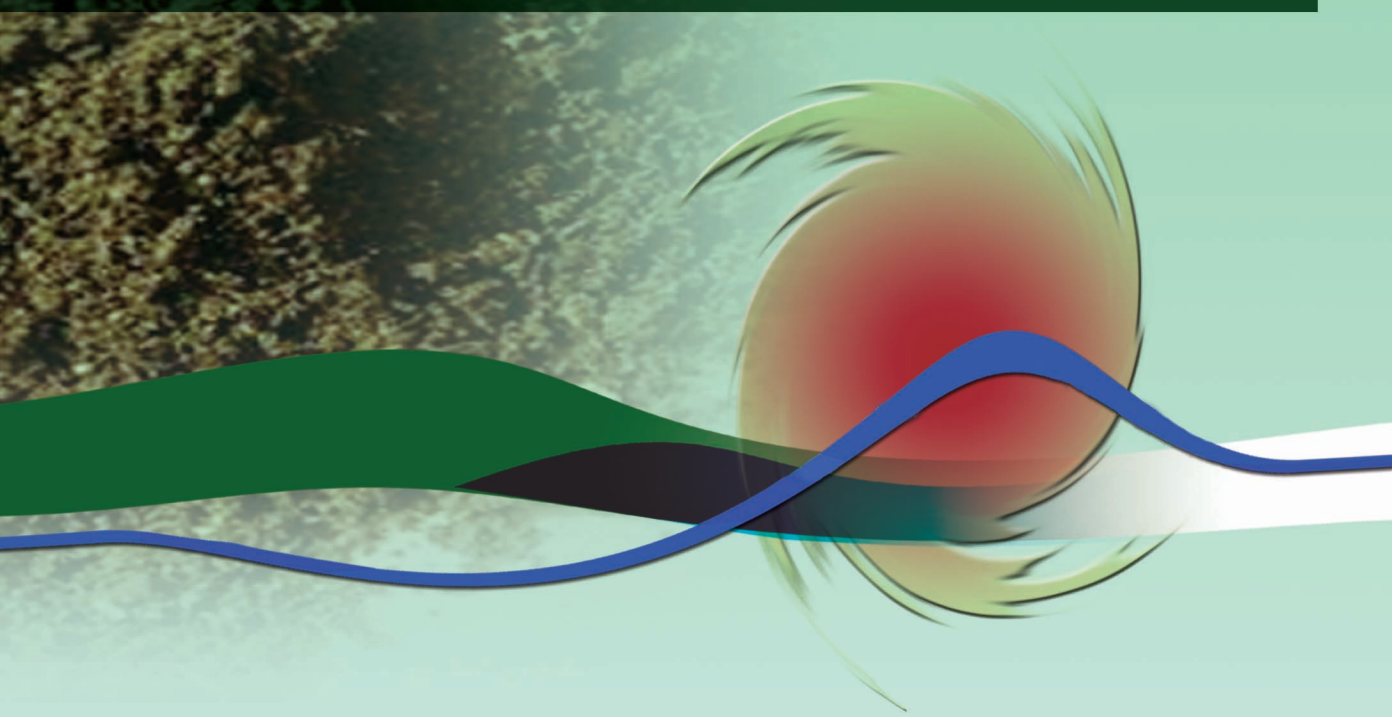
NARS

National Agricultural Research System in SAARC Countries-An Analysis of System Diversity



SAARC

SAARC AGRICULTURE CENTRE

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN SAARC COUNTRIES - AN ANALYSIS OF SYSTEM DIVERSITY

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NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN SAARC COUNTRIES - AN ANALYSIS OF SYSTEM DIVERSITY

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Foreword

The SAARC Agriculture Centre (SAC) is publishing the proceeding of the Consultation meeting on "National Agricultural Research System (NARS) in SAARC countries-An analysis of system diversity" to know about the NARS in the SAARC region. The objectives of the study are: (i) to study the existing National Agricultural Research System (NARS) in the SAARC member countries, (ii) to compare the NARS diversity among the member countries, (iii) to identify the strength and weakness of the systems, (iv) to document the research systems for the policy makers to have better options for their own countries, and (v) to develop research system in individual member countries based on the experience in other countries

The consultation meeting was held at Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh during 22-23 December, 2010. This consultation meeting is a part of the program "NARS in SAARC countries: An analysis of system diversity" initiated by the SAARC Agriculture Centre in early 2010. Under this program, eminent NARS experts from six SAARC countries, namely, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka had been nominated for preparing country reports. Upon completion of the reports the SAARC Agriculture Centre organized the consultation meeting and invited the experts for report presentation and discussion on several important issues under three thematic areas. Moreover, some local experts from Bangladesh attended the consultation meeting and contributed significantly in discussion and preparing recommendations. Finally the experts came up with a number of useful recommendations in order to improve their existing NARS to attain regional food security.

The important feature of this proceeding is the analytical review of the country reports of the NARS in six SAARC member countries. The NARS experts prepared their reports covering all the points in the guidelines provided by the SAC and which were the proper reflection of the NARS in SAARC countries. The reports generally include Governance System of Agricultural Research and Development, Organization of NARS, Institutional Governance, Review, Evaluation, Monitoring Systems and Incentive structure. I am grateful to the authors for their efforts in preparing the valuable reports.

My sincere thanks to Dr. Wais Kabir, Executive Chairman, Bangladesh Agricultural Research Council (BARC) who conceptualized this program and provided continuous advice and suggestions to make this program very successful. I am grateful to Dr. Wais Kabir and also to Dr. Ibrahim Md. Saiyed, SAARC Agriculture Centre for preparing the concept note and writing the review paper of the proceedings. My heartfelt gratitude to them for the tremendous and commendable contributions in editing the proceedings.

There are all together 27 recommendations under the three thematic areas which would be very useful for NARS scientists as well as policy makers not only in the SAARC countries but also in the other countries. These recommendations are the guidelines to improve NARS into better shapes and which ultimately contribute to attain food security.

I hope this book will be helpful for undertaking collaborative activities for effective improvement of NARS in the SAARC region.

I would appreciate receiving feedback, comments or suggestions from users which would help us to do better in the future.

Dr. Abul Kalam Azad
Director, SAARC Agriculture Centre
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Preface

South Asian Association for Regional Cooperation (SAARC) established in 1985, aims at promoting regional cooperation among the member states. Initially Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka were members. Later on Afghanistan became the eighth SAARC country. Under the aegis of SAARC a number of regional centres have been established to promote and accelerate development among the member states in specific areas. SAARC Agricultural Information Centre (SAIC), subsequently renamed as SAARC Agriculture Centre (SAC), was established in 1988 in Dhaka, Bangladesh to promote agricultural R&D among the member states and disseminate of the same. It may be mentioned that the agricultural research in the region has a long history. Formal agricultural research in what today in the region had its beginning in 1880. Initial agricultural research institutes focused on commodity based research. Later, countries began to centralized and consolidate the research operation. This involves establishment of research council for coordination of scattered research. Subsequently there have been a number of changes and revisions in the R&D systems of this region to cater to the need of the farming community.

Agriculture in South Asia is an important source of the national income and major source of livelihood. The agriculture is dominated by small farm holders and research is focused towards this. The research systems have evolved with common historical perspective in the region over the years and changes have taken place in course of time to suit the national needs. There are many management issues common in many countries while diversity exists in many countries. NARS in some countries are yet to develop further. During 2010 SAC took up a program (National Agricultural Research System in SAARC Countries-An analysis of system Diversity) to analyze the NARS diversity in the SAARC countries. In the program the selected research managers were given the responsibility to send country reports on the subject. Subsequently a workshop was organized where the authors presented the country reports. Based on the consultation and country reports a consolidated report has been made.

The authority in the SAC deserves thanks for initiating the program and helping to get the report published. Hope this report will help the policy makers better understand the research systems of the region for further strengthening the research capacity in the region.

Wais Kabir
Executive Chairman
BARC

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Abbreviations

ACR	=	Annual Confidential Report
ADP	=	Annual Development Programme
AEARC	=	Atomic Energy Agricultural Research Centre
AEC	=	Atomic Energy Centre
AEZ	=	Agro Ecological Zone
ALP	=	Agricultural Linkage Program
ANSRECW	=	Annual National Sectoral Research Extension Coordination Workshops
ARI	=	Agricultural Research Institute
ARL	=	Agricultural Research Laboratory
ARM	=	Annual Review Meeting
ARMP	=	Agricultural Research Management Project
ARPCMs	=	Annual Research Programme Coordination Meetings
ARS	=	Agricultural Research Station
ASRB	=	Agricultural Scientists Recruitment Board
ATC	=	Agricultural Technical Committee
BADC	=	Bangladesh Agricultural Development Corporation
BAEC	=	Bangladesh Atomic Energy Commission
BARC	=	Bangladesh Agricultural Research Council
BARD	=	Bangladesh Academy of Rural Development
BARI	=	Bangladesh Agricultural Research Institute
BAU	=	Bangladesh Agricultural University
BFRI	=	Bangladesh Forest Research Institute
BIDS	=	Bangladesh Institute of Development Studies
BINA	=	Bangladesh Institute of Nuclear Agriculture
BJRI	=	Bangladesh Jute Research Institute
BMRC	=	Bangladesh Medical Research Council
BOG	=	Board of Governance
BOM	=	Board of Management
brac	=	Acronym, largest NGO located in Bangladesh
BRRI	=	Bangladesh Rice Research Institute
BSMRAU	=	Bangladesh Council of Scientific and Industrial Research
BSR	=	Bangladesh Service Rules
BSRI	=	Bangladesh Sugarcane Research Institute
BTRI	=	Bangladesh Tea Research Institute
CAAS	=	Chinese Academy of Agricultural Sciences
CARP	=	Council for Agricultural Research Policy (Sri Lanka)

CBO	=	Community Based organizations
CGP	=	Competitive Grants Program
CIFE	=	Central Institute of Fisheries Education (India)
CoRRB	=	Council of RNR Research of Bhutan
CPD	=	Centre for Policy Dialogue
CRRM	=	Central Research Review Meeting
CSO	=	Chief Scientific Officer
DAE	=	Department of Agriculture Extension (Bangladesh)
DARE	=	Department of Agricultural Research and Education (India)
DCRO	=	Deputy Chief Research Officer
DG	=	Director General
DLS	=	Department of Livestock Services
DoA	=	Department of Agriculture
DoF	=	Department of Fisheries
DoL	=	Department of Livestock
DOST	=	Department of Science and Technology
DTC	=	District Technical Committee
EC	=	Executive Council
ECC	=	Extension Coordination Committee
ECNEC	=	Executive Committee of National Economic Council
EMBRAPA	=	Brazilian Agricultural Research Corporation
EPRRI	=	East Pakistan Rice Research Institute
ERD	=	External Relation Division
FACP	=	Food and Agricultural Council of Pakistan
FAO	=	Food and Agriculture Organization of the UN
FMC	=	Fund Management Committee
FMINFSR	=	Federal Ministry of Food Security and Research (Pakistan)
FSR	=	Farming Systems Research
FSRDS	=	Farming System Research and Development Sites
FYP	=	Five Year Plan
GB	=	Governing Body
GDP	=	Gross Domestic Product
GIS	=	Geographic Information System
GO	=	Government Organization
GoB	=	Government of Bangladesh
GOI	=	Government of India
HRD	=	Human Resource Development
HRM	=	Human Resource Management
IAARD	=	Indonesian Agency for Agricultural Research and Development

IAEA	=	International Atomic Energy Agency
IARI	=	Indian Agricultural Research Institute
ICAR	=	Indian Council of Agricultural Research
IMC	=	Institute Management Committee
IMS	=	Information Management System
IPARCC	=	Inter-Provincial Agriculture Research Coordination Committee
IPR	=	Intellectual Property Rights
IPSA	=	Institute of Post-graduate Studies in Agriculture
IRRI	=	International Rice Research Institute
IVRI	=	Indian Veterinary Research Institute
JRI	=	Jute Research Institute
KGF	=	Krishi Gobesona Foundation
KVK	=	Krishi Bigwan Kendra, India
LPR	=	Leave Preparatory to Retirement
M & E	=	Monitoring and Evaluation
MDG	=	Millennium Development Goals
MLTS	=	Multi-Location Testing Sites
MoA	=	Ministry of Agriculture
MoAC	=	Ministry of Agriculture and Cooperative
MoE	=	Ministry of Education
MoF	=	Ministry of Finance
MoFE	=	Ministry of Forests and Environment
MoFL	=	Ministry of Fisheries and Livestock
MoST	=	Ministry of Science & Technology
NAIP	=	National Agricultural Innovation Project
NAP	=	National Agriculture Policy
NARC	=	Nepal Agricultural Research Council
NARC	=	National Agricultural Research Centre of PARC
NARDF	=	National Agriculture Research and Development Fund
NARS	=	National Agricultural Research System
NATCC	=	National Agricultural Technical Coordination Committee
NATP	=	National Agricultural Technology Project
NDRI	=	National Dairy Research Institute
NET	=	National Eligibility Test
NFBSFARA	=	Strategic and Frontier Application Research in Agriculture
NFE	=	Non Formal Education
NGO	=	Non-Governmental Organization
NIB	=	National Institute of Biotechnology
NPC	=	National Planning Commission

NSB	=	National Seed Board
NSSC	=	National Soil Service Center
PAM	=	Production, Accessibility, Marketing
PARC	=	Pakistan Agricultural Research Council
PD	=	Program Director
POA	=	Plan of Action to Implement the NAP
PPD	=	Policy and Planning Division
PRA	=	Participatory Rural Appraisal
PSE	=	Private Sector Enterprises
PSO	=	Principal Scientific Officer
QRT	=	Quinquennial Review Team
QRTs	=	Quinquennial Review Teams
R&D	=	Research and Development
RAC	=	Research Advisory Committee
RARS	=	Regional Agricultural Research Station
RC	=	Research Center
RCD	=	Research Communication Division
RDA	=	Rural Development Academy (Bangladesh)
RGoB	=	Royal Government of Bhutan
RMC	=	Regional Management Committee
RMC	=	Research Management Committee
RNR	=	Council of Renewable Natural Resources
RNR RCs	=	Renewable Natural Resources Research Centres
ROCC	=	Research Institute Coordination Committee
RRM	=	Research Review Meeting
RU	=	Rajshahi University (Bangladesh)
SAARC	=	South Asian Association for Regional Cooperation
SAP	=	School Agriculture Programme
SIDA	=	Swedish International Development Agency
SO	=	Scientific Officer
SRB	=	Scientist Recruitment Board
SRC	=	Staff Research Council
SRD	=	Scientist Recruitment Board
SRDI	=	Soil Resource Development Institute (Bangladesh)
SRS	=	Sugarcane Research Station
SRTI	=	Sugarcane Research and Training Institute
SSO	=	Senior Scientific Officer
STC	=	Scientific Technical Committee
TTMU	=	Technology Transfer and Monitoring Unit (Bangladesh)
UGC	=	University Grants Commission
VERCON	=	Virtual Extension Research Coordination Network
VRC	=	Variety Release Committee

NATIONAL AGRICULTURAL RESEARCH SYSTEM MANAGEMENT IN SAARC COUNTRIES – AN ANALYSIS

Agricultural Research in South Asia

South Asia is the home of 1.6 billion people around 75 percent of which dwells in rural areas. These are mostly poor and live on agriculture. There are many commonalities in agricultural challenges and practices in SAARC countries.

Although a few South Asian countries (e.g. India) are reported to be transforming, but their economy are still dominated by agriculture for livelihood. South Asian agriculture employs about 60 percent of the labor and contributes to average 22 percent of the regional GDP. Though declining, their share of agriculture in the GDP ranges between 16.5 and 40%.. Agriculture is dominated by small holdings (0.6 ha in Bangladesh, 1.41 ha in India). Income disparities exist between agriculture and non-agriculture/ urban sector. As a result migration to urban areas is common, creating labour shortage in agricultural operation. Share of rural population ranges from 66% in Pakistan to 86% in Nepal. About 60% of total holdings are below 1 ha, except in Pakistan. Heavy dependence on rainfed agriculture (about 62% India, 45% Bangladesh, 60% Sri Lanka, 50% Nepal) necessitates effective utilization and control of water.

Favourable agro-climate supports cultivation of wide range of crops including fruits and vegetables. Cereal (rice, wheat and maize), vegetables and pulses are the major stable crops grown in the region. However, yield is lower than the global standard. Fisheries and livestock are also common means of livelihood in the rural South Asia. Bangladesh, India and Pakistan are rich in biodiversity in fisheries.

Natural resources are deteriorating in the region. This is threatening the growth in agriculture due to exploitive agricultural operation. Productivity level is either declining or remains stagnant due to lack of water resources, soil fertility degradation, salinization, etc.

Agricultural research has been playing a pivotal role for increasing production and productivity in the region. National Agricultural Research System (NARS) in the region played a significant role in green revolution by accelerating food production through development of appropriate farm technology. However, the region is facing new challenges of food security associated with increased demand for diversified food items due to income growth, degradation of natural resources, IPR regime, climatic vulnerability and global energy price hike associated with production system of food commodity. Under this background re-visiting of NARS in addressing emerging threat of food security and livelihood improvement demands careful attention.

The NARS of the SAARC Member States though evolved under similar historical perspective, but the organizational structures, governance and management are still different among the countries. Number of institutional innovations took place in the member states to accelerate agricultural research. The consultation meeting reviewed the

diversity of the NARS systems in the member states and found enough room for further development of the NARS in the region. This is an important issue when the countries are facing a number of challenges in increasing agricultural production. This warrants NARS system to be more efficient and capable to deliver technology and develop agricultural production system.

Despite the diverse geography and culture, the agricultural challenges and practices common in SAARC countries. Also the evolution of the research system started with similar goal of increased productivity. However, the system evolved in diversified fashion reflecting specific attention, need and socio-cultural settings. Over the past years, the institutional structure of most agricultural research systems in South Asia has been reorganized. Many of them started functioning before establishment of coordination councils.

NARS is organized mostly under Ministry of Agriculture which deals not only with crops but also with fisheries, livestock and food. Besides, many other agencies under different ministries are also involved in agricultural research. Organization of ministries involved in agricultural research influences performance of agricultural research in the member states.

On the recommendations of the Royal Commission on Agriculture during pre-independence of British India, the Imperial Council of Agricultural Research was established as a Registered Society in 1929. After independence of India and Pakistan, the Council was renamed as Indian Council of Agricultural Research (ICAR) in 1948 in India. During the 1960s, some countries began to centralize and consolidate their agricultural research. In Bangladesh, Nepal and Pakistan, this involved in establishment of agricultural research council with responsibility for management of agricultural research. In 1951 Food and Agricultural Council of Pakistan (FACP) was established. It was renamed as the Agricultural Research Council (ARC) in 1964. In 1979 it was re-designated as Pakistan Agricultural Research Council (PARC) under Federal government. However, subsequently provincial research establishments were created in Pakistan. Bangladesh Agricultural Research Council (BARC) was established in 1973 as the national agency for coordinating agricultural research in Bangladesh. Subsequently, there had been changes in the BARC's role in coordination of research. The BARC act 1996 strengthened NARS to a greater extent by bringing ten agricultural research institutes under overall coordination of BARC. The BARC Act 1996 is being revised to foster more coordination role of BARC.

Nepal Agricultural Research Council (NARC), an apex body for agricultural research in the country was established in 1991 as an autonomous organization.

Historically research and extension was in operation under department of agriculture in most of these countries. Department of Agriculture was established under department of Land records in British Bengal. The Indian department of Agriculture was established in 1905. Considering the importance and requirement for operational flexibility the research institutes were established and subsequently given autonomy.

NARS of Sri Lanka is organized in different way compared to other SAARC countries. Established in 1982, the Department of Agriculture (DOA) was the main

agency involved in non-plantation crop research and extension. There are research institutes under different departments of a number of Ministries. Council for Agricultural Research Policy (CARP) was established in 1987 at national level with responsibility for promoting and coordinating research in agriculture and related fields. Major responsibility of CARP has been to grant and support contract research for research institutes. However, CARP does not play a significant role in decision making in any of the NARS organizations

Council of Renewable Natural Resources (RNR) Research of Bhutan (CoRRB) was established in 2003 under the Ministry of Agriculture with responsibilities for coordinating and supporting the research and extension (development) needs of the farming population. CoRRB is a government agency and is under process of development.

NARS of the SAARC counties has developed as per their needs and aspirations. Number of institutional innovations took place, like Krishi Bigwan Kendra (KVK) of India, Agricultural Linkage Program (ALP) of Pakistan, Krishi Gobesona Foundation (KGF) of Bangladesh, etc. There is much scope to strengthen the agricultural research systems in SAARC countries through development of individual National Agricultural Research System (NARS) for technology generation, and transfer among the farmers. The South Asian agricultural research must be locally, regionally and globally competitive, collaborative, participatory and exchangeable so as to address national and regional problem.

Sharing of strength, weakness and institutional innovations in the region will help develop the NARS further. Therefore, it is an important development agenda in the SAARC region to analyze and adopt the best practices of agricultural research through regional consultation and cooperation.

Global Agriculture Research System

The NARS systems around the world follow several models. There are some models which are the combination of these models.

The Agricultural Research Council (ARC) model: Some large countries with complex research systems have established agricultural research councils to coordinate the work carried out at research institutes. The ARC typically is a public body which has, inter alia, the functions of managing, coordinating or funding research programs. Management of the Councils has proved effective because they are both autonomous and accountable to users and donors for planning and executing research. Indian Council of Agricultural Research (ICAR) falls under this model.

The National Agricultural Research Institute (NARI) model: This model is common in Latin American countries, where agricultural research has been conducted primarily at national level. They control, direct and manage all public funded agricultural research. They may be autonomous or semi-autonomous in budget preparation, scientist recruitment and financial management. They have some experiment stations established at different locations as the basis of the research organization. Brazilian Agricultural Research Corporation (EMBRAPA) falls under this model.

The Ministry of Agriculture (MOA) model: This model was dominant in communist countries and in the immediate postcolonial era. It still prevails in countries where there is less agricultural research capacity. It is characterized by centralized governance and bureaucratic practice. However, new organizational patterns have begun to emerge in recent years that provide greater flexibility. Agricultural Agency for Research and Development (AARD) of Indonesia is the example of this model

Universities and other higher education models: Universities are institutions placed amidst three coordinating forces: the academic oligarchy, the state and the market. These three forces are seldom in balance; they act in a continuous and dynamic tension, which often brings about intellectual, practical and organizational conflicts and ruptures often leading to diffused and contradictory missions. This model exists in USA. (Source: Agriculture at a Cross Roads, International Assessment of Agricultural Knowledge, Science and Technology for Development, IAASTD, Island press, 1718 Connecticut Avenue, NW, Suite 300, Washington D.C. 20009, 2009)

Brazilian Agricultural Research Corporation (EMBRAPA) is known to be the largest in the world after China and India. EMBRAPA was established in 1972, to establish a public company as semi autonomous body linked to the Ministry of Agriculture, Livestock and Food Supply.

Brazil employed 5,400 agricultural researchers, more than any other country in Latin America. EMBRAPA trained 64 percent of the combined research staff employed at the PhD level.

Brazil operates a two-tier system of federal- and state-based government agencies. As a semiautonomous federal agency, EMBRAPA is the largest agricultural R&D agency in Latin America in terms of both staff number and expenditures.

In the Asian countries, agricultural research is being organized in different fashions. Some are autonomous bodies under Ministry of agriculture while some are government departments under different Ministries.

Indonesian Agency for Agricultural Research and Development (IAARD) was established in 1974 under the Ministry of Agriculture. Several research institutes and centres are included within IAARD. These are Indonesian Center for Food Crops Research and Development, Center for Agricultural Engineering Research and Development

Agricultural research In Thailand is organized through several Departments under Ministry of Agriculture and Cooperatives. Department of Agriculture, Department of Fisheries and Department of Livestock etc. conduct research.

Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) was established in 1972. PCARRD, a sectoral council of the Department (Ministry) of Science and Technology, is the apex organization of the Philippines national agricultural research system. For over three decades now, it has been providing a unified and focused direction for national research and development (R&D) efforts in agriculture, forestry, and natural resources (AFNR). There have been number of councils and institutes in existence in Department of Science and Technology (DOST) like the Philippines Council for Aquatic and Marine Research and Development,

advanced Science and Technology Institute, Philippines Nuclear Research Institute etc.

PCARRD provides support to 132 R & D agencies including research institutes under the Department (Ministry) of Agriculture and universities, mostly in consortium mode.

At the national level, the principal agricultural R&D agencies are the Chinese Academy of Agricultural Sciences (CAAS), the Chinese Academy of Fishery Science, and the Chinese Academy of Forestry. Ministry of Agriculture supervises the CAAS. The Chinese agricultural research system is highly decentralized. With more than 58,000 public agricultural researchers in 2005, China's R&D capacity is the largest in the world.

NARS OF BANGLADESH

There are ten agricultural research Institutes under four different Ministries which constitutes National Agricultural Research System (NARS). Institutes within NARS are coordinated by the Bangladesh Agricultural Research Council (BARC), established in 1973. List of the institutes are given in figure 1.

BARC is the autonomous apex body of the NARS which is governed under the broader guidance of a Governing Body (GB). Executive Council composed of all ten institutes (ARIs) and BARC is a policy making body for research program review and scientific human resources management.

Headed by the Executive Chairman, BARC is mandated to coordinate the research activities of the NARS institutes, monitor their research performance, work for increasing their research efficiency and foster linkages of the ARIs with the technology transfer agencies. BARC also ensure that the research output of ARIs is properly disseminated to the beneficiaries. In addition, BARC works for strengthening the national agricultural capability through research planning and coordination. An outline of the NARS in Bangladesh is shown in Figure 1 and Table 1.

Although the BARC is under the Ministry of Agriculture (MoA) having responsibility of crop agriculture, but its unique set up has empowered the organization to serve also fisheries, forestry and livestock sub-sectors.

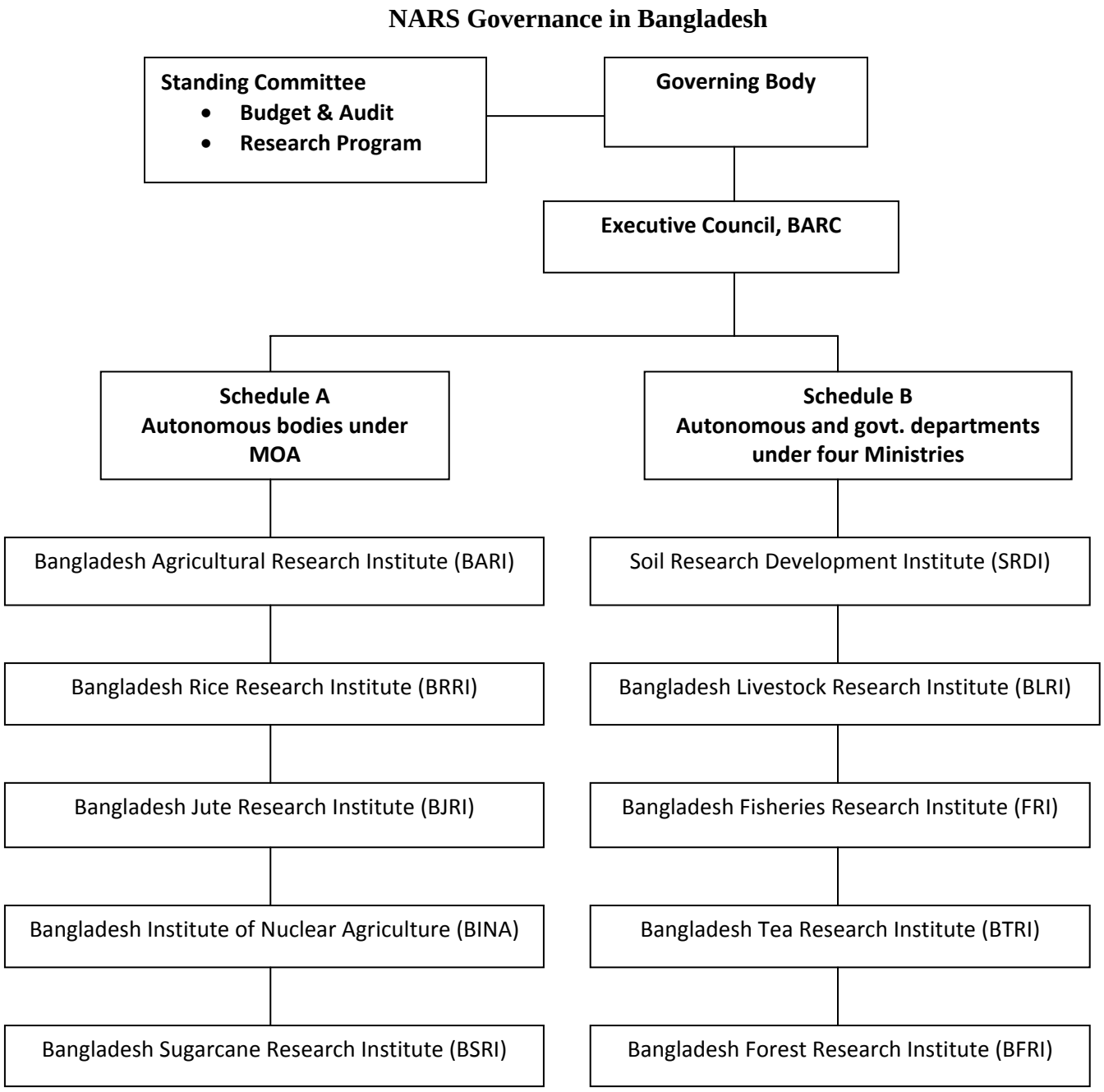

Figure 1: Organizational Structure of NARS in Bangladesh

Table 1. Institutes involved under NARS in Bangladesh and their respective ministries

Institute	Department and Ministry	Head Quarters
Schedule A		
Bangladesh Agricultural Research Institute (BARI): Largest in the country. It has 7 Research Centres, 17 Research Divisions, 6 Regional Agricultural Research Stations (RARS), 28 Agricultural Research Sub-stations (ARS), 9 farming system sites. Total Scientists: 724.	Autonomous, Ministry of Agriculture	Gazipur
Bangladesh Rice Research Institute (BRRI): Nine Regional Stations. Total Scientists: 233.	Autonomous, Ministry of Agriculture	Gazipur
Bangladesh Jute Research Institute (BJRI): It has four Regional Stations and five Sub-stations. Total Scientists: 149.	Autonomous, Ministry of Agriculture	Dhaka
Bangladesh Institute of Nuclear Agriculture (BINA): 13 Sub-stations. Total Scientists: 91	Autonomous, Ministry of Agriculture	Mymensingh
Bangladesh Sugarcane Research Institute (BSRI): Two Regional Stations, One Quarantine Station and six Sub-stations. Total Scientists: 111	Autonomous, Ministry of Agriculture	Pabna
Schedule B		
Soil Resources Development Institute (SRDI):-It has established six Regional and 21 District Branches. Total Scientists: 198	Department, Ministry of Agriculture	Dhaka
Bangladesh Fisheries Research Institute (BFRI): Five Stations. Total Scientists: 78	Autonomous, Ministry of Fisheries and Livestock	Mymensingh
Bangladesh Livestock Research Institute (BLRI): Two Regional Stations. Total Scientists:53,	Autonomous, Ministry of Fisheries and Livestock	Dhaka
Bangladesh Forest Research Institute (BFRI): 21 Field Stations, Total Scientists:102	Department, Ministry of Environment and Forest	Chittagong
Bangladesh Tea Research Institute (BTRI): Three sub-Stations. Total Scientists: 35,	Tea Board, Ministry of Commerce	Srimongal

BARC Act, 2012 includes Bangladesh Sericulture Research and Training Institute (BSRTI) at Rajshahi and Cotton Development Board (CDB) under Ministry of Textile as members of NARS.

GOVERNANCE OF THE INSTITUTIONS

The governance systems of these agencies are described below:

Governance of BARC: BARC is governed under the guidance of a Governing Body (GB) as well as Ministry of Agriculture.

Governing Body of BARC is composed of the 27 members. The Minister, Ministry of Agriculture chairs the GB while Minister of Fisheries and Livestock and Minister of the Ministry of Environment and Forests, act as Co-Chairman. The GB is also represented by two Members of Parliament, Executive Chairman, BARC, Member (Agriculture) of the Planning Commission, Secretaries of the Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Environment and Forests and Ministry of Commerce, Heads of extension departments (crops, fisheries, livestock and forestry). Three eminent scientists, Vice Chancellors of two agricultural universities, Senior officials of Ministry of Finance and Ministry of Establishment and a farmer, an NGO personality and a businessman dealing with agro-products/inputs are also members of GB,

There are two committees attached to the GB, namely finance committee and budget committee. The GB has responsibility to provide overall policy guidelines of agricultural research. Nevertheless, GB needs to strengthen its power further to implement its decisions. Recently, Government has taken initiative to strengthen research coordination.

Executive Council (EC)

The EC comprised of 18 members is represented by Member-Directors of the Council (BARC) and heads of NARS institutes. The EC is responsible to the GB and formulates various policy issues for NARS. The EC reviews and recommends annual research programs and budget of the institutes. The EC is also responsible for policy formulation of HRD of the NARS.

The Executive Council of BARC is composed of the following members, such as:

(a) Executive Chairman, Chairs the Council

(b) Member Directors of BARC (7)

(c) Chief Executives of the Institutes (10)

BARI, BRRI, BINA, BJRI, BSRI, BFRI (Fisheries) and BLRI have Boards of Management (BoM). The Director Generals of the first five of these ARIs are Chairmen of the Boards of Management of the respective ARIs. The Chairman of the Board of Management of BFRI and BLRI is the Minister-in-charge of the Ministry of Fisheries and Livestock. The BFRI (Forestry) and SRDI are run as Government departments.

Boards of Management of ARIs

The Boards of Management of BARI, BRRI, BJRI and BINA have similar compositions. The DG of each institute chairs the BoM. The representation of the BoM of these institutions under Schedule A is eminent scientists, BARC, extension department, farmer, NGO, institute directors, senior scientist, Ministry of Agriculture and Ministry of Finance.

On the other hand, the two ARIs under Schedule B, viz. BLRI and BFRI (Fisheries) have Minister of the Ministry of Fisheries and Livestock as Chairman of the Board of Governors (BoG). Seven out of the ten ARIs and BARC are governed by independent Acts and have separate Service Rules.

BOM of ARIs executes the policies and undertakings of the institute within the framework of the policy directives issues by the government.

Human Resources Management and Development

The NARS institutions have provision for 1808 scientific posts, out of which 1422 are currently working as of June 2009. About 20% of the positions are lying vacant. Among the existing 1422 scientists, only 350 (20%) have Ph.D. degree which indicate lower educational attainment compared to the needs for successful implementation of research programs of the NARS scientists. A programme for filling up the vacant positions, planning for providing higher degree and promotion of the deserving candidate is important. Quality of research output would be negatively affected if the human resources are not improved through implementation of a modest human resource development programme for the NARS within a short period.

The human resource management is the responsibility of the individual institutes under broader provision of BARC set rules. As each NARS institute is operated by individual Acts and separate service rules, there is no centralized provision of recruitment. Therefore, the quality of scientific staffs among the institutes varies significantly.

BARC established a set of criteria for recruitment and promotion of scientists of NARS. Recruitment of scientists at the entry level (Scientific Officer), based on some set criteria is the responsibility of the institutes. Written test for eligibility in recruitment of scientific officer has been introduced recently through one external institute (Dhaka University). The final recruitment is done at the institute level (ARIs).

The promotion of the scientists is based on civil service rule, i.e., availability of vacant position. As a result the scientists are to wait until the senior positions are vacant, even for 15-18 years, although they have all the required qualifications and experiences for promotion. Discipline wise promotion at one institute gives opportunity of one scientist to advance his career based on vacancy while his senior colleague in other discipline is deprived of promotion due to absence of vacancy. Also, inter institutional promotion does not exist that causes frustration among the scientists and creates unholy competition.

Higher studies are carried out with the assistance of donor support projects. IDA credit support made provision (1996-2001 & 2008-20011) for HRD. Individual scientist also arranges scholarship. GOB also supports for higher studies, mostly local. Recently, government is allocating fund to BARC for higher studies leading to in-country Ph.D. degree.

Each organization has an organogram of its own approved by the concerned Ministries like Ministry of Agriculture, Ministry of Finance and Ministry of Establishment etc. A long process of scrutiny and approval is followed after submission of requirement for additional manpower, by the ARIs.

Investment Trend

Investment trend in agricultural research in the recent past has not been encouraging. A review of the yearly budget of the ARIs of NARS for the period 2006-07, 2007-08 and 2008-09 reveals very little difference from year to year except a little increase in BARI, BRRI and BJRI budget. Study shows the investment in agricultural research fluctuates, varies from 0.32 to 0.40% of the agricultural GDP. However, the situation is improving due to implementation of donor supported project like National Agricultural Technology Project.

Revenue Budget is prepared by each ARI and sent to the MoA. The MoA sends the budget to the Ministry of Finance where it is further revised and reduced. In fact, there is no hard and fast rule about financial resource allocation. The MoF, depending on the financial situation of the country in a particular year, decides whether the revenue budget for the various agencies of the Government would increase or decrease from the previous year's budget. The rise or fall of the revenue budget is indicated by a certain percentage point. "The revenue budget this year will rise/fall by 10%".

For the last few years only, a lump sum amount is allocated for implementation of research program of each of the NARS institutes including BARC over their approved revenue budget. It is clear that financial allocation has no relation to the volume of work or quality of performance. But it is to be understood that the budget of a research institute should be fixed on the basis of its research programme and performance as per national priority. Also there is opportunity to improve financial management of NARS.

Table 2. Expenditure (in million taka) of the total NARS (10) institutes & BARC (Operation, capital etc.)

Institute	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*
BARC	*129.742*	*159.121*	*149.582*	*290.772*	*333.298*	*260.971*	*256.507*
BARI	*560.327*	*520.921*	*852.709*	*1215.404*	*1349.429*	*1272.001*	*1099.827*
BRRI	*207.836*	*227.776*	*233.192*	*262.540*	*300.242*	*321.235*	*390.359*
BJRI	*101.992*	*132.104*	*147.266*	*154.667*	*158.869*	*166.786*	*172.989*
BSRI	*53.191*	*50.291*	*61.139*	*101.302*	*110.850*	*106.330*	*142.783*
BINA	*32.601*	*39.277*	*54.563*	*66.668*	*81.714*	*94.566*	*109.692*
BLRI	*62.970*	*68.750*	*69.960*	*86.105*	*70.918*	*82.740*	*90.315*
BTRI	*31.628*	*30.657*	*31.737*	*32.041*	*34.006*	*39.515*	*47.368*
BFRI	*61.199*	*73.412*	*84.968*	*101.417*	*119.792*	*136.174*	*158.097*
FRI	*102.887*	*94.080*	*85.979*	*85.022*	*69.439*	*74.816*	*102.564*
SRDI	*83.370*	*105.329*	*114.027*	*113.450*	*122.659*	*142.513*	*146.178*
Total	*1427.743*	*1501.718*	*1885.12*	*2509.388*	*2751.22*	*2697.647*	*2716.68*

Development budget is prepared by an ARI if there is a need for starting a new research project requiring extra manpower, equipment, infrastructure, facilities, operational fund etc. The institute is required to send it to the MoA. The MoA, after scrutiny sends it to the Planning Commission/External Resources Division (ERD) in case

of donor funding. The project is further evaluated at the ERD and finally passed in the Meeting of the Executive Committee of National Economic Council (ECNEC). The Development budgets are only for a specific period of time (4-5 years). Sustainability of research or the management and utilization of the developed technology often becomes a problem due to discontinuity of project based funding.

During 2009 Bangladesh invested 2.9 billion taka or 125 million purchasing power parity (PPP) dollars (both in 2005 constant prices). This includes NARS institutes, university, other government universities, NGO. Total agricultural R&D spending as a percentage of agricultural GDP (agricultural research intensity) fluctuated and peaked at 0.40 in 2006 and 2007 before declining to 0.32 in 2009 (Micheal Rahija, Shah Md. Monir Hossain, Md. Mustafizur Rahman & Gert-Jan Stads, Country note, Agricultural Science and Technology Indicators, IFPRI & BARC, 2011).

Review, Monitoring and Evaluation

Research review and planning cell is unique forum for the research-extension linkage. Review workshops are mandatory programme for the NARS institutes which are held annually at different levels. At present, research programmes are reviewed at the institute level annually. Divisional heads present the achievements and future programmes of the divisions. The extension departments, universities, BARC, and NGOs are invited to participate in the research review and planning process. Different NARS institutes follow different review process.

Bangladesh Rice Research Institute (BRRI) undertakes research extension workshop once in two years. In the workshop, Department of Agriculture Extension review field problems and feed back the performance of the technologies and knowledge gained by the farmers. The institute also organizes central review workshops once in a year where extension department, scientists, NGOs and private sector participate. The annual research programmes are reviewed in the workshop and finalized by incorporating feedback information from the extension personnel.

Bangladesh Agricultural Research Institute (BARI), the largest research institute, maintains three layers of review programmes (regional, internal and central). Regional Agricultural Research Stations conduct regional review workshops once in a year to review regional crop performance and research programmes associated with BARI mandated crops which are placed in the central review workshop. All scientists of the institute take part in the internal (divisional) review, which takes longer period (about 6-8 weeks). The internal review is more rigorous in nature where all research programmes and projects are reviewed in details to improve quality of research programs and experimental design. The external members are also invited in the process. The central workshop reviews the yearly programmes where external members from extension department, universities, private sector and other organizations, and retired scientists are invited to participate. Usually, the senior level scientists present the research programmes the internal review. The retired scientists of the institutes are also invited to provide inputs for improvement of the research programs.

Other research institutes have also institutionalized review process to improve quality of research involving relevant stakeholders. BARC organizes research programme

reviews separately to avoid duplication of research and to ensure incorporation of national priority. Individual technical divisions are responsible to organize such review in 2-3 days workshop.

Institutional review of NARS was undertaken by independent committees of experts from outside the institutes in 1999. The recommendations were discussed in GB meetings of the Council.

Most ARIs have regular monitoring programmes to oversee the progress and quality of research carried out by the central as well as the outreach stations. Heads of Divisions and Senior Scientists of the concerned Divisions of the ARI visit the laboratory, greenhouse and field experiments. The number of such monitoring visits varies depending on the commodity of research, season and other relevant considerations. On certain occasions, scientists from BARC and some relevant ARIs are also invited by the concerned ARI for monitoring. However organized monitoring and evaluation programme is yet to be developed. Considering the importance of M& E for quality improvement of research BARC has established M& E cell for each of the research institutes.

Research Extension Linkage

There is enough room for the improvement of research-extension linkage. Some ARIs hold seminars/training workshops etc. to impart training and update knowledge of the extension officers about the developed technologies. Some ARIs do not have even technology dissemination division. During 1980 and 90s some nodal committees made significant progress in strengthening R-E linkage. Agricultural Technical Committee (ATC), District Technical Committee (DTC) and the National Agricultural Technical Coordination Committee (NATCC) meetings contributed largely in research programme development, through participatory discussion with the personnel of crops, fisheries and livestock departments. Local level stakeholders including NGOs are also invited to participate in the discussion meetings. The Technology Transfer and Monitoring Unit (TTMU) of BARC has been created for facilitation of primary extension and monitoring of the transfer process. But the TTMU needs to be made more functional with adequate human resources.

Institutes outside formal NARS

A number of national agricultural universities as well as some departments under national universities carry out agricultural research. Besides, some NGOs and private organizations carry out agricultural research independently based on consumers' needs.

The following seven agricultural universities are involved in carrying out agricultural research.

1. Bangladesh Agricultural University, Mymensigh
2. Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
3. Shere Bangla Agricultural University, Dhaka
4. Sylhet Agricultural University, Sylhet
5. Patuakhali Science and Technology University, Patuakhali

6. Haji Mohammad Danesh Science and Technology University, Dinajpur
7. Chittagong Veterinary University, Chittagong

Besides, the following public research organizations conduct some agricultural research.

1. Bangladesh Council of Scientific and Industrial Research
2. Bangladesh Atomic Energy Commission

BRAC, the largest NGO, has network of research and maintains national and international linkage.

Institutional Innovation

Considering the needs for sustainability and operational flexibility of research Krishi Gobeshona Foundation (KGF), a non-profit organization, was established in 2007 under Companies Act 1994. KGF is an independent organization implementing research under Competitive Grants Program (CGP). The World Bank financed NATP (National Agricultural Technology Project) initiated funding, as endowment, to support operation of KGF and CGP. CGP provides funding of location-specific, pre-identified, high priority, multi-disciplinary, short to medium term, problem-solving research and development to develop a more pluralistic research system. NARS institutes, universities, other research institutes, NGOs, and the private sector have been conducting research under CGP.

Future Intervention for Enhancing System Efficiency

The coordination of NARS research is constrained by a number of factors. Firstly, the autonomous institutes within the system (NARS) are functionally scattered under different ministries and are operated under individual Acts and service rules. This is a challenge for BARC to effectively coordinate the research programmes of the institutes. Secondly, the resource allocations of the institutes are channeled through line ministries without functional linkage with the programme review at the council level. This makes the function of EC less effective and less accountable for research undertakings. Thirdly, the management of the scientific human resources is undertaken by the individual institutes with no opportunity for inter institutional transfer or promotion.

Civil Service based promotion system restricts meritorious scientists to upgrade their career. Scientists are to wait for promotion until the higher positions become vacant.

In order to develop a more responsive and accountable system to the global and regional standard, the institutes under NARS may be governed under uniform framework that would allow the system to be more productive and responsive in the agricultural R and D needs. This necessitates reformulating the research system with dynamic organizational set up under unified Act and service rule of the autonomous institutions.

International linkages like CGIAR are maintained by the individual NARS institutes. For better coordination and effective utilization of international research services, Executive Council of BARC may be given the responsibility to maintain international research linkage.

Again, important decisions taken in the GB are not implemented due to further approval requirement of the ministries.

However, the Government is recently allocating financial resources as research cost to BARC. The amount has been found to be effective beginning in providing research support to NARS and agricultural universities in generating technology and knowledge. Also the amount has been used for higher studies in different public universities of Bangladesh and skill development programme of the NARS scientists.

Recent BARC Act 2011 has made provision for better coordinating role of BARC which authorizes it to review annual research programmes or research projects along with financial allocations.

NARS IN BHUTAN

Background of Renewable Natural Resources (RNR) Research System

Council for RNR Research of Bhutan (CoRRB) under the Ministry of Agriculture is the apex national organization for Renewable Natural Resources (RNR) research in Bhutan. Major mandate of CoRRB is to harmonize and prioritize research agenda as per national development priority, formulate research and extension policy and clear all RNR research programme. The Council assisted by various permanent and ad-hoc bodies and committees, provide direction and guidance on policy and planning, technical and scientific and financial matters. The Council is the supreme policy and decision making and approval body. It carries out research programmes through its own network of regionally-based RNR Research Centres and sub centres in collaboration with other organizations (Table 1). However, organizationally, the vision of CoRRB is to grow itself into a real Council with the responsibility for coordinating, funding and managing research programmes within a comfortable level of autonomy for planning and executing research and optimizing use of available resources.

CoRRB has four major region-based Renewable Natural Research Centres (RNR RCs). Each RNR RC is responsible for leading a National Research Program and for implementing research in a specific mandated region. The details are shown in tables 2 and 3.

Table 3. National Mandate and RNR research Centers

National Mandate	RNR Research Centres
Forestry	Yusipang, Thiphu
Field Crops	Bajo, Wangdu
Livestock	Jakar, Bunthang
Horticulture	Wenkhar, Mongar

Table 4. List of Agencies (MoA) Carrying out Research on Specific RNR subjects.

SN	Name of agency/Location	Parent Organization	Main Area of Research
1	National Biodiversity Centre (NBC), Serbithang, Thimphu	Non Departmental	Bio-diversity
2	National Plant Protection (NPPC), Centre, Semtokha, Thimphu	Department of Agriculture	Plant protection and pest diseases
3	National Soil Service (NSSC), Centre, Semtokha, Thimphu	Department of Agriculture	Soil and land management
4	National Mushroom Centre (NMC), Semtokha, Thimphu	Department of Agriculture	Mushroom
5	National Post Harvest (NPHC), Centre, Bondey, Paro	Department of Agriculture	Post harvest
6	Agriculture Machinery (AMC), Centre, Bondey, Paro	Department of Agriculture	Farm mechanization
7	National Centre for Animal Health (NCAH), Serbithang, Thimphu	Department of Livestock	Animal Health
8	National Feed and Fodder Development Programme (NFFDP), Jakar, Bumthang	Department of Livestock	Livestock fodder and feed
9	National Livestock Breeding Programme (NLBP), Serbithang, Thimphu	Department of Livestock	Animal breeding
10	National Warm Water Fishery Centre (NWWFC), Gelephu, Sarpang	Department of Livestock	Fishery
11	National Cold Water Fishery Centre (NCWFC), Haa	Department of Livestock	Fishery
12	Ugyen Wangchuk Environmental and Foresry Institute (UWEFI), Jakar, Bumthang	Department of Forestry	Environment, forestry
13	Nature Conservation (NCD), Division Thimphu	Department of Forestry	Nature (plant and animal) Conservation

The CoRRB is the secretariat of the Council of the RNR Research of Bhutan headed by a Director who is also the Member Secretary to the Council. The secretariat with advice from the Council implements the policy and strategic decisions of the Council meetings.

The secretariat through the council has the executive authority to manage, administer, direct and control the national research fund, coordinate research and extension through its respective divisions and oversee the administration of national

meteorological services system of Bhutan. CoRRB provides leadership in strategic thinking and planning on research programmes.

The Royal Government Five Year Plan Strategy documents for the different research programmes (field crops, horticulture, livestock, and forest) outline the broader research issues and needs. Based on this framework, the annual research agenda and activities are drawn. The RNR research centres in collaboration with the technical departments organize annual meetings of researchers, extension personnel and central agency staff to review past activities and plan for the future.

CoRRB is supported by four committees: Scientific Technical Committee (STC), Extension Coordination Committee (ECC), Variety Release Committee (VRC) & Regional Management Committee (RMC). CoRRB has four major region based Renewable National Resources Research Centres (RNR RCs).

Institutes outside formal NARS

There are some agencies outside CoRRB but within MoA, which undertake research activities. Such research is known as “peripheral research”. However, there is no institutionalized mechanism or monitoring process for this peripheral research. This may lead to duplication of research, a waste of time and resources. The CoRRB is planning to be a clearing house to avoid duplication among different agencies.

Investment trend

The investment in RNR Research has been quite adequate given the limited national resources. The main funding for research comes from the government. The RNR research program has been 4.9% of the total RNR sector budget during 2007-08-2012-13. The CoRRB has a budgetary allocation in 10 the FYP outlay is 198,650 million Ngultrum, out of total 4021,509 million Ngultrum. Other funding sources include financing by stakeholders and other private sources, traditional donors, foreign direct investment and through payment for services.

Human Resources Development and Management

Human resources development programme aims at improving the organizational capacities of research service providers and the individual capacities of researchers. In order to undertake quality research, opportunities for pursuing higher studies are given to researchers. Consistent up-gradation of deserving diploma holders (and lesser degrees) is needed in order to create competitive incentive and reward and increase human resource efficiency.

Although RNR Research in Bhutan is organized by Council, the staffs of the RNR Research system are, however, governed by the Bhutan Civil Service Rules which is same across all agencies.

Research-Extension-Education Linkage

Annual National Sectoral Research Extension Coordination Workshops (ANSRECW) are annual events in Bhutan which constitute the basis of the research programme planning. Every year four such workshops are held, and the objectives of the ANSERCWs are to review/monitor and plan research and extension collaborative activities, exchange information on emerging technologies and research needs, provide forum for agreeing on activities/budgets planned by central programmes and projects for the region, and provide forum for clarification on policy issues, if any. These workshops are attended by the district extension heads and researchers of the concerned sector. Relevant participants from central agencies also attend these workshops. The coordination and organization of these workshops including the agenda setting are jointly done by the respective department and RNR Research Centre.

Institutional Innovations

In the long run CoRRB would serve as a "Clearing House" and encourage agencies outside MoA and private firms, wishing to undertake RNR related research, to follow the adopted research protocol and get their proposal endorsed by CoRRB.

NARS IN INDIA

The Indian Council of Agricultural Research (ICAR) (Figure 2) is an autonomous body under Society Act. Under the Department of Agricultural Research and Education (DARE), the ICAR is an apex organization at the national level in India for promoting science and technology programe in the agricultural research and education. The General Body (GB), composed of total number of 142 members, is the supreme authority of the ICAR headed by the Minister of Agriculture, Consumer Affairs, Food and Public Distribution. Its members are the Ministers for Agriculture, of the states Animal Husbandry and Fisheries, and the Senior Officers of the various state governments, representatives of Parliament, industry, educational institutes, scientific organization and farmers.

The present agricultural research system in India has been developed over years of experience and experimentation which have undergone major changes in development of organization and activities.

The present agricultural research system comprises of essentially two main streams, the ICAR at the national level and the Agricultural Universities at the state level. Besides, several other agencies such as General Universities, Scientific Organizations, and various Ministries/ Departments at the Centre, and also Private sector participate directly or indirectly in the NARS activities.

The Union Minister of Agriculture is the President of the ICAR. The Principal Executive Officer of the ICAR is the Director-General, who is also the Secretary to the Government of India in the Department of Agricultural Research and Education.

The Governing Body is the chief executive and decision making authority of the ICAR. It is headed by the Director-General of ICAR. It is assisted by the Standing Finance Committee, Accreditation Board, Regional Committee, Policy and Planning Committee, several Scientific Panels, and Publications Advisory Committee. In the scientific matters, the Director General is assisted by 8 Deputy Director Generals. The ICAR receive funds from the Government of India and from the proceeds of the Agricultural Produce.

The Research set-up of the ICAR is given in Table-4. For effective communication of research findings among farmers, the ICAR maintains an effective network of Krishi Vigyan Kendras and Trainers and Training Centre along with Zonal coordinating Units.

The ICAR is unique in having concurrent responsibility for both research and education in agriculture. The Charter of the ICAR also includes extension education, which is carried out through a network of projects and other mechanisms. There were 97 research institutions working under ICAR (2009-10).

The central government provides public funding for 5 year plan period in consultation with the Planning Commission for agricultural research and education (R & E) which passes through ICAR. ICAR prepares budget both for plan & non-plan period for the institutes/ centers/ projects. Research priority of Indian NARS is decided through very rigorous process. Planning Commission of India sets up Working Group before the start of Five Year Plan (FYP) to recommend areas for research and education. The working group is headed by a well known agriculture scientists. The 8 Regional Committees constituted by ICAR looks after the regional issues to fix up research priorities.

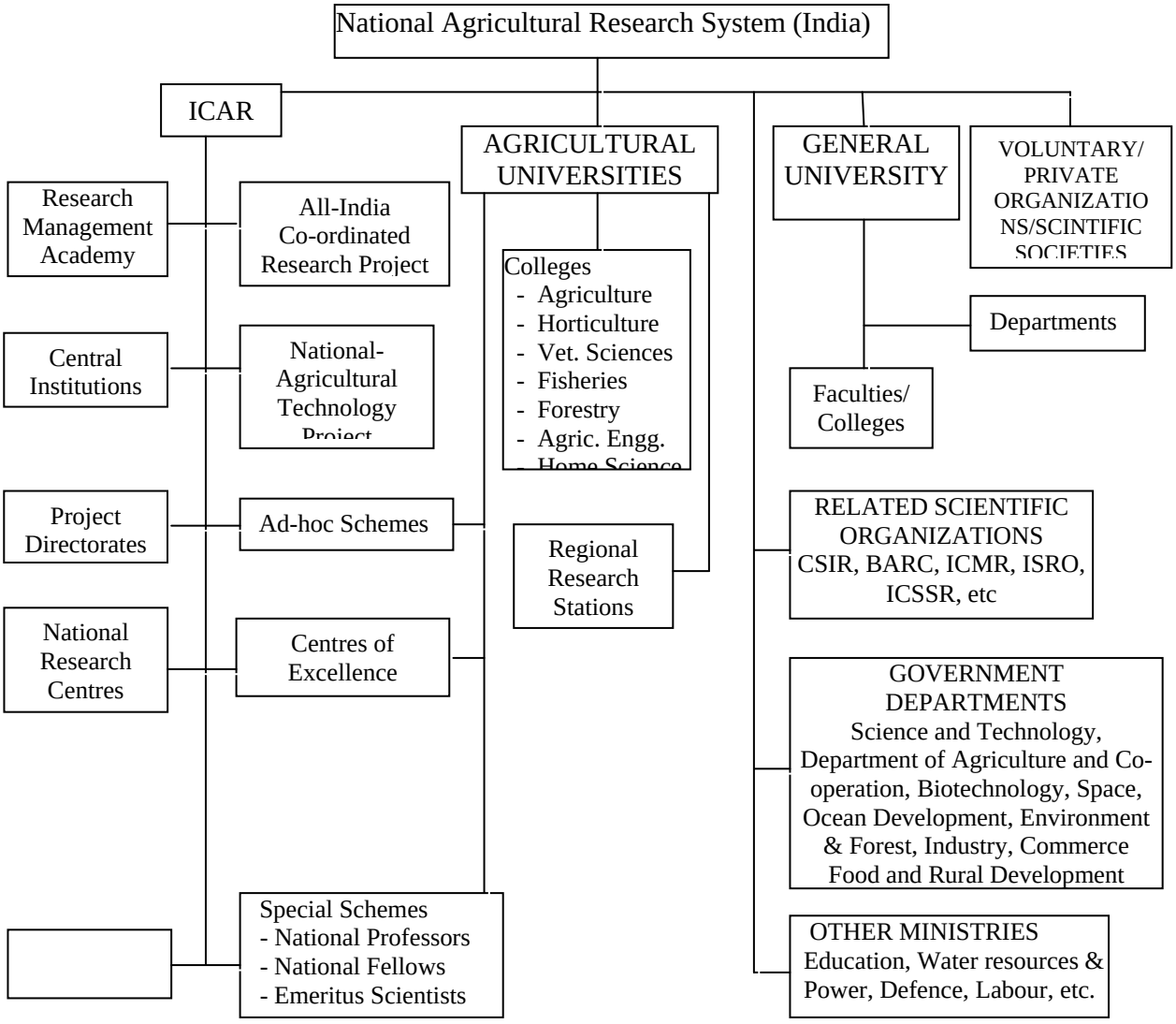

Figure 3: Organizational Structure of NARS in India

The ICAR by now has established 580 Krishi Vigyan Kendras (KVK) at the rural district level, and contemplate to have one KVK in each of the remaining 588 rural districts of the country by the end of the X Plan as an innovative institutional model for assessment, refinement and on farm demonstration of Agricultural technologies and training of trainers/farmers.

Table 5. ICAR institutions in different discipline (INDIA)

Division	Institutes	National Bureax	National Research Centre	Project Directorate
Crops Science	10	2	7	6
Horticulture	10		12	
Animal Science	7	1	7	4
Fisheries	6	1	1	
Natural Resources Management	8	1	3	1
Agricultural Engineering	6			
Agricultural Extension			1	1
Agricultural Education	1			
Total	48	5	31	12

The task of coordinating and supporting the present agricultural education system in India has been assigned to the ICAR by the Government of India. Having the statutory power vested in it, ICAR coordinates and supports higher agricultural education in the country at par with that of University Grants Commission (UGC). The Council partly provides funds to agricultural universities and monitors the course curriculum. To undertake new course/ degree program, the SAU needs to take permission from the Council. To maintain the quality of higher education in agricultural universities, accreditation of the agricultural university is done by the Committee constituted by the ICAR.

Review, Monitoring and Evaluation

The ICAR has the Institute Management Committee (IMC), Staff Research Council (SRC), Research Advisory Committee (RAC), and the Quinquennial Review Teams (QRTs) at the institutional level for guiding and monitoring the work of institutes. The Quinquennial Review Team (QRT) performs 5 yearly review of performance of every Institute. The recommendations of the QRT are placed before the Governing Body for approval prior to their implementation.

Based on the funding sources, review process is adopted for evaluation of activities performed. Activities (research, education and extension) performed using funding from the council is done at divisional level by the Deputy Director General (DDG). Individual institute falling under respective division submits work plan for Five Year Period based on the direction given by the division to pursue most important areas, suggestions of working group formed by the ICAR in consultation with Planning Commission, and scientists, own assessment while working with farmers.

Review of educational programmes is done by DDG (Education) of ICAR both in ICAR Deemed Universities, State Agricultural Universities and affiliated Agricultural

Colleges. Review of outreach programmes performed by KVKs is done by DDG (Extension) ICAR at regional level.

Management Committee (MC) also reviews Institute programmes twice in a year for smooth functioning of activities. Director of the Institute is the Chairperson of the MC. Secretary of MC briefs the past proceedings, and proposes the current demand before the MC. Chairperson seeks the approval of MC members for further action.

Institutional reviews are usually done at the end of Five Year Plan period by a Quiquennial Review Team (QRT) of individual ICAR institute / SAU by the experts group mainly from the outside system. QRT assess the activities (research/education/extension) and make suggestions for improvement.

Research programmes of the Institute are monitored by both Research Advisory Committee (RAC) and Institute Research Council (IRC). The RAC reviews research programmes in its meeting held once or twice in a year and suggest correction based on national and global context of research in the thrust areas. The IRC evaluates research through maintaining Research Project Files.

Investment Trend

Indian NARS is mainly under public domain. The distinction between R&E expenditures was not uniformly maintained in the government accounts, making separate accounts for 'research' expenditure difficult.

Government investment on agricultural R&E includes the expenditure made by the Union and all State Governments, and Union Territories. These data were compiled from various accounts of the Union and State governments (GOI) and contain all Plan and Non-Plan expenditures on revenue and capital accounts.

Funds from the Union Government support the ICAR. Besides supporting a network of ICAR institutions, a part of funds are transferred to SAUs in the form of research schemes and annual grants. The State Governments support SAUs which are entrusted with the responsibility of imparting education and conducting state or location specific research. Some government funds are also used to support research in public organizations like Agro Economic Research Centres and commodity research stations outside the ICAR and SAU system.

Funding for public agricultural research and education is provided by the government in the form of block grants with allocations determined through live-year plans. The Indian Council for Agricultural Research (ICAR) receives most of its funding from the central government, although in the 1990s, and the early 2000s some additional funding was derived from a World Bank project and other donor sources. Internally generated income and other sources of funding are negligible. The State Agricultural Universities (SAUs) receive about two-thirds of their funding from allocations from the state government and a considerable amount from central government allocations through ICAR, SAUs are relatively more successful in generating internal resources (Nienke M. Beintema and Gert-Jan Stads, Diversity in Agricultural Research Resources in the Asia-pacific Region, Agricultural Science and Technology Indicators Initiatives, IFPRI & APAARI, 2008)

There has been quantum jump in total government investment in agricultural R&E in the country during 1981-2007. The investment in agricultural R&E was Rs 1875 million in 1981, and increased to Rs 7704 million in 1991 and Rs. 25446 million in 2001. It further rose to Rs. 43200 million in 2007.R&E investment during 1981-2007, increased by 23 times.

The changing emphasis on the structure of the NARS over time has changed the share of Centre and State Governments in the national investment. During 1980s and 1990s state governments contributed about 54 per cent of the total investment (Table 5). However, the reverse is noticed for states after 2000. The increasing centralization in R&E expenditure is not a welcome sign as agriculture is a state subject.

Table 6: Per cent share of central and state governments in the national investment (India)

Period (TE)	Centre	States
1980-81 to 82-83	46.9	53.1
1991-92 to 93-94	44.6	55.4
2005-06 to 07-08	54.0	46.0

Trends in public expenditure on R&E in terms of R&E intensity (investment as percentage of agricultural gross domestic product) have shown that R&E intensity increased from 0.45 per cent in 1995 to 0.64 per cent in 2007. These intensity ratios indicate that investment in R&E is growing over time. During 2005-06 to 2007-08, the share of Central and States in R&E expenditure was 54% and 46%, respectively.

Research-Extension-Education Linkages

ICAR, through over 90 All-India Coordinated Research Projects (AICRP), has research linkage with 28 State Agricultural Universities (SAU) and one Central University. These Universities conduct ICAR-funded research in over 300 Research Stations. Main responsibility of transfer of technology lies with the State Governments as agriculture is a state subject.

Efforts have been made to institutionalize 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), the research extension leakages are organized twice a year to discuss critical research and development issues. At the regional level, eight regional committees have been constituted to review research and development status in the ICAR institutes and SAUs located in the region.

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.

The task of coordinating and supporting the present agricultural education system in India has been assigned to the ICAR. ICAR coordinates and supports higher agricultural education in the country at par with that of University Grants Commission. The Council

partly provides funds to agricultural universities and monitors the course curriculum. To undertake new course/ degree programme, SAU needs to take permission from the Council. To maintain the quality of higher education in agricultural universities, accreditation of agricultural university is done by the Committee constituted by the ICAR. Apart from these, the ICAR takes higher education through its four institutions viz., Indian Agricultural Research Institute (IARI) New Delhi, Indian Veterinary Research Institute (IVRI), National Dairy Research Institute (NDRI), and Central Institute of Fisheries Education (CIFE).

Human Resource Management and Development

There are 30,000 scientists in the NARS system including SAUs and KVKs. The ICAR provides short-term fellowships to post-graduate and doctoral students in the form of Junior Research Fellowships and Senior Research Fellowships, respectively, for undertaking quality research in agriculture in frontier areas. The ICAR provides opportunity to acquire higher training by its scientists both in India and abroad. Training/ capacity building within country is under the purview of the Director of the ICAR Institute. The total cost of training is borne by the institute. ICAR also encourage scientists to acquire higher training in foreign countries in limited number depending upon the importance of area and need of the institute providing full cost. ICAR awards scholarships (in the form of ICAR National Professor, ICAR National Fellow and Emeritus Scientist) to eminent scholars to undertake basic and strategic research in frontier areas.

Recruitment of Scientists

Independent Agricultural Scientists Recruitment Board (ASRB) headed by eminent scientists has the sole responsibility to recruit scientists of all categories. Eligibility test is conducted throughout the country to first hand screening of future scientists of ICAR regionally.

M**i**ssion/Mandate of ASRB is recruitment to the posts in the Agricultural Research Services (ARS) of ICAR and to such other posts and services specified by the President of ICAR. ICAR from time to time through competitive examinations /direct recruitment by selection etc. has the principal mandate to make available the best human resources to man the various positions in ICAR in the country.

The selection procedure varies according to level of posts. At entry level, scientists are selected for Agricultural Research Service (ARS) through all-India written test followed by an interview. The candidates securing/ scoring aggregate high percentage are offered both ARS and National Eligibility Test (NET), while other are given the NET certificate and are eligible for appearing for the post of Assistant Professor/ Lecturer in SAUs and General Universities and Agricultural Colleges. The RMPs at the headquarters and the institutes are filled by advertisement and selection for the tenure of five years. Under the new service rules, every scientist may have to work for sometime during his/ her carrier to solve problems of neglected and tribal areas.

Selection of Faculty Members at entry level (i.e. Assistant Professor/Lecturer) and for higher posts in SAUs, faculties/ colleges of agriculture and allied field in general universities are done through open interview. Selection for faculty posts in agricultural

institutes /colleges affiliated to the general universities are also done though open interview.

Incentives for the Scientists

A. **Career Advancement Scheme (Post up-gradation):** In addition to the conventional promotion system, ICAR provides post up-gradation of the scientists based on merit. The system enables the scientist to get promotion if vacant position is not available through rigorous evaluation process.

B. **Housing, Medical Facilities, Children Education, Enhanced salary, IPR benefit**

C. Incentives for Small Family Norms

D. Immediate Relief to the Family of an Employee who Dies while in a Service

E. Scientists Emeritus: Every year ICAR invites senior scientists to apply for the scheme. The position is available for three years term for conducting specific job.

F. National professor Scheme

G. Sabbatical Leave

H. Technology Marketing

I. Awards

Institutional Innovation

National Agricultural Innovation Project (NAIP) in 2006 has been initiated to tackle challenging emerging issues facing Indian agriculture and to consolidate the gains under the completed NATP. The overall objective of NAIP is to facilitate the accelerated and sustainable transformation of Indian agriculture in support of poverty alleviation and income generation through collaborative development and application of agricultural innovations by the public organizations in partnership with farmers groups, the private sector and other stakeholders.

ICAR has created a new fund called National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA). The fund aims to build capacity for basic and strategic research of national and long-term importance to break yield and quality barriers and make India a global leader in research for development, through the partnership of all research organizations who can contribute towards this objective. Scientists from all research institutions, universities and private sector with proven research capacity and located in India are eligible to participate.

NARS IN NEPAL

Before the NARC was established, research and extension was under MoAC and that was headed by Director General (DG). To foster research with adequate autonomy NARC was established to carry out agricultural research independently.

Under National Agricultural Research System there are various public and private institutions and organizations established in different years under different acts and ordinance. Among them, Nepal Agricultural Research Council (NARC), an apex body for agricultural research, was established in 1991 as an autonomous organization under "Nepal Agricultural Research Council Act - 1991". NARC (Figure 3) is an

autonomous body having two tiers, the Council and the Executive Board. Within NARC, there are two institutes (NARI and NASRI), 13 disciplinary divisions, 3 cross cutting divisions, 3 cross cutting units, 14 national commodity research programme, 4 regional agricultural research stations and 13 research stations along with 50 agro-ecological out-reach sites. There are 16 Members in the Council headed by Minister, Ministry of Agriculture and Cooperatives (MoAC), represented by secretaries, scientists, university, entrepreneur etc. Executive Board, headed by Executive Director (ED), NARC, represented by Ministries, Departments of agriculture and livestock.

Centrally located Out-reach Research Division (ORD) of NARC is responsible to plan, manage, coordinate and strengthen out-reach program.

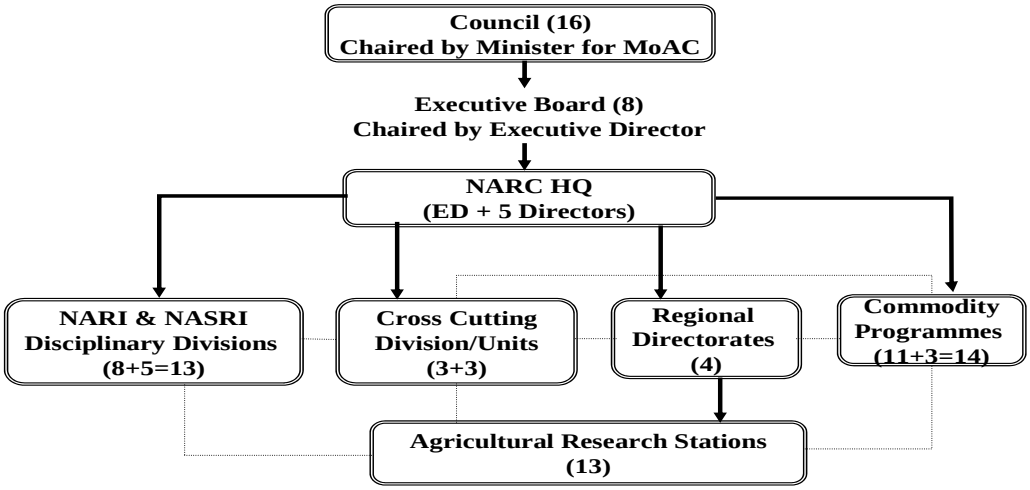

Figure 5. Organogram of Nepal Agricultural Research Council

The Council of NARC is the main governing body for decision making whereas Executive Board executes the decision of the Council. The Executive Director act as an administration chief of NARC and implements the decisions made by Executive Board and govern to run the approved programme. Directors of NARC assist the executive director in implementing the programme.

At ministry level, the Secretary of the Ministry of Agriculture and Co-operative coordinates with the help of Executive Director of NARC. In Executive Board, the Chairman and the Executive Director of NARC makes the co-ordination with different ministries, Government Departments and National Planning Commission as the Joint Secretaries of the ministries and Director General of DoA and DoLS are the members of Executive Board. Heads of most of the NARS institutes are the member of the Council of NARC. Similarly, the Executive Director of NARC is one of the members in Executive Board or Executive Committee or Governing Board of different NARS institutes. At national level, there is National Agricultural Technical Working Group chaired by the Executive Director of NARC.

Institutes outside NARS

The Nepal Academy of Science and Technology (NAST) under the Ministry of Science and Technology is an independent body to promote science and technology in the country. National Agriculture Research and Development Fund (NARDF), established in 2001, is an autonomous organization to promote the participation of government, private, non-government and educational institutes and civil society for agricultural research and development for over all development of agricultural sector in the country.

Two educational institutes are directly involved in agricultural research and development activities. Institute of Agriculture and Animal Science (IAAS) under Tribhuvan University (TU) promote interdisciplinary research. Similarly, Himalayan College of Agricultural Sciences and Technology (HICAST), a private institute, provide academic degree in the field of agriculture and livestock.

There are a number of non-government organizations (NGOs) involved in the agricultural research and development activities.

Research-Extension-Education Linkage

Research - extension -farmers linkage needs to be improved significantly. To bridge the gaps the Government of Nepal has approved the guidelines for Agricultural Technical Working Group Meeting. According to the guidelines, the linkage and coordination mechanism is targeted for different hierarchy comprising from central levels to district levels where frequent interactions among the institutions are mandatory so that coordination mechanisms are tied up in the annual targets of all institutions.

Departments have their regional, district level and village level (Service centre) offices. NARC has outreach division to coordinate with the Departments. All research stations in NARC have their own outreach units for testing and verifying NARC technologies at village level.

Human Resources Management and Development

NARC recruitment committee has all the authority to recruit and promote staffs. The committee is composed of five members chaired by the Executive Director. Scientists are recruited at two levels namely Scientist Level 1 (S1) and Scientist Level 3 (S3) through open competition.

Seniority is the main criteria for promotion within the NARC. The evaluation of the individual scientists and researchers are based on the work performance and is done once in a year after the end of fiscal year through personal performance appraisal.

In the past, donor agencies such as the World Bank, USAID and the CGIAR centres sponsored higher trainings (M.Sc. and Ph.D.). IRRI is also supporting higher study. There is the provision of getting short or long term higher training by any scientist within NARC and by an agriculturist in government organizations through their own effort. Scientists can get five years of study leave in their whole service period only after the completion of three years permanent job within the same organization.

Two institutions under NARC (NARI & NASRI) are in process of transforming into national Academy of Agricultural Sciences to act as deemed university.

As of 2011, NARC has more than 400 vacancies for scientists and technical officers. (Micheal Rahija, Hari K. Shreshtha, Gert-Jan Stads and Ram Bahadur Bhujel, Country note, Agricultural Science and Technology Indicators, IFPRI & NARC, 2011).

Investment Trend

There are three modes of financial resources available to NARC namely, grants from Government, grants from national and international donor agencies and fund obtained from sell proceeds, consultancy services and others. Government allocates a lump sum amount of budget for NARC through the Ministry of Agricultural and Co-operatives. The operational, administrative and capital costs are allocated according to the approved project proposal. The Council of NARC approves the allocated budget under different expenditure headings. It has right to guide and reallocate the budget, if any.

The expenditure in agricultural research and development has increased during 1995 to 2000 mainly due to the project support from World Bank. In the past, USAID was the principal supporter of agricultural research for several decades. The various sub-sectors within agriculture have received differential emphasis in government resource allocation over time and their performance varied. The absolute amounts of budget to different sub-sector shown an increasing trend over time, but there are wide fluctuation from year to year. In the recent years, the annual budget for NARC has been increasing year by year. But the trend shows that its share in the National budget and MoAC budget is decreasing year by year since 2003/2004 (Figure 4). In 2009, Nepal invested 520 million Nepalese rupees in agricultural R & D.

In 2009, Nepal invested 520 million Nepalese rupees or 23 million purchasing power parity (PPP) dollars in agricultural R & D (both in constant 2005 prices) or just 0.24 percent of its AgGDP. This includes NARC, other government agencies, NGOs, and university. (Micheal Rahija, Hari K. Shreshtha, Gert-Jan Stads and Ram Bahadur Bhujel, Country note, Agricultural Science and Technology Indicators, IFPRI & NARC, 2011).

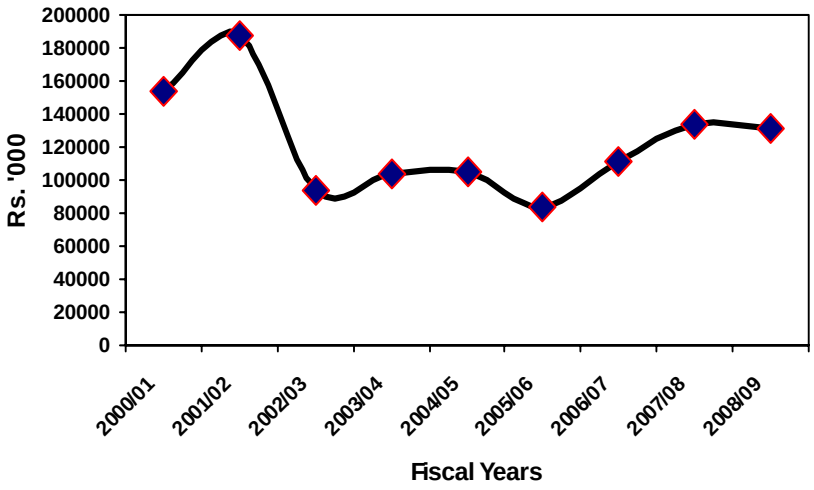

Figure 6. Trend of allocation of operational budget in NARC

Institutional Innovation

The National Agricultural Research and Development Fund [NARDF] was established in 2001.The Fund is comprised of money received from the Government's allocations and other sources approved by the Ministry of Finance.

NARDF is governed by a seven person Fund Management Committee [FMC] chaired by the Secretary of the Ministry of Agriculture and Co-operatives. It is administered and operated by the NARDF Secretariat. Awards are in the form of grants to successful organisations or collaborative partnerships. The Fund targets government, non-government, educational, private sector, civil society, co-operative and Community Based organizations (CBO).

Future Intervention for Enhancing System Efficiency

NARC and other institutions are autonomous and each institution decides their own priorities and mandates. Due to this, coordination between different government (GO), Non-governmental organizations (NGO), and INGO suffers, consequently the implementation of different projects are affected. The other constraints faced by the NARS are mentioned below.

1. Fund for research:

The research organizations are not getting sufficient fund from the government to work efficiently. Research operational fund is also very little to address many important research issues. Besides, there is problem in getting donor fund due to lengthy process involved in getting the needed approval by three Ministries such as the Ministry of Agriculture and Cooperative (MoAC), Ministry of Finance (MoF) and National Planning Commission (NPC)

2. Decentralized Administration

Though Council is the supreme body but many important decision are delayed due to long gap between meetings for decision making. Executive board of NARC is another body from which many importants decision are undertaken. The members are from different organizations like MoF, MoAC, NPC, DoA , DLS and others. It is very difficult to get time from them for this meeting as they are very busy with their own duties and responsibilities.

Research farm/stations/programmes have to look towards NARC headquarters for all administrative decision

3. Carrier Advancement or Incentatives to the employees

- In NARC, the salary of the scientists and other staffs are very low as compared to SAARC countries. Even though there are some provisions for different allowance like fuel, house rent, children education etc in the bylaws, but they are not in the execution.

-Though there are rules and regulations for the promotion of scientists and other employees, but takes lot of time (more than a decade) to get their promotion.

4. Evaluation of Research System

- Although review of research programmes is done at central and regional level at MoAC, field level monitoring system is done in isolation. Evaluation of different activities is inadequate.

NARS IN PAKISTAN

Agricultural research in Pakistan is performed by a large number of federal/central institutes, provincial agricultural research institutes (ARIs), Agricultural universities at provinces and private sectors/companies. The federal research establishments are involved in basic and strategic research, provincial research institutes are concentrating on applied research, agricultural universities are engaged in basic research and private sectors/companies (agro-industry) are carrying out the fertilizer, pesticides, seed, machinery and adaptive research. The types of agencies involved in agricultural research are shown in Table 7.

About sixteen institutions are established at federal levels which are overseeing their respective part of National Agricultural Research System. At the provincial government level, agriculture is divided into five fields: crops, livestock and fisheries, food, natural resources (soil water, forestry, and wildlife), and education. Each of the four provinces has a main agricultural research institute (ARIs) under the administrative control of the Department of Agriculture.

Table 7. NARS institutes with their administrative status and headquarters (Pakistan)

Institutes	Status and Ministry	Headquarters
1st Stream	**The PARC System**	
Pakistan Agricultural Research Council (PARC)	Autonomous, Federal Ministry of Food Security and Research (MINFSR)	Islamabad
National Agricultural Research Centre (NARC)- Largest research institute under PARC, organized with 13 Institutes	Establishment of PARC.	Islamabad
Southern Agricultural Research Centre (SARC)		Karachi, Sindh
Arid Zone Research Centre (AZRC)		Quetta, Balochistan. Umerkot, Sindh. Bhawalpur, Punjab. D.I.Khan, KPK
Mountain Agricultural Research Centre (MARC)		Gilgit, Juglot, Gilgit-Baltistan, NAs
Technology Transfer Institutes (TTIs)		Faisalabad, AJK, Tandojam, Quetta, Peshawar, Gilgit
Small Ruminants Research Institute (SRRI)		Shoran, Balochistan
Shaheed Benazir Bhuttoabad Research		Nawabshah,

Stations		Sindh
Coastal Agricultural Research Institute (CARI)		Lasbala, Balochistan
Horticultural Research Institute (HRI)		Khuzdar, Balochistan
National Sugarcane Research Institute		Thatta, Sindh
Livestock Research Institute (LRI),		Turbat, Balochistan
National Tea Research Institute		Shinkiari, Mansehra, KPK
2nd Stream Other Scientific Organizations/Councils/Centres of Excellence		
Pakistan Central Cotton Committee (PCCC)	MINTI	Karachi
Federal Seed Certification and Registration Department (PSCRD)	MINFSR	Islamabad
Agricultural Policy Institute (API)	MINFSR	Islamabad
Pakistan Atomic Energy Commission (PAEC)	Autonomous body under President of Pakistan	Islamabad,
Nuclear Institute for Agriculture and Biology (NIAB)		Faisalabad
National Institute for Biotechnology and Genetic Engineering (NIBGE)		Faisalabad
Nuclear Institute for Food and Agriculture (NIFA)		Peshawar
Nuclear Institute of Agriculture (NIA),		Tandojam, Sindh
Pakistan Science Foundation (PSF)	Autonomous under Ministry of Science & Technology	Islamabad
Pakistan National Accreditation Council (PNAC)	Autonomous under Ministry of Science & Technology	Islamabad
Pakistan Council of Scientific and Industrial Research (PCSIR)	Autonomous under Ministry of Science & Technology	Islamabad, Lahore, Karachi, Peshawar, Quetta
Pakistan Council for Research in Water Resources (PCRWR)	Autonomous under Ministry of Science & Technology	Islamabad
Pakistan Institute of Development Economics (PIDE)	Autonomous body under Ministry of Planning	Islamabad
Pakistan Forest Institute (PFI)	Ministry of Environment	Peshawar
Center for Applied Molecular Biology	Autonomous under	Lahore

(CAMB)	Ministry of Science & Technology	
Center of Excellence in Water Resources Engineering (CEWRE)	Autonomous body under Ministry of Education	Lahore
International Water & Salinity Research Institute (IWSRI)	Autonomous body under Ministry of Water and Power	Lahore
Soil Survey of Pakistan (SSP)	Ministry of Defense	Rawalpindi
Higher Education Commission (HEC)	Autonomous body under Ministry of Education	Islamabad
3rd Stream	**The Provincial Agricultural Research Systems**	
Ayub Agricultural Research Institute (AARI), Punjab	Dept. of Agriculture, Government of Punjab	Faisalabad
Agricultural Research Institute (ARI) Sindh	Dept. of Agriculture, Government of Sindh	Tandojam, Sindh
Agricultural Research Institute (ARI) Balochistan	Dept. of Agriculture, Government of Balochistan	Sariab, Quetta, Balochistan
Agricultural Research Institute (ARI) KPK	Dept. of Agriculture, Government of KPK	Tarnab, Peshawar, KPK
4th Stream	**The Provincial Agricultural Universities Systems**	
The University of Agriculture	Autonomous, HEC, MoE	Faisalabad
Pir Mahir Ali Shah Arid Agricultural University	Autonomous, HEC, MoE	Rawalpindi
The Sindh Agricultural University	Autonomous, HEC, MoE	Tandojam
The KPK Agricultural University	Autonomous, HEC, MoE	Peshawar
Veterinary University	Autonomous, HEC, MoE	Lahore, Punjab
Agricultural Colleges		Punjab, Sindh, KPK and AJK

PARC is the apex national organization working in collaboration with other federal and provincial institutions in the country. The governance structure of PARC is presented in Figure 7. Recently, PARC has been placed under Federal Ministry of Food Security and Research at the Federal government.

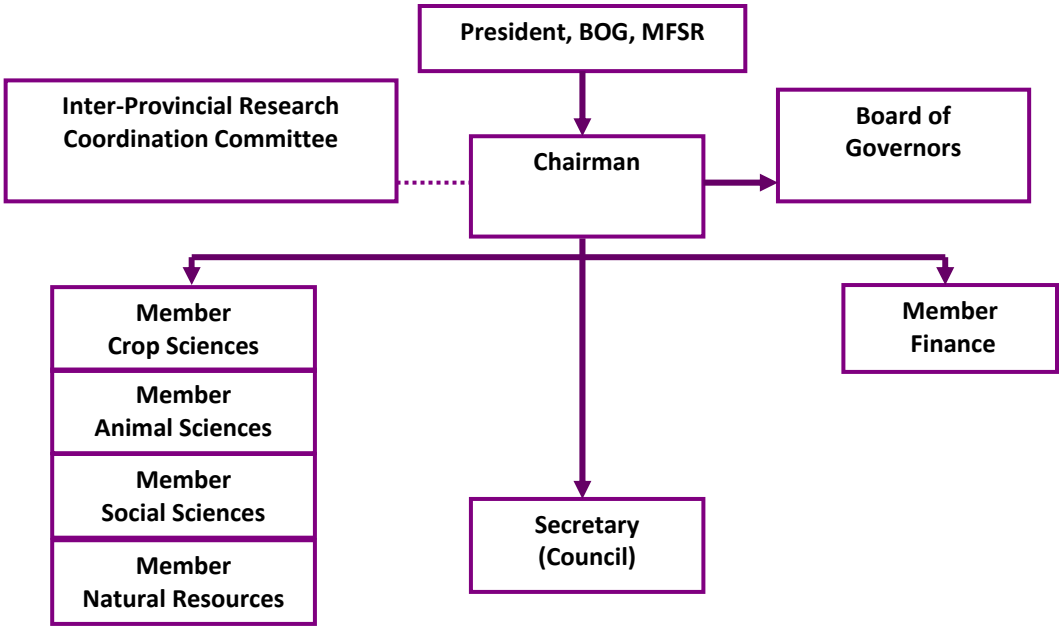

Figure 7. Governance structure of PARC

The overall decision-making body of PARC is its Board of Governors (BOG) empowered with administrative and financial matters. The Board is assisted in its operation by a number of Committees. The Federal Minister for Food Security and Research (MFSR) is the President of the Board. BOG constituted 25-Members Inter-Provincial Agricultural Research Coordination Committee (IPARCC), four Technical Expert Committees one each for Animal Sciences, Plant Sciences, Social Sciences and Natural Resources.

Seven research establishments 1 at NARC and 6 in other agro-ecological zone in the country within the PARC structure, each headed by a Director Generals. All D.Gs exercise all the power of the head of the centre for the purpose of various rules and regulation of PARC. The D-Gs and Directors exercise such power for their functioning as are delegated to them by the Chairman, PARC

National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad offers several services and marketable products. The educational programmes leading to MPhil and PhD degrees have also been incorporated in the institute's mandate for the development of human resources. .

National Agricultural Education Accreditation Council (NAEAC) was established in 2006 by Higher Education Commission (HEC) with the mandate to carry out a comprehensive programme of accreditation of agricultural degree programmes in private and public sector agriculture education institutions. The major function of the National Agricultural Education Accreditation Council is to organize and carry out a comprehensive programme of accreditation of agriculture programmes leading to

degrees/diplomas based on approved policies, procedures and criteria, and publish a list of ranking of degree programmes.

The Planning Commission of Government constitutes task force and working groups before the start of five year plan to recommend areas of agricultural research in Pakistan. These task force/working groups are further sub-divided into sub-groups in order to identify and proposed topical and future agricultural research thrust based on national and international experiences. Then this becomes the basis for fixing research priority at PARC's technical division level, provincial research institute level and provincial agricultural university level. The Research Advisory Committee, Management Committee, and Technical Working Group discusses the issues to be addressed and accordingly the research programmes are pursued during the financial year.

Human Resources Development and Management

The latest agricultural research manpower survey indicated a total of 4,725 scientists within the Pakistan agricultural research system made up of 455 Ph.Ds, and 3,006 MScs. The proportion of Ph.Ds to total scientific staff in Pakistan is about 10 percent.

Council has recently obtained post-graduate degree awarding status by establishing National University of Agricultural Sciences (NUAS) which will teach cutting-edge knowledge to students at M.Phil and Ph.D level.

In PARC performance of each individual scientist is evaluated through filling up Performance Evaluation Report at the end of each year. Both federal and provincial ARIs utilize their Annual Confidential Reports (ACRs) for evaluating the individual scientist working either in the federal or provincial research agencies.

The normal promotion to higher positions and assignments to specific jobs help in bringing out the inherent talent and quality for leadership in a scientist. The recruitment of any scientist in a research organization is based on his/her performance, experience and qualification. Institutes send their staff demand to the establishment office and accordingly the establishment office advertises the post. Upon receiving the applications, the establishment office sends those applications to the appointment committee for recruitment.

PARC has paid a special attention on the development of scientific man power for agricultural research. This includes recruitment of outstanding young graduates through rigorous test and interview procedure and their grooming into professional by providing them special training, both in country and abroad. PARC has developed a talent Pool scheme in which sufficient posts in different grades (up to SPECIAL PAY SCALE, SPS 11) have been provided so that the senior scientists with sufficient research achievements can be promoted to higher grades. To coordinate, organize and execute this programme, a Research Graduate School is established for postgraduate teaching. Besides, the laboratory facilities and outreach areas of NARC and allied institutions of PARC have been declared as adjunct campus of the University. PARC has also developed a programme for different categories of training viz: i) short courses for improving productivity of major crops, ii) academic training courses in Pakistan institutes, iii) short term training courses and academic training leading to M.Sc and Ph.D in NARC.

An attractive salary package which includes Research Allowance is offered to the scientific staffs. A Scientific Officer of public research institute obtains much higher salary and benefit than that of Lecturer of a public university. Ph.D scholars obtain additional allowance of Rs.7,500/- per month. In addition to that retirement benefits are available for the scientific staffs.

The incentive structure includes basic salary, house rent, medical allowances and other benefits. The basic salary scale of Govt. bodies and autonomous bodies differ. Basic pay scale and medical allowances of autonomous NARS institutes are higher than the government bodies (entry level scientists. of autonomous agency is Rs.12970-27770 per month, while government body is Rs.9850-24650 per month).There is provision for re-imbursement of cost of medicine for out door treatment/consultation made with the approved AMAS/Specialists and lab tests done from approved Labs/Govt. hospitals Dispensaries etc.

Investment Trend

The expenditure of PARC has been rebounded during 1999–2003, mainly due to the US-financed Agricultural Linkage Program (ALP). ALP was launched in 2000 its main objective is to promote and support R&D activities in accordance with Pakistan's long-term development goals and scientific cooperation with the United States in the agricultural sector.The spending of NARC has been increased more than double during 1991–2003. The primary cause for this increase was a rise in salary expenditures following the hiring of new staff when the ban on recruitment freeze ended. Since 2003, government allocations to federal agricultural research agencies increased slightly, with a sharp increase during the 2006/07 budget period.

Total agricultural R&D spending at provincial government agencies in Balochistan and KPK declined slightly during 1991–2003, at rates of 0.4 and 1.4 percent per year, respectively, while spending remained fairly stable in the Punjab and increased by 2.3 percent per year in Sindh throughout the same period. Agricultural R&D spending by the higher education sector grew at an average rate of 0.5 percent per year during 1991–2003.

Endowment funds from the sale of commodities under the Food for Progress programme are used to support agricultural research and development activities in accordance with Pakistan's long-term development goals and to promote scientific cooperation between Pakistan and U.S. agricultural scientists. According to the Department of Agriculture, endowments have been established with the Pakistan Agriculture Research Council (US $23 million), the Pakistan Science foundation (US $15 million), the University of Agriculture, Faisalabad (US $12 million), the Ministry of Agriculture/Economic Wing (US $3 million), the Peshawar Agriculture University (US $1 million), and the Peshawar Forestry Institute (US $1 million). The interest generated on these endowments, which is used for programme implementation is reported to be about US $5 million per year.

Review and Monitoring

The research programmes are reviewed mostly on yearly basis in the federal research establishment where these programmes are reviewed bi-annually (during Kharif and Rabi season) in the provincial ARIs. The review of research programmes is a regular

event with research planning. At the time of planning process, firstly, previous research programmes are reviewed and then new research programmes submitted for consideration. Institutional review is performed mostly on yearly basis.

The technical divisions of PARC monitor the progress of Agricultural Linkage Programmes (ALP) projects. The project in-charge submits the progress of the projects to the directorate of planning/ALP secretariat on six monthly and annual bases. The six monthly progress/technical reports are provided within 15 days after the project is over.

Research-Extension-Education Linkage

Trainings/refresher courses are organized for the extension staff to enhance their knowledge on the latest technologies. The Punjab Province is implementing a new approach of farmer's group participation in four districts which will be extended to the whole province in phases. This may be adopted by other provinces. The new system involves a "Group Participatory Approach" aiming at integrated crop management through Training of Trainers (TOT), Training of Facilitators (TOF) and Farmers' Field Schools (FFS) where the farmers will be trained.

Institutional Innovation

Higher education plays the role of leadership in the society. The functions of the university are to develop the people physically, mentally and spiritually.

Agricultural Linkage Programme (ALP): The Government of Pakistan allowed PARC to establish an Agricultural Research Endowment Fund (AREF) with funds received under ALP. The income from interest thus generated shall be used for ALP activities/projects in line with the Pakistan's long-term research/development goals for the agriculture sector. The goals focus on food security, poverty alleviation and promoting broad based equitable and sustainable agriculture. A management system establishes the ALP Fund's Programme and Priorities and its financial and managerial policies. Board of Directors shall be the governing body of ALP Fund and shall be responsible for the Fund's programmes and its financial and managerial policies.

Council has recently obtained post-graduate degree awarding status by establishing National University of Agricultural Sciences (NUAS) which will teach cutting-edge knowledge to students at M.Phil and Ph.D. level.

Pakistan Science Foundation (PSF): This agency is responsible for comprehensive scientific and technological information dissemination, promotion of research in the universities and other institutions/centers, establishment of science centers, exchange of visits of scientists and technologists, etc.

Future Intervention for Enhancing System Efficiency

Effective linkage between actors in agricultural research and development is constrained by the governance of the public administration system, as well as by the lack of operational budgets. Centralized decision making and lack of operational flexibility also limits research operation. (Source: Missing linkages in Asian agricultural innovation and the role of public research organizations, Govert Gijsbers, Innovation Policy Group).

The major problems/issues identified in the present Agricultural Research System are: (i) Lack of Effective Autonomy (ii) Inadequate Funding (iii) Weak

Coordination (between federal and provincial, federal/federal & provincial/provincial institutions) (iv) Lack of Incentive Framework (v) Poor Transfer of Technology to Farmers (vi) Overlapping Role of PARC and its Centers (vii) Over-staffing and lack of Professionalism in Admin. & Finance (vii) Lack of flexibility in use of operating funds for research activities which badly affect research output (viii) Over-bureaucratization of Admin and Financial Procedures.

The administration has been recently (few months back) decentralized and it would take some time to see the outcome.

Career advancement/incentives structure of the scientific professional

- Agricultural research system in Pakistan offers limited career growth opportunities and little financial incentives even to the highly qualified scientists.
- The scientists have inadequate links with the international and national research and educational institutions, extension agents, and the farmers.
- There is rapidly aging profile of agricultural scientists and a continuous brain drain from the system.

Review/Evaluation of research programmes

- Research priorities in NARS are strongly persuaded by crisis management rather than carefully considered long term criteria.
- Most of the budget allocation is meant for research on crops especially major crops whereas small amounts are allocated to research on other fields like livestock, horticultural crops, natural resource management, and fisheries etc.

Reform Agenda for Improving the NARS is covered under the heads of (i) Organization and Management (ii) Administration and Finance (iii) Research Coordination (iv) Human Resource Development. The brief description is given as under:

ORGANIZATION AND MANAGEMENT: (i)Improving governance in operational and financial management (ii) Emphasizing basic & strategic research (iii) Catalyzing scientific & technological advances (iv) Nurturing ‘science ethics’ and rewarding innovativeness (v) Promoting merit-based recruitment/career progression system (vi) Acting as a resource centre of knowledge and policy on Agri. Research and Development in the country.

ADMINISTRATION AND FINANCE: (i) Revision of PARC financial and service rules and regulations to enable PARC exercise autonomy (ii) Right sizing to minimize redundancies and overstaffing (iii) Introducing performance based management system (iv) Simplification of procedures (procurement, budgeting, accounting, auditing and administration) (v) Exercising financial prudence and due diligence in all operations (vi) Rationalization and management of satellite offices (vii) Modernization of admin and financial systems and procedures (viii) Changing the role of Administration and Finance Divisions from ‘Control and Command’ to ‘Support Services’.

RESEARCH COORDINATION: (i) Strengthening coordination with federal & provincial agencies (research, education and extension) (ii) Adequate funding of high priority coordinated programmes in strategic/applied research (iii) Increased coordination with HEC/Universities and (iv) Exchange of PARC/NARS scientists to enhance capacity building. Under international programme the reform agenda is as under: (i) Enhancing

strategic partnership with IARC/CG system (ii) Attendance at selected international seminars, conferences, training programmes and (iii) Improving mechanism of MOU funded projects

HUMAN RESOURCE DEVELOPMENT: (i) Rationalization of technical and support staff vis-à-vis workload, skill mix (ii) Career progression, staff development and training (iii) Performance evaluation system and accountability (iv) Transparency in decision making – recruitment and promotions and (v) Enhanced communication at all levels.

IMPLEMENTATION OF REFORMS AGENDA: (i) Strategic Planning and Research Priorities (ii) Financial and Administrative Regulations (iii) Procurement Procedures (iv) Human Resource Management (v) Grievance and Conciliation Procedures (vi) Review of PSDP Projects to Accelerate Progress and Funds Utilization and (vii) Actions on major issues concerning finance, administration and house keeping of PARC/NARC campuses, security and satellite offices (on-going exercise).

NARS OF SRI LANKA

Unlike in any other countries in South Asia, Sri Lanka has both research and extension under one command. The Department of Agriculture (DOA) functions under the Ministry of Agriculture. The DOA is one of the largest government departments with a large number of agricultural scientists and a network of institutions covering different agro ecological regions island-wide. Research is also being undertaken by the institutes under MA. DOA is also responsible for seed and planting material production and regulatory services. DOA has many research stations spreading over all the important agro-ecological zones island-wide under the purview of commodity based institutes. Department of Export Agriculture has 6 centers mainly covering the growing regions of the export agricultural crops.

Council for Agriculture Research Policy (CARP) was formed in 1987 by the parliamentary act for coordination and promotion of agriculture research. The council consists of 14 members who are appointed by the Minister of Agriculture (MA) The Secretary of the Ministry of Agriculture is the chairman of the Council. Executive Director is the chief executive officers of the council. He acts as the secretary to the Council. National Agricultural Research System at present includes 14 research organizations (Table 8) scattered island-wide that are closely linked with the CARP.

CARP has institutionalized Competitive Contract Research Grant Programme (CCGGP) to support research to government, education al Institutes and private sector organizations. Government allocates funds to CARP which enables to carry out problem oriented innovative research and encourages partnership. Despite a rise in CCRGP funds but it funds still represent a very small percentage of total agricultural R&D spending.

Table 8. Major Agencies involved in Agricultural Research in Sri Lanka

Agency	Ministry	HQ
Council for Agricultural Research Policy – CARP (autonomous)	MA	Colombo
Department of Agriculture – DOA	MA	Peradeniya
Rice Research and Development Institute-1 center		Batalagoda
Field Crops Research and Development Institute,-3 centers		Mahaillupallama
Horticultural Crops Research and Development Institute-3 centers		Gannoruwa
Department of Export Agriculture – DEA- 6 centers	MA	Peradeniya
Institute of Post Harvest Technology –IPHT (autonomous body)	MA	Anuradhapura
Hector Kobbakaduwa Research and Training Institute -HARTI (autonomous)	MA	Colombo
Veterinary Research Institute, VRI, Department of Animal Production and Health	MLD	Peradeniya
Forest Research Centre, Department of Forest Conservation	MENR	Kurunegala
Rubber Research Institute – RRI	MPI	Agalawatta
Coconut Research Institute – CRI (semi-autonomous)	MPI	Lunuwila
Tea Research Institute – TRI (autonomous under Tea Research Board	MPI	Talawakele
Sugarcane Research Institute – SRI (statutory body)	MSDC	Udawalawa
National Aquatic Resource Agency -NARA statutory body, governs by a board	MFOR	Colombo
MA: Ministry of Agriculture; MLD: Ministry of Livestock Development; MPI: Ministry of Plantation Industries; MFOR: Ministry of Fisheries & Ocean Resource; MSDC: Ministry of Supplementary Crops Development; MMEC: Ministry of Minor Export Crops MENR: Ministry of Environment and Natural resources; HQ: Headquarter		

Each research organization in NARS acts independently in deciding research programmes and their implementation with the concurrent understanding of its line ministry. There is no specific institution involved in directing or identifying the research needs for different organizations. Each research institute identifies their research priorities and all organization acts independently in identifying their resource needs (both physical and human) and allocation. Council does not play a major role in decision

making in any of the NARS organizations but formulate the National Agricultural Research Policies and Strategies with the concurrence of the organizations. The chief executive officers of NARS organizations represent their organizations at the council. Council helps to train the scientists of NARS abroad by providing necessary financial resources and finding necessary placement for the eligible candidates. In addition, council acts as an agency of providing necessary funds for NARS scientists through contract research programme.

Institutes outside NARS

There have been universities and postgraduate institutes as partners of the national agricultural research system but they are not included in the NARS at present. This may be because unlike in some other countries, universities in Sri Lanka do not directly engage in applied or strategic research but generally involve in basic research activities and upliftment of the standards of higher education.

Research-Extension Linkages

Sri Lanka has a very good research – extension linkage as both the organization are under the administrative control of the Department of Agriculture, Provincial Regional Technical Working Group (RIWG/RTWG) meetings are held at the provincial/regional level biannually with the participation of extensionists as well as researchers to plan and formulate the agriculture programme for each province. Researchable problems of farmers identified at these meetings are later utilized in research planning. In addition extension officers have free access to the researchers in the DOA and extension staff assist the researchers in performing the adaptability testing process of the newly identified technologies. Also, the Department of Export Agriculture has its own extension personnel to disseminate technology and get the feedback. Most other commodity research organizations such as Tea Research Institute (TRI), Rubber Research Institute (RRI), have established their own extension facilities. Therefore, the NARS organizations in Sri Lanka have good research-extension linkage. Institute of Post Harvest Technology relies on the biannual research – extension meetings of the DOA to gather information and disseminate the knowledge. Sugarcane Research Institute do not have its own well established extension facilities. They depend on the extension workers attached to the sugar industry. National Aquatic Resource Agency also does not have a well-established extension net work but relies mostly on the stakeholders' responses and the output of the socio economic division of National Aquatic Resource Agency (NARA).

Human Resources Development and Management

NARS institutes of Sri Lanka have 118 Ph.Ds. The scientists are recruited, based on vacant positions, through competitive examinations followed by interviews. Salary structure of the scientists at the government departments is similar to that of the civil service or other island-wide parallel services. However, the privileges and allowances given for different services are different. All the scientists in the government departments are eligible to receive a pension upon their retirement. Those who are working at the statutory boards do not receive a pension but their accumulated provident fund. Both employee and the employer contribute to the provident fund in which the contribution of the employer is greater. Age at retirement is not different among the organizations and it is 60 years at present.

Department of Agriculture has its own system of presenting awards to the young and the best scientists. The selection is done by an external board that represents academics from universities, senior officers of the DOA and a representative from the sponsoring private agencies. There is no prize or reward system at present in other research organizations.

Investment Trend

Government departments depend on funds from treasury for their operation, but the while research organization, working with the plantation crops, do not fully depend on the treasury. They receive their budget through the CESS funds obtained either from export or import. Some of the statutory bodies however depend on the treasury for funds. The export of tea is subject to a tea cess. This cess is 2.50 Rs. per kilogram. The coconut cess is 01 Rs. per kilogram of desiccated coconut exports. In contrast, the cess for sugar is charged on import instead of export. Total public spending as % of Agricultural output is 0.36.

Agricultural research is primarily financed by the government through a dual funding system. The majority of funds are directly provided to the agencies, while funds for strategic research are channeled via the Council for Agricultural Research Policy (CARP) through a competitive grant program. A few research agencies under the Ministry of Agriculture, Livestock, Lands, and Irrigation receive sizable shares of their budgets from public or private enterprises. The four research agencies under the Ministry of Plantation Industries focusing on export crops (tea, coconut, rubber, sugarcane) are mainly financed through a sales levy (cess), although coconut research is supplemented by considerable additional government support.

Review and Monitoring

Regional research centers of the DOA review the research programmes bi-annually and evaluate the progress of the scientists. Disciplinary working groups are consisted of the working group coordinators and senior scientists of the same discipline who annually review and evaluate the research progrmmes of the scientist. Research mangers and senior extension workers often participate at these meetings and automatically included into the review panel. Each scientist has to submit his/her quarterly physical progress to his/her head at the research centre. Progress and the problems of all the planned activities are reported back to the central progress monitoring and evaluation unit. Researchers submit a separate report for each performed research activity at the end of the year to their immediate research manger.

Future Intervention for Enhancing System Efficiency

Sri-lanka's agricultural research and development is small compared to that of other countries in south Asia. Even this small agricultural R & D effort is scattered over a large number of government ministries and agencies. CARP, established to coordinate and provide governance to this fragmented research system, is neither mandated to provide this governance role effectively, nor adequately equipped and staffed for effective coordination. The main research units in Sri Lanka are part of at least five different ministries and generally do not have the flexibility.

Research management position is preferred by the senior scientists which conversely affects the research strength of each sector. This is particularly true in the case of government departments.

NARS IN SAARC COUNTRIES: A COMPARATIVE ANALYSIS

1. NARS Organization

Countries	(NARS Legal status & Institutes involved)	Ministries
Bangladesh	BARC, autonomous body, coordinates NARS, consists of 8 Autonomous institutes & two government bodies.	Four Ministries: Min of Agr, Min of Fisheries & Livestock, , Min of Environment & Forest, Min of Commerce
Bhutan	CoRRB represents NARS with four RNR Research centres.	Ministry of Agriculture
India	ICAR, autonomous body, aids, promotes and coordinates research and education activities. Created under Society Act, comprising 44 Institutes, 5 Central institutes (Deemed to be university), 6 National Bureaux, 26 Project Directorates, 19 National Research Centers, and 79 All-India Co-ordinated Research Projects, 49 SAUs & 589 KVKs constitute present NARS.	One division (DARE) of the Ministry of Agriculture & Cooperation
Nepal	NARC, autonomous body, having two institutes (NARI & NASRI) constitute NARS	Ministry of Agriculture and Cooperatives, dealing both crop & livestock
Pakistan	PARC, autonomous body having 9 research establishments and National Agricultural Research Center (NARC) with 7 institutes. PARC mandated to undertake, aid, promote and coordinate agricultural research. Federal institutes and provincial bodies under department of agriculture & are active in research	Ministry of Food Security and Research (Formerly, Ministry of Food and Agriculture (MINFA), deals crop and livestock including food distribution.
Sri Lanka	Department of Agriculture (DOA) is mainly responsible for research & extension. DOA operates 3 institutes; MA operates three autonomous institutes including CARP. Three autonomous institutes under MPI. CARP, responsible for contract research funding, with limited role in decision making in research.	Ministry of Agriculture Ministry of Plantation Industries, Ministry of Livestock Development, Ministry of Fisheries & Ocean Resource, Ministry of Supplementary Crops Development.

2. Research Entities outside Formal NARS

Subject	Research Outside NARS
Bangladesh	University, BRAC (NGO), Bangladesh Council of Scientific & Industrial Research, Atomic Energy Commission, private entities
Bhutan	13 research centres under MOA, 5 in dept. of agri, 5 with dept livestock, 2 with dept of forestry, one non departmental
India	Indian Council of Scientific and Industrial Research, Bhabha Atomic Research Centre, Department of Science and Technology (DST), Department of Ocean Development, General Universities, Private entity,
Nepal	National Academy of S & T, University, National Agriculture Research & Development Fund, NGO,
Pakistan	Provincial research: Ayub Agricultural Research Institute (AARI), Agriculture Research Institute, Quetta, Agriculture Research Institute (ARI) Tarnab, Agriculture Research Institute (ARI), Sindh. Pakistan Central Cotton Committee, Nuclear Institute of Agriculture and Nuclear Institute of Agriculture under Pakistan Atomic Energy Commission, Pakistan Science Foundation, Pakistan National Accreditation Council, Agricultural Policy Institute (API), Pakistan Council of Scientific and Industrial Research, Pakistan Council for Research in Water Resources, Pakistan Institute of Development Economics, Pakistan Forest Institute, Center for Applied Molecular Biology, Center of Excellence in Water Resources Engineering, International Water & Salinity Research Institute, Soil Survey of Pakistan. University,
Sri Lanka	Five Government Depts. and seven autonomous statutory bodies under seven ministries. Dept of export crops has seven centres, Others are Tea Research Institute, National Aquatic Resource Agency, university.

3. NARS Governance

Countries	NARS governance	Policy making body
Bangladesh (BARC)	Non-uniform service structure, governed by individual acts and service rules of autonomous institutes. ARIs as government departments are operated by govt rule.	BARC operates with Governing body (highest) & Executive Council. Also, being public body, government rule also applies.
Bhutan (CoRRB)	Being organized	Council headed by Agriculture Minister as president.
India (ICAR)	ICAR is the supreme body. All institutes/centres/entities are operated by one rule. At Institute level, Director has full control over its activities including manpower, abiding of rules of ICAR.	General body (highest) & governing body

Nepal (NARC)	The Council make policy and the executive board implements policy	Council & Executive Board
Pakistan (PARC)	All research entities (establishments & NARC) under PARC are governed by one rule. Provincial research bodies are governed by government rule.	Board of Governors.
Sri Lanka	Mostly government departments. Autonomous bodies like CARP are governed by its service rule.	CARP has a 14 member body, Headed by the secretary MA.

4. Composition of highest-Policy making body of Council

Countries	Number of Members	Composition
Bangladesh (BARC)	26 (Governing body)	Concerned Ministers (3), Secretaries (5), MPs (2), VC (2), DGs of extension depts.(3), Farmers etc. Minister for Agriculture chairs.
Bhutan (CoRRB)	10 permanent members and 10 associate members (Council)	Minister, Secretary, Directors including CoRRB, and officials in the MoA.
India (ICAR)	142 (General Body)	State Ag Ministers, Secretaries, Heads of scientific organizations, MPs, Farmers etc. Institutions by rotation
Nepal (NARC)	16 (Council)	Ag Minister, Secretaries (5), Dean of University, Scientists (4), NGO, Ag Enterprise.
Pakistan (PARC)	15 (Board of Governors), BOG is empowered for Administrative and Financial matters.	FAM chairs, Concerned Ministers, Vice Chancellors, Pakistan Atomic Energy Commission, etc. BOG constituted also 25-Members Inter-Provincial Agriculture Research Coordination Committee (IPARCC) to coordinate.
Sri Lanka (CARP)	14 (Council)	Not fixed, appointed by the Minister of Agriculture. Council is chaired by the Secretary MA.

5. Major responsibility of Council

Countries	Mandate	Functions
Bangladesh (BARC)	Research	Review of research programmes. Policy formulation of appointment/recruitment of Scientist of institutes. Research priority setting, HRD and limited research support (including university).
Bhutan (CORRB)	Research & Extension	Clearing house of research within Ministry of Agriculture.
India (ICAR)	Research & Education	Manages research of its institutions, supporting network projects including SAUs. Institutes are responsible to the ICAR for technical, financial and other matters (DDG of ICAR). Research priority setting and approval of programmes. Allocate funds and reviews programmes/ projects to its network institutes. HRD-provides scholarships for higher studies, awards National Professor, Emeritus Scientist etc. Responsible for HR management (recruitment/ promotion of all categories of scientists and managers) through ASRB. Awarding scientists. Maintains international relation like CG centers.
Nepal (NARC)	Research	Manages agricultural research of its institutions (2). Also approves and allocates funding, HR management (recruitment/ promotion of all categories of scientists) of the institutes. Institutes are responsible to the NARC.
Pakistan (PARC)	Research	Manages agricultural research through its research establishments including centers. Institutes/ establishments involved with PARC are responsible to the PARC for technical, financial and other matters. Research priority setting and approval of programmes. Allocate funds and reviews programs/projects to its research establishments. HRD- provides scholarships for higher studies. Responsible for HR management (recruitment/ promotion of all categories of scientists and managers). Responsible for managing ALP including funding. Maintains international relation.
Sri Lanka (CARP)	Research	Research policy support and funding of contract research among the institutes.

6. Second layer of policy making body

Countries	Members of the 2nd layer policy making body
Bangladesh (BARC)	17 (Executive Council), Heads of NARS (10) & heads of division (7) of BARC, Executive Chairman of BARC chairs.
Bhutan (CoRRB)	CoRRB Secretariat
India (ICAR)	25 (Governing Body), Secretaries (5), VCs (3), farmers (3) Directors of nominated institutes (3), scientists (3), D-G, ICAR Chairs the GB.
Nepal (NARC)	8 (Executive Board), ED, 3 Joint Secretaries: Mo Agriculture, Mo Finance & Planning Comm, DGs of DoA & Livestock services, one Regional Research Stations and Programme Director
Pakistan (PARC)	Executive Committee (Chairman & Members of PARC)
Sri Lanka (CARP)	-

8. Resources Allocation & Mode of Resource Allocation

Countries	Resource allocation for research
Bangladesh (BARC)	Revenue Budget is prepared by the authorities of each ARI and is sent to the MoA. The MoA sends the budget to the Ministry of Finance. Lump sum amount is allocated for research to each of the NARS institutes including BARC over and above their revenue budget. Limited role of BARC (New act proposed BARC's role in resource allocation).
Bhutan (CoRRB)	The RNR research program of the MOA has been 4.9% of the RNR sector budget for the 10th five year plan until 2013.
India (ICAR) .	The ICAR receives public funds for a Plan period (five years) from the Government of India after approval from the Planning Commission, for managing agricultural research, and education in the country. Thereafter, Council allocates funds to its Institutions, and State Agricultural Universities. Fund requirements for five-year period both under Plan and Non-Plan heads are submitted by each Institute to the concerned Division of the Council. ICAR submits requirement to DARE. The DARE submits total fund requirements to the Government. The approved budget is allocated to the institutes/centers and SAUs through ICAR. Besides, institutions of ICAR also receive fund for research projects from international donor agencies through ICAR.

Nepal (NARC)	Government allocates a lump sum amount of budget to NARC through the Line Ministry. This budget is divided under staff cost, operational cost, administrative cost and capital cost by planning division within NARC. The Council of NARC approves the allocated budget for different expenditure headings. It has right to guide and reallocate the budget, if any.
Pakistan (PARC)	PARC receive public fund from Government of Pakistan through relevant Ministry (until recently through Ministry of Food and Agriculture (MINFA). Funds requirements for every year are proposed by each institute and centre and submitted to the council. The proposed funds are thoroughly discussed at the division level of the council and funds proposals of each institute/centre aggregated for demand at technical division level. After aggregation at PARC level it is submitted to Ministry. The Ministry submits total fund requirement to the Government for funding. The approved budget from the Government is allocated to PARC and PARC allocate to different centres/institutes accordingly.
Sri Lanka (CARP)	Through Ministry

8. Human Resources Profile of NARS

Countries	Total Scientists	Percent (%) Ph.D.
Bangladesh (BARC)	NARS, 1800 (sanctioned), 1441 existing, (46%), Other govt. 477 (15%). University 1126 (35). Private 60 (02%). Total 3104.	20 (NARS)
Bhutan (CoRRB)	55	10
India (ICAR)	4539 ICAR (20.7%), SAU 13633 (62%), other public 2749 (12.6%), Private 948 (4.3%)	78
Nepal (NARC)	406,	18
Pakistan (PARC)	PARC, 680 (13%). Other federal agency 653 (13%). Provincial ARIs 2810 (54%), Universities 1048 (20 %). Total 5191	32
Sri Lanka (CARP)	964, DOA accounts for nearly 50% of the total scientific personnel in the institutes	17

Percentage shows comparison of the total agricultural scientists

9. Scientist Recruitment/Promotion

Countries	Scientists recruitment
Bangladesh (BARC)	Four Scientists tier (SO, SSO, PSO & CSO). Criteria set by BARC. Individual Institutes recruit upto PSO. BARC responsible for recruitment & promotion for CSO of autonomous ARIs under MOA. Promotion is based on civil service rule, i.e., based on vacancy.
Bhutan (CoRRB)	Five Scientists tier Bhutan Civil Service Rule, based on vacancy.
India (ICAR)	Three Scientists tier (Scientist, Senior Scientist & Principal Scientists) The recruitment of scientist/ faculty member in ICAR institutions and SAUs takes place through an open system purely on merit on all-India basis. Agricultural Scientists Recruitment Board (ASRB), an independent body recruits scientists of ICAR. Merit and experience based promotion: Career Advancement Scheme (CAS) is one of the processes which help employees to move into next higher grade.
Nepal (NARC)	Eight (Level 1 to Level 8) NARC recruitment committee has all the authority to recruit and promote staffs. The committee is composed of five members chaired by the Executive Director. Scientists are recruited at two levels namely Scientist Level 1 (S1) and Scientist Level 3 (S3) through open competition.
Pakistan (PARC)	Four Scientists tier (SO, SSO, PSO & CSO) Centrally through appointment committee of PARC. Chairman of the council has the authority to recruit any person on the basis of requisite Qualification. The recruitment of any scientist in a research organization is based on its efficient performance, experience and qualification. PARC has developed a talent Pool scheme in which sufficient posts in different grades (up to grade 20) have been provided so that senior scientists with sufficient research achievement can look up to promotions to higher grades.
Sri Lanka (CARP)	Individual Institutes recruit through competitive test. In other research organizations, the recruitment process is similar to that of the government departments.

10. Incentive Structure

Countries	Retention of skill and retirement age
Bangladesh (BARC)	Similar to the government service. However scientists under autonomous Bodies are not entitled to some govt. facilities like rest and recreation allowances. The Incentive includes medical allowance, festival allowances and other benefits. Pension scheme in some institutions are introduced. Retirement age as per civil service rule of 59 years.
Bhutan (CoRRB)	Being developed
India (ICAR)	Incentives for Higher Qualification, Incentives for Small Family Norms, Immediate Relief to the Family of an Employee who Dies while in a Service, Group Insurance Scheme, Sabbatical, Retirement Benefits (service gratuity, retirement gratuity, and death gratuity), Leave Encashment. Scientists emeritus and National Professor system, ICAR National Professor', 19 ICAR awards of different categories for scientists institutionalized. Retirement age 62 years (Civil service 58).
Nepal (NARC)	NARC scientists and other staffs are receiving similar salary and incentives similar to government civil service. Sabbatical leave is given in NARC twice for a period of one year each in whole service period. The pension is provided after the retirement of the staffs within NARC. 25 Year's Services Medal is given who have served the institution for 25 years or more. Retirement age 60 years (Civil service 58).
Pakistan (PARC)	Basic pay scale and medical allowances of autonomous institutes are higher than the government bodies. Also Ph.D. allowances, Remote/hard area compensation allowances, Special Science & technology allowances have been institutionalized. Retirement Gratuity, Death Gratuity, Leave Encashment, Farewells grant, Medical facility, House Rent Allowance, Research Allowance. Retirement age, same as civil service, 60 years.
Sri Lanka (CARP)	Similar to all govt departments. Full pay study leave is granted to the researchers to pursue their studies leading to a higher degree. DOA awards to the young scientists and the best scientist. There is no prize or reward system exists with the other research organizations at present. Retirement age, civil service rule 60 yrs.

11. Priority Fixation of Research

Countries	Priority fixation of Research
Bangladesh (BARC)	BARC & Institute level through consultation with relevant stakeholders. Institutes takes annual programmes in consultation with stakeholders
Bhutan (CoRRB)	Government Five Year Plan strategy document for different research programs outlines issues and needs.
India (ICAR)	The research priority is decided through a rigorous process involving Working Groups, set up by the Planning Commission (highest planning body in India), and eight Regional Committees constituted by the ICAR. In addition, several other bodies like Research Advisory Committee (RAC), Management Committee (MC), Quinquennial Review Team (QRT), and Institute Research Council (IRC) help in prioritizing research agenda of the respective institutes. The Working Group, headed by a well known agriculturist, constitutes several sub-groups to identify and suggest topical and future research areas based on the national and international experiences. The ICAR also consults Regional Committees to suggest regional research priorities.
Nepal (NARC)	Priority for agriculture sector is fixed by National Planning Commission (NPC) at national level and also by MoAC. Consequently, priority in agriculture research at national level is dependent on National Planning Commission priority which is Top-down. On the other hand, bottom-up approach is also followed based in the feed back from extension department to the research institutes according to the stakeholders demand. Finally Executive Board and Council approve the priority brought through the bottom-up process.
Pakistan (PARC)	The Planning Commission of Government constitute task force and working groups before the start of five year plan to recommend areas of agricultural research. This becomes the basis for fixing research priority at PARC's technical division level, provincial research institute level and provincial agricultural university level. The Research Advisory Committee, Management Committee, Technical Working Group also discusses the issues to be addressed and accordingly research programme to be pursued during the financial year.
Sri Lanka (CARP)	There is no specific institution involved in directing or identifying the research needs for different organizations. Each research institute identifies their research priorities and all organization acts independently in identifying their resource needs (both physical and human) and allocation.

12. Research Planning Process

Countries	Research Planning process
Bangladesh (BARC)	Research planning process is an annual exercise. Research Review Meetings (RRM) where representatives from extension are invited. The Annual Research Programmes thus chalked out is presented at the Central Research Review Meeting (CRRM) held of the Headquarters.
Bhutan (CoRRB)	Annual research programme coordination meetings (ARPCM) monitor progress, coordinate and plan.
India (ICAR)	At the national level, ICAR is responsible for planning of agricultural research in India. The research schemes received from the research institutes, SAUs and private institutions across the country are technically examined first by the concerned Division at the ICAR headquarters and then put up for consideration before the scientific panels. After the schemes are examined for financial implications by the Standing Finance Committee, these are placed before the Governing Body of ICAR for final approval. In the ICAR system, once the broad research programmes are decided at the divisional level, the responsibility of formulation of individual research projects is left to the institutes
Nepal (NARC)	The planning division of NARC sends project proposal formats with the recommendations made from Regional Agriculture Technical Working Group (RATWG) and National Agriculture Technical Working Group (NATWG) meetings along with guidelines from MoAC, NARC and National Planning Commission to all the institutions of NARC.
Pakistan (PARC)	At the national level, PARC and Provincial level, ARIs and universities are responsible for the planning research. The research projects received from various establishment of PARC, provincial ARIs and provincial agricultural universities are first technically examined by the Technical Working Group (TWG) at institute level. Each institute has its own TWG which meets annually. After clearance from Research implementation and management committee (RIMC), these projects are put up for the consideration of Research Advisory Committee and then put up for the consideration of inter provincial research coordination committee (IPRCC). After the schemes are examined by IPRCC, they are finally placed before the BOG for approval.
Sri Lanka (CARP)	Each commodity institute of DOA build up its own programme for research giving due attention to the five year plan of the main department. The activities undertaken are decided at the regional level and sub regional level by the scientists attached to the research centers of each institute. Discussion on the research programme takes place at the regional level prior to

	the execution of the programme. All the scientists in a particular discipline discuss the regionally approved programmes at the national level called as disciplinary working group meeting. Disciplinary working group meetings held annually It is the working group, which decides the suitability of the project/activity submitted and each scientist who submitted and presented the programme executes the technically approved programmes of the respective disciplinary working group. The overall coordinator has to submit the final report to the Director General of Agriculture.

13. Technology Marketing

Countries	
Bangladesh (BARC)	The institutes do not have any programme of technology marketing. However institutes maintain MOU with private sector to transfer technology.
Bhutan (CoRRB)	Being developed
India (ICAR)	The Intellectual Property and Technology Management (IP&TM) Unit in ICAR has been established. Individual institutes of ICAR are empowered to enter into licensing contracts.
Nepal (NARC)	The technology so far developed in NARC has to be made available to the stakeholder under government rules. There is no license fee or royalty for delivering the approved agricultural technologies. However, some of the technologies on fishery, off-season vegetable production, and source seed production of cereals have been commercialized.
Pakistan (PARC)	A company, PARC Agrotech Trading Company (PATCO), has been registered, to patent and commercialize the technologies, services and produces developed. PARC established a Technology Transfer Institute (TTI). It regularly holds field days, exhibitions, fairs, disease and pest control and promotional campaigns for agro based industry. PARC signed more than 30 contracts with private sector firms for commercialization of new technology over the past 15 years.
Sri Lanka (CARP)	Through conventional system of technology transfer

14. Research Extension-Linkages

Countries	Research Extension-Linkages mechanism
Bangladesh (BARC)	ARIs organize seminars/training workshops etc to impart training and update knowledge of the extension officers on developed technologies and to get feedback.
Bhutan (CoRRB)	Annual sectoral research extension coordination workshops are held annually to review, monitor and plan research & extension program.
India (ICAR)	Institutionalized at the national, regional, state and zonal levels. At the national level, Department of Agriculture & Cooperation (DAC) interface joint meetings of the senior officers from the ICAR and DAC are organized twice a year to discuss critical agricultural R&D issues. At the regional level, 8 Regional Committees were constituted to review R&D status in the ICAR institutes and SAUs located in the region. These committees are represented by the senior research and extension officers, farmers' representatives and NGOs and meet once in two years. The meetings and seasonal workshop of Zonal Agricultural Research and Extension Advisory Committee facilitate close interaction among the researchers, extension workers and farmers.
Nepal (NARC)	Technical Working group meeting maintains coordination between research and development institutions. Linkage is targeted for different hierarchy comprising from central to district levels.
Pakistan (PARC)	IPARCC is the highest level coordination committee. The committee representing by the Universities at provinces, Provincial Agricultural Research Institutes, Provincial Livestock and Dairy Development Departments, Applied Economics Research Centre, Sindh, Chief Economists from Balochistan and Khaber Pakhtoonkhaw and Members of PARC.
Sri Lanka (CARP)	Research–extension group meetings are held at the provincial level biannually with the participation of extensionists as well as researchers to plan and formulate the agriculture programme for each province. Extension officer have free access to the researchers in the DOA and extension staff ably assists the researchers in performing the adaptability testing process of the newly identified technologies. Department of Export. Agriculture too has its own extension unit to disseminate technology and obtain the feedback

15. Review and Monitoring

Countries	
Bangladesh (BARC)	Annual Development Programme review takes place in the monthly meeting in MOA. The meeting reviews all projects and programmes under the ministry including research. Minister for agriculture presides the meeting where planning commission representative participates. Council also reviews the research programme discipline wise.

Bhutan (CoRRB)	RNR RCs in collaboration with the technical departments organize annual meetings, review past activities and plan for the future.
India (ICAR)	At the institute level, review & monitoring are carried out by the Divisions and IRC, and through a comprehensive review by specially constituted Quinquennial Review Team (QRT), once in five years. Different research schemes of the ICAR are monitored by the Divisions at the headquarters and overall implementations of the planed scheme through Plan Implementation and Monitoring Unit.
Nepal (NARC)	The performance evaluation of programmes and institutes is reviewed at MoAC in presence of the National Planning Commission and the Ministry of Finance under the chairmanship of Secretary of MoAC. In NARC, review is performed at regional and central level in presence of the MoAC, the National planning Commission and the Ministry of Finance and Extension Dpartments Monitoring and evaluation division of NARC at central level performs the programme and institutional review within the NARC. The programmes and the institutional review of the organizations under MoAC are reviewed once at the end of the fiscal year.
Pakistan (PARC)	Planning Commission, besides monitoring of the on-going projects, undertakes evaluation of completed development projects. Monitoring of projects funded under ALP are conducted and organized by ALP secretariat of PARC. The Technical divisions of PARC also monitor the progress of ALP projects.
Sri Lanka (CARP)	Regional research centers of the DOA review the research programmes bi-annually and evaluate the progress made by the scientists. Disciplinary working groups review and evaluate the research progrmmes of the scientist annually. Each scientist has to submit his/her quarterly physical progress to his/her head at the research centre and progress and the problems of all the planned activities are reported back to the central progress monitoring and evaluation unit. CARP or the National Science Foundation periodically reviews the Institutes in the Department of Agriculture. Research programmes of the scientists at Tea research Institute are reviewed externally and the process is practiced in every two years. In rubber Research Institute, an outside panel – Research Evaluation Committee, evaluates every year research programme. The progress is reviewed by a board of the Sugarcane Research Institute together with the representatives from sugar industry.

16. Institutional Innovation

Countries	Institutional Innovation
Bangladesh (BARC)	**Krishi Gobeshona Foundation (KGF):** independent body by company act. Fund management (KGET) manages fund while BARC provides research direction. Executive Chairman BARC chairs the Board
Bhutan (CoRRB)	Being developed
India (ICAR)	**National Agricultural Innovation Project (NAIP**) to facilitate the accelerated and sustainable transformation of Indian agriculture in support of poverty alleviation and income generation through collaborative development and application of agricultural innovations by the public organizations in partnership with farmers groups, the private sector and other stakeholders. **Krishi Vigyan Kendra** (KVK)-An innovative science based institution to impart vocational skill training to the farmers and field level extension workers. On-farm testing and frontline demonstration on major agricultural technology made it more important. ICAR provides 100% financial support. Infrastructure includes 50 acres of complex (hand book of Agriculture, ICAR, New Delhi, 2006) **National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA)** under ICAR. The fund aims to build capacity for basic and strategic research of national and long-term importance to break yield and quality barriers and make India a global leader in research for development, through the partnership of all research organizations. Scientists from all research institutions, universities and private sector with proven research capacity and located in India are eligible to participate. **Deemed universities:** Four institutes, IARI, IVRI, NDRI, CIFE of ICAR and Allahabad Agricultural Institute, are the deemed universities, offering post graduate degrees in agricultural sciences. ICAR established under Society Act while it has been placed under DARE of the Ministry of Agriculture & Cooperation.
Nepal (NARC)	**National Agricultural Research & Development Fund:** autonomous independent body under MoAC for research grant for GO, NGO, CBO, Private sector. Nepal Academy of S & T: headed by the Prime Minister

Pakistan (PARC)	**Agricultural Linkage Program (ALP) of PARC**: Scientific Cooperation with US, funding research, separate body led by PARC. The Government allowed PARC to establish an Agricultural Research Endowment Fund (AREF) where all proceeds raised from the sale of US wheat shall be transferred. Fund received will be invested in government's approved schemes/institutes. The ALP Fund is an independent entity and accepts proposals for grants from all public or private entities which demonstrate needed research and development (R&D). PARC Agrotech Trading Company (PATCO) has been described earlier. **Pakistan Science Foundation**: Autonomous body under Federal Ministry of S & T for promotion of science, museum, award, funding. **Higher education Commission**: National Agriculture Education Accreditation Council (NAEAC) was established by Higher Education Commission (HEC) with the mandate to carry out a comprehensive programme of accreditation of agriculture degree programmes in private and public sector agriculture education institutions. Accreditation is a mandatory process for all relevant academic programmes offered by public and private sector institutions.
Sri Lanka (CARP)	The National Science Foundation (NSF):.NSF facilitates research, development and innovation to create a knowledge economy under the Ministry of Technology and Research. It also facilitates capacity building, infrastructure development, technology transfer, knowledge creation and sharing in all fields of science & technology to improve the quality of life of the people.

Recommendations of the Regional Consultation Meeting on "National Agricultural Research System (NARS) – An Analysis of System Diversity" held during 22-23 December 2010 at Bangladesh Agricultural Research Institute, Gazipur

NARS in the region played a significant role in leading green revolution by accelerating food production in developing appropriate farm technology. However, the region is facing newer challenges of food security associated with increased demand of diversified food items led by income growth, degradation of natural resources, IPR regime, climatic vulnerability and global price hike of food commodity. Under this background re-visiting of NARS in addressing emerging threat of food security and livelihood improvement with newer opportunities demands careful attention.

The NARS of the SAARC Member States though evolved with similar historical perspective, organizational structures, governance and management vary among the countries. Number of institutional innovations took place in the member states to support agricultural research. The consultation meeting reviewed the diversity of the NARS systems in the member states and found there is enough room for further development of the NARS in the region. This is more important when the countries are facing number of challenges in increasing agricultural production with decreasing natural resources, increasing diversified food demand and climatic uncertainties. This warrants developing NARS system more efficient and capable to deliver technology that can be transferred to the agricultural production system.

Recommendation of the workshop

Thematic area I: Organization, Governance and Priority Setting

1. Governing body of the apex organization should be an independent for formulating and implementing policy for efficient research operation. Keeping this in view it should be adequately represented by agricultural researchers, policy makers, extension experts, educationists and others associated with agricultural research and development, which will act as supreme authority for policy, administrative and financial decision.
2. Depending on the systems of individual member country an efficient and effective autonomy is deemed to be necessary for proper functioning of NARS institutes.
3. The research fund for the NARS institutes is to be allocated by the Government in the form of yearly block allocation.
4. Review of the research programmes of the NARS institutes by external panels of experts on 5-year intervals is essential since tremendous changes occur both in research needs as well as development of sophisticated technologies.
5. The apex body will approve the financial allocations for the NARS institutes on the basis of their research programmes and involvement of financial requirements for each programme.

6. Five Year Research Plan along with Budgetary Plan has to be formulated by each institute, submitted to its apex body and finally approved by its Governing Body through review process.
7. The apex body should be adequately manned considering the extent of planning, monitoring, resource allocations, HR management of research programs and projects.
8. Monitoring and Evaluation strategy should be developed and implemented for research conducted by each NARS institute on seasonal and yearly basis. Impact assessment of the research programs needs to be institutionalized with reference to investment in research undertakings. However, the organograms, mandates and management strategies of the institutes should be reviewed and evaluated by a panel of external experts after every five years.
9. Considering the global advancement of science and technology, international and regional cooperation in agricultural research is getting much importance. Apex body for agricultural research coordination may be organized with an international relation wing to accelerating the benefit of such cooperation. The local offices of the international organizations may be located in the premises of the apex body for harnessing locational benefit.
10. Apex bodies, therefore, may provide funds for research to the Universities/Private Research Agencies etc. through competitive grants basis for conducting required basic research.
11. Agricultural research is being undertaken beyond institutes coordinated by the council or within the periphery of NARS, such as research entities in province/state or in other central/federal government. NARS should recognize those entities through complementarities.
12. Innovative funding mechanism through competitive research grant programs, being operated in the member states (such as Agricultural Linkage Program, ALP of Pakistan, created under endowment fund) may be reviewed for possible adoption in other member states to supplement public research.
13. Recent development in technology marketing in some countries may receive appreciation in other countries. This may be reviewed further for possible adoption through formulating adequate policy.

Thematic Area II: Research-Extension-Education Linkage

1. Strategic guidance for effective linkages of the Research, Extension and Education organizations is to be formulated by the apex body for enhancing technology generation, validation and transfer. Krishi Vigan Kendra popularly known as KVK (Agricultural Science Center) in ICAR, India may be reviewed for possible multiplication in other member states.
2. Each apex body should have a technology transfer wing having provision for requisite number of personnel for monitoring and evaluating extension activities by the extension related entities. National and local level nodal points comprising research and extension service providers should be strengthened and linked for

efficient agricultural technology system.

3. A large number of highly qualified scientists are engaged in universities. Collaborative research programs involving universities may be undertaken through strengthened linkage. For such linkage, research fund allocation, monitoring and evaluation by the apex body is to be established through liaison with UGC/competent authority of member countries.

Thematic Area III: Human Resource Management /Development

1. To utilize the experience and skill in agricultural research, retirement age should be relaxed upto 65 years with an intention to retain merit in the system.
2. Enhancing scientific skill and leadership quality among the scientific professionals in addressing problems in the agricultural production system deserve special attention in the NARS in the region.
3. An independent Recruitment Board should be established for recruitment of NARS scientists centrally to maintain uniform quality standard of the scientific professionals. Such a system of recruitment is likely to deter undue influence from other quarters. Likewise promotion of scientists should be under the purview of the apex bodies.
4. There should be a National Agricultural Research Service cadre in each of the member country along with establishment of proper protocol of the scientists compared to the other cadres prevailing in the country.
5. Each member country should review the human resource development and management system including career development, promotion, incentives, etc. to retain the scientists of the research institutes as well as allure those who already gone out of the country to come back and serve their nations.
6. The SAARC Agriculture Centre should study and review the institutional innovations taking place in the members states as learning process of research managers and policy makers. SAC may further review the best practices/management practices/policies for retaining skilled scientists of the member countries through visit and on the spot analysis.
7. Since agricultural research is a dynamic process and new challenges and opportunities are being developed at a fast rate in different countries, capacity building of agricultural scientists is crucial to make them successful in research program. Therefore, each NARS institute should develop a five year career plan for capacity development of their scientists and such plans should be reviewed by the apex body in keeping this with national relevance.
8. System of exchanging/sharing of knowledge/technologies to be strengthened among the SAARC member countries on regular basis.
9. Science centered administrative system should be introduced in the NARS instead of civil service centered system to create enabling environment for the advancement of agriculture. A system of promotion of scientists through upgradation of posts should be introduced irrespective of availability of posts in the upper tire.

10. National Agricultural Scientist (NAS) and scientists emeritus scheme should be introduced or strengthened in the SAARC countries taking advantage of available national skill and expertise in the country or abroad. Such introduction will ensure fruitful utilization of hard earned experience of some highly qualified scientists after their retirement through their engagement in some time bound and result oriented research programs.
11. Management position of the NARS institutes (Director/Director General) should be filled up through a Search Committee formed by the Governing Body of the apex organization. Other research management positions should be filled up through seniority and leadership quality among NARS scientists.

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN BANGLADESH

Appendix A

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN BANGLADESH

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National Consultant: Bangladesh

December, 2010

Content

List of Tables

1. INTRODUCTION

Bangladesh can boast of possessing a relatively broader research base in the agriculture sector compared to some other countries under SAARC. The entire agricultural research endeavour in the country has been organized into a system designated as the National Agricultural Research System (NARS) comprised of the Bangladesh Agricultural Research Council (BARC) as its apex body and ten agricultural research institutes (ARIs). In addition, there are three agricultural universities involved in higher education and academic research in crops, livestock, fisheries and forestry. A number of non-government organizations (NGO) are also involved in some agricultural research and extension.

1.1. Agricultural research, production and national GDP

Research in the leading ARIs has resulted in highly significant and positive changes in farming practices, crop yield as well as quality. There has been phenomenal growth in agricultural production in Bangladesh during the last three and a half decades. The country became independent with 75 million people and food grain production of about 10 million tons. Food grain deficiency was only about 1.2 million tons in 1971 while in 1999-2000 the country became self – sufficient in food grains[1]. This situation prevailed till the year 2004-05 and then there was a slow decline till 2007. The growth rate in grain production, however, has improved during 2008 and 2009. The livestock, fisheries and forestry sub-sectors recorded a stable growth of four to five percent in recent years[2]. Contribution of research to the sustained growth in the major sub-sectors of agriculture was quite significant during this period because a good number of sophisticated technologies were made available to the farmers. Favourable growth in agriculture had so far significant contribution to the country's overall GDP growth of 6% and above, in addition to reasonably steady maintenance of food supply specially food grains to the enormously large population. The agricultural growth rate of above 4% leading to the country's overall higher growth of GDP, around 6% during the years 2003-04, 2005-06 and 2006-07, suggests that the development priority should be directed to faster growth in Agriculture[3].

1.2. Sectoral policy, prologue and shortcomings

One of the Constitutional obligations[4] of the country is to develop and sustain a society in which the basic needs of the people are met. Food, being one of the basic needs, naturally received quite adequate attention in agricultural planning exercises. Formulation of the National Agricultural Policy (NAP)[5] and the Plan of Action (PoA)[6, 7]

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1 Shaikh, M.A.Q. 2008. Food and Agriculture in Bangladesh: Current Situation and Long Term Challenges. Bangladesh Agriculture 2(1):47-54.

2 MoF, 2007. Bangladesh Economic Review -2008. Ministry of Finance, Government of Bangladesh, Dhaka.

3 Quasem, M.A. 2008. Agricultural Development in Bangladesh: Challenges Ahead. Bangladesh Agriculture 2(1): 1-37.

4 GOB, 1972. The Constitution of the People's Republic of Bangladesh, Ministry of Law, Justice and Parliamentary Affairs, Govternment of Bangladesh, Dhaka.

5 MOA, 1999. National Agricultural Policy (NAP), Ministry of Agriculture, Govt. of Bangladesh, Dhaka.

to implement the NAP are actually the latest milestones in the process. The NAP, approved in 1999, is considered to be the country's first comprehensive and self contained policy statement in the crop sector. However, BARC had already prepared a Strategic Plan Technical Document prior to the formulation of NAP and used internally within BARC. Then in 2000, BARC prepared a Vision Document[8] for research in broad agricultural sub-sectors like crops, livestock, fisheries and forestry.

The Government has developed strategies to meet the Millennium Development Goals (MDGs). Nevertheless, attainment of the MDGs, particularly the MDG-1 calling for eradication of extreme poverty and hunger, would require substantial changes in the broad policies and strategic framework for attaining sustainable growth, increased farm income, competitiveness and commercialization of the broad agriculture sector including crops, vegetables, fisheries, livestock and forestry. Only in this way it may be possible to maximize the sector's contribution to overall economic growth, food security and poverty reduction.

However, it is discouraging that the average agricultural GDP growth rate of 3.1% during 1980-2000 has declined to below 2% during the last few years. This is an alarming challenge in the face of (1) declining natural resource bases like land, water etc, and (2) increasing population. Since about 75% of the country's population live in the rural areas accounting for about 85% of the total poor, an improved performance of the agricultural sector contributing to accelerated agricultural growth is critical to reduction of rural poverty. But the existing technology generation and dissemination systems are weak and ill-prepared to meet the emerging challenges due to multifarious administrative and policy constraints[9].

The constraints, bottlenecks and weaknesses pertaining to the overall performance of the National Agricultural Research System (NARS) prevailing in the country will be delineated as the study under consideration progresses step by step. It will become clear that various governance and management issues needing improvement and streamlining entail a long list indeed.

2. GOVERNANCE SYSTEM OF AGRICULTURAL RESEARCH AND DEVELOPMENT

2.1. Historical background

Agricultural Research in Bangladesh has a long history. The single-most potent factor in raising productivity was a wide range of scientific advances through research

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6 Shaikh, MA.Q. 2001. National Consultant: Consulting Report on Plan of Action to Implement the National Agriculture Policy (Agricultural Research and Development Component), MoA, FAO, GoB, Dhaka.

7 MOA-GOB/UNDP/FAO, 2003. Plan of Action (PoA) to Implement the National Agriculture Policy, Ministry of Agriculture, Govt. of Bangladesh, Dhaka.

8 BARC, 2000. Bangladesh NARS – 2020: A Vision Document for Agricultural Research, Bangladesh Agricultural Research Council, Dhaka.

9 Shaikh, M.A.Q., 2008 Consulting Report on "Reformulation of BARC ACT 1996 for Greater Efficiency of the National Agricultural Research System", Bangladesh Agricultural Research Council, Dhaka.

along with complementary support for investments in agriculture[10]. Formal agricultural research in the British Bengal had its beginning a decade before the 20th Century[11]. A Department of Agriculture was established at that time under the Department of Land Records and systematic research on jute started at the turn of the Century. Private tea research began about the same time. Bengal Department of Agriculture was established in 1905 and rice research was started in 1908. A nucleus Agricultural Research Laboratory (ARL) was established at Tejgaon, Dhaka in 1908 to serve the provinces of Bengal and Assam. Sugarcane, tobacco and manurial trials began. At about the same time, an Experimental Station involving 355 acres of land was set up and became known as the Dhaka Farm. There were only 17 scientists at the Farm in 1925 to work on rice, jute, cotton, pulses, oilseeds and sugarcane.

A Royal Commission on Agriculture was constituted for India which served from 1926-28. On the recommendation of this Commission, the Imperial Council of Agricultural Research (ICAR) was established in 1929 for undivided India. Although agriculture was a provincial responsibility at that time, ICAR started providing nationwide coordination to the work at the central research institutes and the state research stations/farms. A Deepwater Rice Research Centre was set up at Habigonj in 1934[12].

Education being an important element of the agricultural research process, the country benefited enormously from quite early and good quality educational resources from the Bengal Agricultural Institute (BAI) founded in 1938. BAI was the only school for higher education in agriculture in the province. It was subsequently affiliated with the Bangladesh Agricultural University (BAU) but was administered by the Bangladesh Agricultural Research Institute (BARI). Notwithstanding the worldwide economic depression, which reduced the resources for agricultural research in the mid-1930s, the work continued and improved varieties of rice, sugarcane and jute were introduced/developed by the end of 1939.

The end of the British Raj in 1947 resulted in the partition of the Imperial Council of Agricultural Research (former ICAR) into Indian Council of Agricultural Research (present-day ICAR) and Food & Agricultural Council of Pakistan (FACP). New research agencies devoted to some crops were organized in the then East Pakistan starting from 1951 onwards[13]. Research agencies on jute & sugarcane were established in 1951, while the Bangladesh Forest Research Institute was established in 1955. An Agricultural Research Institute (ARI) was set up in 1957 under the Directorate of Agriculture

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10 SAC Newsletter, Vol. 17, No.2 (April-June, 2007), SAARC Agriculture Centre, BARC Complex, Farmgate, Dhaka-1215.

11 Badruddoza, K.M. 2001. National Agricultural Research System (NARS) – An Overview. In: Mian, M.A. Wadud et al. (Eds.), Agricultural Research in Bangladesh in the 20th Century, Bangladesh Agricultural Research Council (BARC)/Bangladesh Academy of Agriculture (BAAG), Dhaka.

12 Kabir, K.M.E. and Bagchi, T. 2008. Agricultural Scientist Dr. Shah Md. Hasanuzzaman: Pioneer of Rice Research (in Bangla), Kazi Daud (Publisher), 491 Baro Maghbazar, Dhaka.

13 Badrudozza, K.M. 2001. National Agricultural Research System (NARS) – An Overview In: Mian, M.A. Wadud et al. (Eds.), Agricultural Research in Bangladesh in the 20th Century, Bangladesh Agricultural Research Council (BARC)/Bangladesh Academy of Agriculture (BAAG), Dhaka.

(Research and Education) of the then East Pakistan. The Bangladesh Tea Research Institute (BTRI) was founded in 1958. Three years later, the Atomic Energy Agricultural Research Centre (AEARC) was established in 1961.

The year 1962 was a boon to agricultural education and research since the Bangladesh Agricultural University was established in 1962 at Mymensingh and it soon became the primary institution for agricultural education offering both undergraduate and graduate level degrees. It was also a year of severe blow to agricultural research since the then Pakistan Government acquired the well laid out and scientifically designed Monipur (previously Dacca) Farm to establish the Second Capital of the country. The present National Parliament was built in one part of the farm. In this backdrop, the East Pakistan Rice Research Institute was set up in 1970 at Joydebpur (now Gazipur)[14].

The months of the war of independence (1971) constituted a difficult period for agricultural research. A lot of crop and animal germplasm, breeding materials, research plots and data, publications, agricultural research equipments, machines etc. were lost but untiring efforts of some senior scientists of the time helped in reorganizing the unorganized research system by 1973. One of the most important developments was Presidential Order No. 32, April 5, 1973 establishing the Bangladesh Agricultural Research Council (BARC) as the national agency for coordinating agricultural research in the country.

A college of Agricultural Sciences named Institute of Post-graduate Studies in Agriculture (IPSA) was created as a part of BARI in 1983. It was a graduate study institution located at Salna, Gazipur and offered degrees at the Master's and Doctorate levels. The Livestock Research Institute and the Fisheries Research Institute were established in 1984. IPSA was converted into The Bangobandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) at Salna in 1998 and the Sher-e-Bangla Agricultural University (SBAU) at Dhaka was established in 2001.

The above-mentioned treatise is merely a sketch of the milestones in the long and arduous history of establishment of the institutions related to the National Agricultural Research System. The gradual administrative and functional changes of most of these research and educational institutions will be dealt with in the following section of this report.

Apart from BARC and its constituent institutions, the other agencies involved in agricultural research, in one way or the other, include (i) Dhaka University (DU), (ii) Bangladesh Council of Scientific and Industrial Research (BCSIR), (iii) Rajshahi University (RU), (iv) Bangladesh Academy of Rural Development (BARD), (v) Bangladesh Atomic Energy Commission (BAEC), (vi) Rural Development Academy (RDA), (vii) Bangladesh Medical Research Council (BMRC), (viii) National Institute of Biotechnology (NIB), etc. and a few Non-Government organizations (NGO). Historical background of these organizations are not narrated for the sake of brevity.

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[14] Kabir, K.M.E. and Bagchi, T. 2008. Agricultural Scientist Dr. Shah Md. Hasanuzzaman: Pioneer of Rice Research (in Bangla), Kazi Daud (Publisher), 491 Baro Maghbazar, Dhaka

2.2 Establishment of the institutions (ordinances, acts) and their reformation, transformation and development

The establishment of institutions, their relevant Ordinances and Acts, as well as their successive reformation, transformation and developmental stages are narrated below. The institutes have been dealt with on the basis of their length of organized existence i.e. from older ones to younger ones.

2.2.1. Bangladesh Sugarcane Research Institute (BSRI)

A Sugarcane Research Station (SRS) was established at Ishurdi, Pabna in 1951 as a provincial facility under the Ministry of Agriculture, the then East Pakistan. In 1973, the SRS was raised to the status of Sugarcane Research Institute (SRI) through a project and was placed under the Ministry of Industry. After some years the SRI was renamed as Sugarcane Research and Training Institute (SRTI).

Thereafter, SRTI was renamed as Bangladesh Sugarcane Research Institute in 1996 through promulgation of Ordinance No. 23, 1996. This Ordinance was repealed and an Act (No. 11, 1996) was passed for the institute in the Parliament and Gazetted[15].

The present-day BSRI is an outcome of the various transformations and development stages that the institute has gone through during 45 years from 1951-96. However, strangely enough, the latest Act of BSRI has no provision for any kind of allegiance to the Bangladesh Agricultural Research Council (BARC). In other words, as per the Bangladesh Sugarcane Research Institute Act 1996, BSRI is not accountable to BARC in any way, like the other six autonomous ARIs.

2.2.2. Bangladesh Jute Research Institute (BJRI)

Like sugarcane, one of the earliest endeavours of organized agricultural research in the then East Pakistan was on jute. A separate facility to this effect was created in 1951 at Dhaka. After independence of Bangladesh, a Jute Research Institute (JRI) was founded vide Ordinance No. XXII, 1973 which was soon repealed by Act No. XIII of 1974. The Act was later amended vide Ordinance No. XXI of 1983. In 1996, the Bangladesh Jute Research Institute (Amendment) Ordinance (No. 9, 1996) was promulgated and that was soon repealed and the Bangladesh Jute Research Institute Act (No. 8, 1996) was passed[16]**.** Through the latest Act, BJRI has been made accountable to BARC to the effect that any direction issued by the Bangladesh Agricultural Research Council under or in pursuance of the provisions of section 8 or 14 of BARC Act (No. 7, 1996)[17] would be complied with.

2.2.3. Bangladesh Agricultural Research Institute (BARI)

The Agricultural Research Laboratory established at Tejgaon in 1908 underwent a series of reorganizations in the mid-1950s. These led to the establishment of the Agricultural Research Institute (ARI) in 1957 under the Directorate of Agriculture

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15 The Bangladesh Gazette (Extraordinary), August 17, 1996; Ministry of Law and Parliamentary Affairs, Government of Bangladesh, Dhaka.

16 Bangladesh Gazette August 17, 1996, Bangladesh National Parliament, Dhaka.

17 Bangladesh Gazette (Extraordinary), Bangladesh Agricultural Research Council Act, 1996, August 17, 1996, Bangladesh National Parliament, Dhaka.

(Research & Education) of the then East Pakistan. This ARI was the only facility for conducting research on all crops other than sugarcane, jute and tea.

The loss of Dhaka Farm in 1962 (as mentioned earlier), was a year of major disruption for agricultural research in the province since there was a serious lack of strong institutional base. The Government acquired 650 acres of land near Joydebpur in 1966 as a replacement for the Dhaka Farm[18]**.** After some preliminary infrastructure development, The Bangladesh Agricultural Research Institute Ordinance 1976 (Ordinance No. LXII of 1976) was promulgated and the institute slowly started developing there. In 1996, The Bangladesh Agricultural Research Institute (Amendment) Ordinance (No. 17, 1996) was promulgated in 1996 and then repealed through Act No. 11 of 1996[19]**.**

2.2.4. Bangladesh Rice Research Institute (BRRI)

Research on rice has indeed followed a long and uneven path. The initial rice research activity was started at the Dhaka Farm and improved rice varieties were developed by 1939. Establishment of the Deepwater Rice Research Centre at Habigonj in 1934 was another milestone. However, the loss of Dhaka Farm in 1962 resulted in a severe set back to rice research. Rice germplasm collection of 50 years numbering over a 1000 was lost[20]. But the work was continued, and with the cooperation of rice scientists, the first high yielding varieties (HYV) of rice were introduced in the country by the International Rice Research Institute (IRRI) in 1965. Around this time the ARI scientists were conducting rice breeding on lands borrowed from the Savar Dairy Farm. In 1970, the then East Pakistan Rice Research Institute (EPRRI) was established and part of the acquired land at Joydebpur was selected as the site for the EPRRI.

After liberation, EPRRI designated as Bangladesh Rice Research Institute (BRRI), was one of the first to have satisfactory buildings, laboratories and lands. Bangladesh Rice Research Institute Act. 1973 (No. X of 1973) was passed in the National Parliament. This Act was amended as The Bangladesh Rice Research Institute (Amendment) Act, 1996 (Act No. 5, 1996)[21]**.** In this amended Act it was included that the Institute or any of its functionaries shall ensure that any direction issued by the Council under or in pursuance of the provisions of section 8 or 14 of Bangladesh Agricultural Research Council Act, 1996 (Act No. 7, 1996) is complied with.

2.2.5. Bangladesh Institute of Nuclear Agriculture (BINA)

The metamorphosis of agricultural research using nuclear techniques had an improvised and unique beginning as early as in 1960 through the establishment of agricultural discipline-wise laboratories in a few rooms allocated by the Jute Research

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18 Badruddoza, K.M., 2001. National Agricultural Research System (NARS) – An Overview. In: Mian, M.A. Wadud et al. (Eds.), Agricultural Research in Bangladesh in the 20th Century, Bangladesh Agricultural Research Council (BARC)/Bangladesh Academy of Agriculture (BAAG), Dhaka.

19 Bangladesh Gazette (Extraordinary) August 17, 1996, Bangladesh National Parliament, Dhaka.

20 Kabir, K.M.E. and Bagchi, T. 2008. Agricultural Scientist Dr. Shah Md. Hasanuzzaman: Pioneer of Rice Research (in Bangla), Kazi Daud (Publisher), 491 Baro Maghbazar, Dhaka.

21 The Bangladesh Gazette (Extraordinary) Act No. 5, 1996 August 17, 1996, Bangladesh National Parliament, Dhaka.

Institute, Dhaka. The facility was moved to a rented house in Dhanmondi Residential Area, Dhaka in 1961 and was named Atomic Energy Agricultural Research Centre (AEARC). The Centre was merged with the newly built Atomic Energy Centre (AEC), Dhaka in 1965 and was given the status of a Division i.e. Agriculture Division. Agricultural research using radioisotopes and varietal improvement efforts through induction of mutations were conducted at lands borrowed from the Savar Dairy Farm.

A Swedish delegation visited all the agricultural research agencies and Agricultural Universities of Pakistan in 1970 with the intention of bilateral help. In their assessment, the research achievements of the Agriculture Division of AEC and its future potential surpassed those of all the other individual agricultural research agencies of Pakistan as a whole. On their recommendations, the Agriculture Division of AEC was raised to the status of an institute and was named as Institute of Nuclear Agriculture (INA). Construction for housing INA within the campus of the Bangladesh Agricultural University (BAU) at Mymensingh started in 1971 but was disrupted during the war of independence. After liberation of Bangladesh, construction of a two-storied modern building was completed by 1974 and INA moved there in January, 1975. The Swedish International Development Agency (SIDA) provided generous aid for procurement of equipment, expert service and human resource development (HRD) by way of higher education and training. The International Atomic Energy Agency (IAEA) administered the fund and management of the developmental issues described above in lieu of a nominal service charge from SIDA.

The Institute of Nuclear Agriculture was made independent of the Bangladesh Atomic Energy Commission (BAEC) through a Proclamation of the Hon. President of Bangladesh on 24th March, 1982 and INA was transferred from the Ministry of Science and Technology (MoST) to the Ministry of Agriculture (MoA). The institute was given the status of a national agricultural research facility through proclamation of an Ordinance in 1984[22] and was named as Bangladesh Institute of Nuclear Agriculture. This Ordinance was amended on 29th March, 1984[23]. This Ordinance was again superceded by the Bangladesh Institute of Nuclear Agriculture (Amendment) Ordinance 1996, which was repealed and The Bangladesh Institute of Nuclear Agriculture (Act No. 1996) was passed in the Parliament[24].

2.2.6 Bangladesh Forest Research Institute

The Bangladesh Forest Research Institute was also one of the earliest institutes of the then East Pakistan. It was established in 1955. It has been run as a Government Department ever since its establishment.

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22 The Bangladesh Gazette (Extraordinary), Ordinance No. II of 1984, Thursday, January 5, 1984; Ministry of Law and Land Reforms, Government of Bangladesh

23 The Bangladesh Gazette (Extraordinary), Ordinance No. XXIII of 1984, Thursday, 29th March, 1984; Ministry of Law and Parliament Affairs, Government of Bangladesh.

24 The Bangladesh Gazette (Extraordinary), Saturday, August 17, 1996; Bangladesh National Parliament, Dhaka.

2.2.7. Bangladesh Tea Research Institute (BTRI)

A Tea Research Institute (TRI) was founded in 1958 to replace the scientific facilities that were lost to the country at the time of partition of the Indian Subcontinent. The TRI was later became the scientific arm of the Bangladesh Tea Board. No worthwhile change or transformation has occurred in this ARI.

2.2.8. Bangladesh Livestock Research Institute (BLRI)

The precursor of BLRI, the Livestock Research Institute was established in 1984 through promulgation of the Livestock Research Institute Ordinance, 1984 (No. XXVIII of 1984)[25]. This Ordinance was amended by the Ordinance No. LVII of 1984[26]. This Ordinance was again amended by The Livestock Research Institute (Amendment) Ordinance, 1996 (No.22, 1996). In the same year, this Ordinance was repealed by the Bangladesh Livestock Research Institute (Amendment) Act, 1996 (Act No. 9 of 1996)[27].

2.2.9. Bangladesh Fisheries Research Institute (BFRI)

A Fisheries Research Institute was established within the campus of the Bangladesh Agricultural University, Mymensingh, through Ordinance No .XLV in 1984. That Ordinance was amended by The Fisheries Research Institute (Amendment) Ordinance (No. 21, 1996)[28]. Ultimately, this Ordinance was repealed by the Bangladesh Fisheries Research Institute Act, 1996 (Act No. 10 of 1996)[29].

2.2.10. Soil Resource Development Institute (SRDI)

SRDI originated in 1961 as the East Wing Directorate of the Soil Survey Project of the then Pakistan under the Ministry of Agriculture and Works with the assistance of FAO/UNDP. The aim of the organization was to make a quick inventory of the soil and land resources for assessing their potentials for agriculture and other uses.

During 1963-1965, Reconnaissance Soil Survey of almost the entire country was completed except the Sundarbans and the Chittagong Hill Tracts. In 1969, the then Government of Pakistan established Central Soil Resource Institute to carry out comprehensive soil research with its two regional offices at Dhaka and Lahore.

After emergence of Bangladesh, the regional office at Dhaka started functioning as Department of Soil Survey under the Ministry of Agriculture and Forest, GoB. Soil Survey Interpretation Scheme and Expanded Soil Survey Programmes were launched in 1974 and 1976, respectively. Regional offices in the Divisional level and District offices in the older districts were set up under 'Expanded Soil Survey Programme' in 1976 and started functioning phase by phase since 1979.

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25 The Bangladesh Gazette (Extraordinary), April 23, 1984; Ministry of Law and Justice, Govt. of Bangladesh, Dhaka.

26 The Bangladesh Gazette (Extraordinary), September 17, 1984; Ministry of Law and Justice, Government of Bangladesh, Dhaka.

27 The Bangladesh Gazette (Extraordinary), August 17, 1996. Bangladesh National Parliament, Government of Bangladesh, Dhaka.

28 The Bangladesh Gazette (Extraordinary), (Ordinance No. 21, 1996), Bangladesh National Parliament, Dhaka.

29 The Bangladesh Gazette (Extraordinary), June 15, 1996, Bangladesh National Parliament, Dhaka

The Soil Resource Development Institute (SRDI) came into existence in 1982-83. This institute absorbed the Department of Soil Survey, Soil Survey Interpretation Scheme and the Expanded Soil Survey Programme in 1983 and all the scientists were brought under Bangladesh Civil Service (Agriculture) and opened 4 Regional offices at Divisional level and 14 District offices at older district level. The Analytical Services Division (ASD) of BARI, along with its four Regional Laboratories at Comilla, Joydebpur, Khulna and Rajshahi was merged with SRDI in 1993. The expansion of SRDI came to an end with the opening of its two research centres namely, 'Soil Conservation and Watershed Management Centre' (SCWMC) at Bandarban and 'Salinity Management and Research Centre' (SMRC) at Batiaghata during 1994-95.

2.2.11. Bangladesh Agricultural Research Council (BARC)

The origin of this organization can be traced back to 1947 when partition of India led to the establishment of ICAR in India and FACP in Pakistan. Both the Councils had similar purposes i.e. to undertake, aid, promote and coordinate agricultural research in their respective countries. One of the most important milestones of agricultural research in Bangladesh was establishment of the Bangladesh Agricultural Research Council through Presidential Order as the National Agency to coordinate agricultural research[30]. The continuing development of research institutions led to further restructuring in 1976. Further amendment was brought in the PO No. 32, 1973 vide Ordinance No. L1 of 1976 i.e. the BARC Amendment Ordinance, 1976[31].

A few concrete actions of the MoA on the functional relation of some ARIs with the newly established BARC gradually led to consolidation of the research system further. These were as follows[32]:

I. On September 10, 1979, the Ministry of Agriculture (MoA) directed that BARI would be designated as a Constituent Unit of BARC while operating under its own Board for administrative and management of affairs.

II. As a further step, the MoA on September 15, 1979 directed BARI, BRRI and BFRI (Forest) to process their schemes/projects through BARC for scrutiny and approval before forwarding those to the Government.

III. On May 27, 1982 MoA declared BARI, BRRI, BFRI and BINA to be Constituent Units of BARC while working under their respective constitutions, but BARC was given the supervisory control over these ARIs.

IV. On July 24, 1983 the institutes like BARI, BRRI, BINA and BJRI were made autonomous bodies and were declared as Constituent Units of BARC.

A strong possibility of a much closure research liaison between BARC and the Bangladesh Agricultural University (BAU) emerged in 1983. In fact, Ministry of

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30 The Bangladesh Gazette (Extraordinary), Presidential Order No. 32, April 5, 1973.

31 The Bangladesh Gazette (Extraordinary-PP 1987-1992), July 5, 1976.

32 Badruddoza, K.M. 2001. National Agricultural Research System (NARS) – An Overview In: Mian, M.A. Wadud et al. (Eds.), Agricultural Research in Bangladesh in the 20th Century, Bangladesh Agricultural Research Council (BARC)/Bangladesh Academy of Agriculture (BAAG), Dhaka.

Education (MoE), the administrative Ministry of this university passed an office order on October 11, 1983 announcing "decision of the Government allocating the BAU as the business of Agriculture and Forest Division of Agriculture" but this was revised later on and the BAU was again brought under the MoE[33].

This decision destroyed the possibility of utilizing the technical knowledge of a vast number of highly qualified teachers of BAU and the later founded Bangobondhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) and Sher-e-Bangla Agricultural University (SBAU) as well as the latest agricultural and veterinary universities of Sylhet, Chittagong etc. in conducting agricultural research under direct coordination of BARC. A great opportunity for nation building was thus lost.

The Bangladesh Agricultural Research Council Amendment Ordinance, 1976 Ordinance No. LI of 1976 was amended vide Act No. 28 of 1988 (BARC Amendment Act, 1988)[34]. Through this Act, BARC was given wide powers over 10 ARIs listed as under:

Schedule of Institutes brought under BARC's coordination by Act No. 28 of 1988.

1. The Bangladesh Agricultural Research Institute
2. The Bangladesh Rice Research Institute
3. The Bangladesh Jute Research Institute
4. The Bangladesh Institute of Nuclear Agriculture
5. The Bangladesh Forest Research Institute
6. The Bangladesh Tea Research Institute
7. The Sugarcane Research and Training Institute
8. The Fisheries Research Institute
9. The Bangladesh Livestock Research Institute
10. The Soil Resources Development Institute

The BARC's Act No. 28 of 1988 was amended by The Bangladesh Agricultural Research Council Ordinance, 1996 (Ordinance No. 16, 1996). The BARC Ordinance 16 of 1996 was soon repealed by the BARC Act, 1996[35]**.** In this Act, all the scheduled ARIs listed in BARC's No. 28 of 1988 have been kept under BARC's purview.

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33 Badruddoza, K.M. 2001. National Agricultural Research System (NARS) – An Overview. In: Mian, M.A. Wadud et al. (Eds.), Agricultural Research in Bangladesh in the 20th Century, Bangladesh Agricultural Research Council (BARC)/Bangladesh Academy of Agriculture (BAAG), Dhaka.

34 Bangladesh Gazette (Extraordinary), May 24, 1988. Ministry of Law and Parliament Affairs, Government of Bangladesh, Dhaka.

35 The Bangladesh Gazette (Extraordinary), Act No. 7 of 1996, August 17, 1996. Bangladesh National Parliament, Dhaka.

2.3. Establishment of the present NARS

The long and arduous path up to establishment of the present NARS has been narrated above. BARC together with these ten institutes forms the present NARS. BARC was given the responsibility of serving as a national organization and a coordinating agency for research on all aspects of agriculture including crops, livestock, soil, water, crop protection, agricultural engineering, forestry, fisheries, economic and social science.

With the passage of the BARC Act 1996, the complicated process of establishing the present NARS was culminated temporarily. However, there is scope for further legal and administrative improvements.

At present, the BARC is the apex body of the national agricultural research system acting like an umbrella under which the entire national agricultural research effort is coordinated as well as strengthened through planning and integration of resources. But the BARC Act, 1996 needs major amendments to strengthen BARC's authority over the ARIs for ushering greater efficiency of the NARS[36].

2.4. Prevailing governance systems in the NARS (Government Department, Autonomous Body Etc.)

Out of the 10 ARIs under the purview of BARC, only six (BARI, BRRI, BJRI, BINA, BSRI and SRDI) belong to the Ministry of Agriculture (MoA). The BLRI and BFRI (Fisheries) belong to the Ministry of Fisheries and Livestock (MoFL), The BFRI (Forest) to the Ministry of Forest and Environment (MoFE) and The BTRI to the Ministry of Commerce (MoC). On the other hand, BARI, BRRI, BINA, BJRI, BSM, BLRI and BFRI (Fisheries) are autonomous organizations, whereas SRDI, BFRI (Forestry) and BTRI are Government Departments (Table-1). Placement of 10 ARIs under four different Ministries as well as the diversified status of some of the ARIs (e.g. autonomous and Government Department) have created a serious system diversity hindering smooth, efficient and effective coordination by BARC to a considerable extent.

3. ORGANIZAION OF NARS

3.1. Institutes involved in the NARS

As mentioned earlier, The Bangladesh Agricultural Research Council (Amendment) Act, 1988 shows 10 institutes in its schedule. These institutes have again been kept in the Bangladesh Agricultural Research Council Act, 1996 but the ARIs have been divided into two groups, e.g. schedule "Ka" and schedule "Kha". Crop research institutes have been included in the schedule "Ka" and the ARIs dealing with other commodities have been listed under schedule "Kha". The two schedules are shown along with their administrative status, line Ministry and Headquarters in Table 1.

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[36] Shaikh, M.A.Q., 2008. Consulting Report on "Reformulation of BARC ACT 1996 for Greater Efficiency of the National Agricultural Research System", Bangladesh Agricultural Research Council, Dhaka

Table 1. NARS institutes with their administrative status and Headquarters

Institute	Status & Ministry	Headquarters
Schedule "Ka"		
1. Bangladesh Rice Research Institute (BRRI)	Autonomous, Ministry of Agriculture	Gazipur
2. Bangladesh Jute Research Institute (BJRI)	Autonomous, Ministry of Agriculture	Dhaka
3. Bangladesh Agricultural Research Institute (BARI)	Autonomous, Ministry of Agriculture	Gazipur
4. Bangladesh Institute of Nuclear Agriculture (BINA)	Autonomous, Ministry of Agriculture	Mymensingh
5. Bangladesh Sugarcane Research Institute (BSRI)	Autonomous, Ministry of Agriculture	Pabna
Schedule "Kha"		
1. Bangladesh Livestock Research Institute (BLRI)	Autonomous, Ministry of Fisheries & Livestock	Savar, Dhaka
2. Bangladesh Fisheries Research Institute (BFRI)	Autonomous, Ministry of Fisheries & Livestock	Mymensingh
3. Bangladesh Tea Research Institute (BTRI)	Department, Tea Board, Ministry of Commerce	Sri Mongal, Moulovibazar
4. Bangladesh Forest Research Institute (BFRI)	Department, Ministry of Forest and Environment	Chittagong
5. Soil Resources Development Institute (SRDI)	Department, Ministry of Agriculture	Dhaka

BARC together with these ten institutes forms the NARS. BARC was given the responsibility of serving as a national organization and a coordinating agency for research on all aspects of agriculture including crops, livestock, soil, water, crop protection, agri-engineering, forestry, fisheries, economics and social science.

3.2. Description of the NARS organizations, their structural and functional outlays [37,38]

The purpose of this section is to describe the stakeholder organizations of research, their organizational set up and responsibilities. As already mentioned earlier, the stakeholder agencies involved in agricultural research mainly belong to the Ministry of Agriculture (MoA), Government of Bangladesh (GoB). MoA is the highest and the central body of the GoB in the crop agricultural sector. It is responsible for the overall

[37] SAARC 2009. Paper for Preparation of National Agricultural Research Systems (NARS) in the SAARC Countries-An Analysis of System Diversity, Bangladesh part, SAARC Agriculture Centre, Dhaka, Bangladesh.

[38] Shaikh, M.A.Q. 2005. National Consultant for Research and Extension, Consultancy Report on Project Identification Study on Crop Sector Development and Diversification in Bangladesh, Japan International Cooperation Agency (JICA), Dhaka.

administration and supervision of the activities of all the crop agricultural research organizations of the country[39]. Generation of technology is mainly carried out by the NARS headed by the BARC.

3.2.1. Bangladesh Agricultural Research Council (BARC)

The administrative head of BARC is Executive Chairman and the six Divisions are headed by Member Directors. BARC has no mandate to conduct research. It is mandated to coordinate the research activities of the NARS institutes, monitor their research performance, work for increasing their research efficiency, foster linkages of the ARIs with the technology transfer agencies and also ensure that the research output is properly disseminated to the beneficiaries of the ARIs. In additions, BARC works for strengthening the national agricultural capability through research planning, coordination, integration and resource allocation.

Another major responsibility of BARC is strengthening of national research capabilities through contracting donor agencies and maintaining linkages with international agricultural research organizations. One of the most significant works done by BARC is prioritization of agricultural research needs of the country. It needs no emphasizing that the successful implementation of agricultural research programmes commensurate with high research standards primarily depends on comprehensive prioritization of research needs.

BARC also undertakes periodic review of the NARS institutes and also contributes to policy planning issues in the sub-sectoral areas of agricultural research and development e.g. crops, livestock, fisheries etc. Another important function of BARC is to prepare a National Agricultural Research Plan. Such a plan generally identifies the areas of research for short, medium and long term with a scope of periodical updating. The plan is intended to provide a basis for systematic and effective use of the country's resources to not only achieve autarky in food production through pragmatic multi-disciplinary research but also to improve the welfare of the rural poor.

BARC undertakes periodic study to determine the manpower status in agricultural research and initiates manpower development programs for NARS scientists. Such programmes include both local and foreign training leading to MS and Ph.D. degrees as well as post-doctoral programmes in the areas of crops, livestock, fisheries, forestry, agricultural economics, agricultural engineering and related fields. In addition, BARC organizes workshops, seminars and short training programmes.

3.2.2. Bangladesh Agricultural Research Institute (BARI)

BARI is headed by a Director General and is the largest ARI of the country conducting research to increase production of cereals (excluding rice), oilseeds, pulses, fruits, vegetables, tuber crops, spices, palms, nuts and flowers through scientific management of land, water, fertilizers, pests and diseases, development of crop varieties with resistance to biotic and abiotic stresses, development of improved cropping systems for optimizing production, development of tools and machinery to contribute to

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[39] Memento, Agri-Invest 2003, Bangladesh, December 2-3, 2003. Board of Investment (PM's Office)/MoA/SEDF, Dhaka.

productivity of farm labour, testing packages of new and improved technologies on farms and transfer improved technologies to the beneficiaries. Its mandate includes all crops except rice, jute, sugarcane and tea.

BARI has 774 researchers 7 Research Centres, 17 Research Divisions, 6 Regional Agricultural Research Stations (RARS), 26 Agricultural Research Sub-stations (ARS), 12 Farming System Research and Development Sites (FSRDS) and 83 Multi-Location Testing Sites (MLTS) located at different agro-ecological zones (AEZ) of the country.

BARI has well-organized farms, buildings and laboratories needed for carrying out its activities. The institute does not have a formal Extension Division, but has a Training and Communication Wing (TCW) which sometimes arranges training of the scientists, extension workers, farmers and other end-users. Verification of BARI-developed technologies in the farmer's fields by the On-Farm Research Division is the main extension mechanism followed in this ARI. The TCW is understaffed and hence its activities are quite limited.

3.2.3. The Bangladesh Rice Research Institute (BRRI)

BRRI is headed by a Director General, is the country's second largest agricultural R&D agency and focuses on all aspects of rice research including varietal improvement, production technologies, and, technology transfer. So far, BRRI has developed 53 high yielding rice varieties with various improved characters and large number of production technologies. The institute operates with 19 Research Divisions, 3 Support Service Divisions and 8 Sections. There are 9 Regional Stations across the country for different agro-climatic areas for rice production. The Institute employs 238 researchers. In addition to conducting fundamental and applied research on rice for generating basic knowledge as well as evolving improved technologies, BRRI promotes first-line extension services including Adaptive Trials, On-farm Research, Farming System Research, Action/Operational Research and Extension Research.

3.2.4. Bangladesh Institute of Nuclear Agriculture (BINA)

BINA is headed by a Director General. It has 98 scientists in 10 Divisions and six Sub-stations. The institute is mandated to conduct research through peaceful uses of nuclear techniques to evolve improved crop production technologies. The institute has been conducting strategic and fundamental research using nuclear and biotechnological techniques in all aspects of crop agriculture - crops, soils, pests, diseases, soil fertility and for all environmental conditions – drought, rainfed, water-logged, saline, hilly and coastal, for raising sustained productivity and production in harmony with environment. The institute's research programmes are geared to the development of a stable and productive agriculture by evolving new crop varieties using mutation breeding followed by conventional breeding techniques, scientific management of land and water and technologies to improve production and nutritional quality of crops.

3.2.5. Bangladesh Sugarcane Research Institute (BSRI)

BSRI is headed by a Director General and has 67 researchers in different disciplines. The institute consists of 10 Divisions, two Regional Stations, one Quarantine Station and six Sub-stations. This institute conducts research on all aspects of sugarcane production and sugarcane-based cropping patterns. The detailed mandate include development of

high yielding cane varieties for sugar and 'gur' production; having resistance to diseases and insect pest; early, medium and late maturity to accommodate the intensive cropping sequences of major agro-ecological zones; development of improved cultural practices including intercropping and relay cropping patterns; development of improved varieties and cultural practices for minor sugar crops.

3.2.6. Bangladesh Jute Research Institute (BJRI)

BJRI is also headed by a Director General. The institute has three main branches, namely, Agriculture Research, Technological Research and Marketing & Economic Research. It has 17 Divisions, four Regional Stations and five Sub-stations. The scientists conduct **agricultural research** for improving production of jute and allied fibres as well as **technical research** for diversifying their use in producing new jute products. Marketing and Economic Research includes assessment of economic and social impacts of production, prices and markets. In essence, strategic and fundamental research are being conducted in the institute on all aspects of jute for generating basic knowledge and evolving improved and environmentally sound technologies for raising sustained productivity, production and processing.

Agriculture Research: Major emphasis is to develop short duration and high yielding varieties of both white and tossa jute; white jute varieties with improved fibre quality, short duration varieties of kenaf and mesta and agronomic and protection technologies to shift major cultivation from white to tossa jute.

Technological research: To identify fibre properties required in new varieties that are essential to produce quality products from jute, develop processes and equipment for manufacturing new jute products; provide technical services to manufacturers with emphasis on establishing new jute industries.

3.2.7. Soil Resources Development Institute (SRDI)

SRDI is headed by a Director, and is mandated to carry out a) inventories and survey of soil and land resources, b) demand driven applied research related to soil analysis and land resources, c) soil related services to farmers, d) analysis of soil, water, plant, fertilizer and heavy metals including Arsenic, and e) quality control of soil analytical services done by laboratories of GO/NGOs. It employs 233 researchers and it has two research stations, one is Soil Conservation and Watershed Management Centre (SCWMC) for conducting research in hilly areas about soil erosion and soil conservation and another is Salinity Management Research Centre (SMRC) to select crops and cropping patterns suitable for coastal areas and, to conduct research to identify location-specific agricultural technologies. The Central Laboratory of SRDI is at Dhaka and it has established four Regional and 20 District Branches.

More elaborately speaking, SRDI conducts research on physical, chemical and biological aspects of nutrient management in soils. Studying, inventoring, mapping and interpreting the soil resources of the country for land use planning and management, controlling land degradation and rehabilitating the degraded soil for improving productivity also fall under the institute's declared mandate. It is also providing soil testing and analytical services and rendering Geographical Information Service (GIS).

3.2.8. Bangladesh Livestock Research Institute (BLRI)

BLRI is headed by a Director General and it employs 61 Researchers in 10 Research Divisions and two Regional Stations. BLRI was established with mandates: to identify livestock and poultry production constraints at the national and farm level, to solve those problems through multi- and inter-disciplinary and inter-institutional research and to develop technologies to help food and nutrition security for the increasing population, poverty alleviation, employment and income generation as well as control of environmental pollution.

3.2.9. Bangladesh Fisheries Research Institute (BFRI)

A Director General is the head of BFRI. The institute has 80 researchers and four Stations, two of which is on fresh water fishes, one on brakish water fishes while the fourth one is on marine fisheries. BFRI was established to carry out and coordinate basic and adaptive research for development and optimum utilization of all living aquatic resources; to develop low-cost, less labour intensive, environment friendly improved fish culture and management technologies; to develop technologies for commercially important aquatic products including shrimps; and to develop skilled technical manpower through training and demonstration.

3.2.10. Bangladesh Forest Research Institute (BFRI)

A Director is the executive head of this institute. About 70 researchers are working in the institute. Major objectives of the institute are to optimize forest productivity in hills, plains, villages and costal areas through the application of technology and to alleviate poverty; provide research back-up to forestry and agroforestry in waste and marginal land for optimum and sustainable utilization; rational utilization of forest produces through the application of technology; help in conservation of biodiversity and environmental balance in national and rural forests. BFRI (Forest) conducts applied and adaptive research through 17 Research Divisions under two branches, Forest Management Branch and Forest Products Branch. The Forest Management Branch comprises 11 Research Divisions, viz, Silviculture Research, Silviculture Genetics, Mangrove Silviculture, Plantation Trial Unit, Forest Economics, Seed Orchard, Forest Inventory, Soil Science, Forest Protection, and Minor Forest Products. There are 21 Research Stations in different parts of the country based on dendro-ecological conditions. The Forest Products Branch includes six Research Divisions like Woodworking and Timber Engineering, Seasoning and Timber Physics, Wood Preservation, Pulp and Paper, Veneer and Composite Wood Products and Forest Chemistry.

3.2.11. Bangladesh Tea Research Institute (BTRI)

BTRI is headed by a Director, has three major Research Departments and three Sub-stations. BTRI focuses on the development of high yielding tea varieties and improved production technologies. Various research programmes are conducted by 21 researchers. In addition, the institute has collaborative research programmes with other research institutes and universities.

4. STATUS OF AUTONOMY AND THE GOVERNANCE OF THE NARS ORGANIZATIONS

4.1. Status of autonomy

The BARC, BARI, BRRI, BINA, BJRI, BLRI, BFRI (Fisheries) & BSRI are autonomous organizations, BFRI (Forestry), BTRI and SRDI are run as Government departments (Table 1). The former eight organizations are autonomous partially since these are administered by most of the rules and regulations followed by Government departments. On the contrary, the employees of these organizations are deprived of some benefits like pension, recreation leave with one month's pay etc. enjoyed by those employed in Government departments.

4.2.Governance of the institutions

As far as the governance of the NARS organizations are concerned, there are many non-uniformities among them. The governance systems of these agencies are described below:

4.2.1. Governance of BARC: BARC is governed under the guidance of a Governing Body (GB) (Bangladesh Agricultural Research Council Act, 1996)[40]**.**

The Governing Body of BARC is composed of the following members:

(a) Minister-in-Charge of the Ministry of Agriculture, ex officio, who shall also be its Chairman;

(b) Minister-in-charge of the Ministry of Fisheries and Livestock and Minister-in-Charge of the Ministry of Environment and Forests, ex officio, who shall also be its Co-Chairmen;

(c) Two Members of Parliament nominated by the Speaker;

(d) Executive Chairman, BARC ex officio;

(e) Member (Agriculture) of the Planning Commission, ex officio;

(f) Secretaries of the Ministries of Agriculture, Fisheries and Livestock, Environment and Forests and Commerce, ex officio members;

(g) Vice Chancellor, Bangladesh Agricultural University, Mymensingh, ex officio;

(h) Two officers, one from Finance Division, Ministry of Finance and one from Ministry of Establishment not below the rank of Joint Secretary to be nominated by the respective Ministry / Division;

(i) Director General of Department of Agricultural Extension, Directors of the Directorate of Livestock Services, Department of Fisheries, Director of the Department of Environment and Chief Conservative of Forest, ex officio;

(j) Three eminent scientists to be nominated by the Chairman from the areas of crops, livestock, fisheries, forestry, environment, natural resources or from social science or any other related area who are not serving full time at any of the

[40] Act No. 7, 1996, Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

institutes of the system;

(k) One ideal farmer, one representative from the agricultural business community; one representative from the NGOs involved in agricultural research, development and extension to be nominated by the Chairman.

Explanation: (1) The Ministry or Division dealing with agriculture mentioned in clause(a) and (f), member dealing with agriculture mentioned in clause(e) and Directorate of Agriculture Extension mentioned in clause(j) shall mean the concerned Ministries or Divisions, Member and Directorates, respectively.

(2) No act done by the Council shall be invalid on the ground merely of the existence of any vacancy or defect in the constitution or the composition of the Governing Body.

Direction and administration of BARC

(1) Subject to the provisions of the BARC Act 1996, the general direction and administration of the affairs and functions of the Council vests in the Executive Council (EC) which exercises all powers and performs all functions as may be exercised or performed by the Council.

(2) The Executive Council, in discharging its power and functions, is responsible to the Governing Body and follows the instructions as is given to it by the governing body from time to time.

The Executive Council of BARC is composed of the following members, such as:

(a) Executive Chairman, ex officio; S/he is also the Chairman of the Council.

(b) Member Directors, ex officio;

(c) Chief Executives of Institutes by whatever designations they may be called, ex officio;

4.2.2. Governance of the ARIs

As far as the governance of the ARIs are concerned, there are multifarious anomalies among the respective Acts passed for these institutes in 1996. The most common governance feature of the ARIs is a "Board" for each, which is the highest authority for general direction, administration and supervision of the affairs of the Institutes. The 'Board' may exercise all powers and do all acts and things that may be exercised or done by the Institutes.

The foremost anomaly is on the nomenclature of the Boards, adversely affecting the autonomy of the institutes. BARI, BRRI, BINA, BJRI and BLRI have Boards of Management (BoM). The Directors General of the first four of these ARIs are Chairmen of the Boards of Management of the respective ARIs[41, 42, 43,44]. The Chairman of the Board

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41 Act No. 11, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

42 Act No. 5, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

43 Act No. 4, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

of Management of BLRI is the Minister-in-charge of the Ministry or Division dealing with fisheries and livestock[45].

On the other hand, BSRI and BFRI (Fisheries) have Boards of Directors (BoD), and the Chairmen of these Boards are, respectively, the Minister-in-charge of the MoA and the Minister-in-charge of the Ministry or Division dealing with fisheries and livestock i.e. MOFL [46,47].

The BTRI, BFRI (Forestry) and SRDI are run as Government departments and hence not much variation is visible among these ARIs.

The Boards of Management of BARI, BRRI, BJRI and BINA have similar compositions. The constitution of the BoM of BARI is presented below as a sample for these group of ARIs.

The BoM of BARI

Constitution of the Board:

(1) The Board shall consist of the following members, namely:-

(a) the Director-General, ex officio; who shall also be the Chairman;

(b) two eminent scientists, one in any social science and the other in the field pertaining to the specialty of the Institute, from outside the Institute to be nominated by the Ministry or Division dealing with agriculture;

(c) a representative of the Council to be nominated by it;

(d) a representative of the Department of Agricultural Extension, not below the rank of Director, to be nominated by the Ministry or Division dealing with agriculture;

(e) the Directors of the Institute, ex officio;

(f) two senior scientists of the Institute; to be nominated by the Ministry or Division dealing with agriculture;

(g) two representatives, one from among the farmers and the other from among the Non-Government Organizations (NGOs) performing functions similar to those of the Institute, to be nominated by the Ministry or Division dealing with agriculture; and

(h) two representatives, one from the Ministry or Division dealing with agriculture and the other from the Finance Division of the Ministry dealing with finance, not below the rank of Deputy Secretary, to be nominated by the respective Ministry or Division,

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44 Act No. 8, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996, Bangladesh National Parliament, Dhaka.

45 Act No. 9, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

46 Act No. 11, 1996; The Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

47 Act No. 10, 1996; Bangladesh Gazette (Extraordinary), August 17, 1996; Bangladesh National Parliament, Dhaka.

(2)The Director-in-charge of Administration of the Institute shall act the Secretary of the Board

The slight variations in the BoMs of other institutes are as follows:

(1) BINA has two additional members in its BoM, e.g.

(a) A representative of the Bangladesh Atomic Energy Commission, not below the rank of Director, to be nominated by that Commission, and

(b) The Dean of the Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh, Ex officio;

(2) BJRI has four additions namely

(a) One eminent technologist in the field of jute products, to be nominated by the Ministry or Division dealing with jute;

(b) A representative of the Bangladesh Federation of Chambers of Commerce and Industries, to be nominated by that Federation;

(c) A representative of the Bangladesh Jute Mills Corporation, not below the rank of Director, to be nominated by the Ministry or Division dealing with jute;

(d) three representatives, one from each of the Ministries or Divisions dealing with agriculture, finance and jute.

On the other hand, the three ARIs viz. BLRI, BFRI (Fisheries) and BSRI having Ministers-in-charge of the Ministry or Division dealing with the specific commodities relevant to the institutes as Chairman of the BoM, have more or less similar composition of their Boards. The constitution of the Board of Directors of the Bangladesh Fisheries Research Institute is presented below as a sample for this group of ARIs:

The BoM of BFRI (Fisheries)[48]

The Board shall consist of the following members, namely:

(a) Minister-in-charge of the Ministry or Division dealing with fisheries and livestock, who shall also be the Chairman of the Board, ex officio;

(b) Two Members of Parliament nominated by the Speaker;

(c) Secretary of the Ministry of Division dealing with fisheries and livestock Division, who shall also be the Vice-Chairman of the Board, ex officio;

(d) Secretary of the Finance Division of the Ministry dealing with finance, ex officio;

(e) The Chief Executive of the Council, ex officio;

(f) Vice-Chancellor, Bangladesh Agricultural University, ex officio;

(g) Member (Agriculture), Planning Commission, ex officio;

(h) Director-General, Department of Fisheries, ex officio;

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48 The Bangladesh Fisheries Research Institute (Amendment) Act, 1996 (Act No. 10, 1996), Bangladesh Gazette (Extraordinary) August 17, 1996: Bangladesh National Parliament, Dhaka

(i) two persons to be nominated by the Government from among persons engaged in research activities in the Institute;

(j) two persons to be nominated by the Government from among persons having interest in fisheries development; and

(k) Director-General of the Institute, who shall also be the Secretary of the Board.

The only exception out of these three ARIs is the BSRI. The composition of the Board of Directors of this ARI has three additions as members, e.g.

(1)Secretary of the Ministry of Industry,

(2)Chairman of the Bangladesh Sugar and Allied Food Corporation,

(3)Two Seed producing farmers, to be nominated by the Government.

4.2.3. Governance of the NARS ARIs vis-a-vis BARC

It is clear from the above mentioned description that seven out of the ten ARIs have independent Acts as well as separate Service Rules. It is interesting indeed to note that BARC, through its Act 1996, has been given responsibility for carrying out all sorts of activities for promotion of research through 10 ARIs but seven of the latter organizations are governed by their own Acts and Service Rules while three are fully government Departments.

Acts of six out the seven autonomous ARIs include a clause like, "Certain directions, etc. of the Council (BARC) given effect to – Notwithstanding anything contained in this Act, the Institute or any of its functionaries shall, in relation to the affairs of the Institute, ensure that:

(a) Any direction issued by the Council (BARC) under or in pursuance of the provision of section 8 or 14 of BARC 1996 (Act No. 7 of 1996) complied with; and

(b) Any recommendation or determination made or advice given by the said Council (BARC) under or in pursuance of the said provisions is given effect to.

(c) Provided that where, in the opinion of the Institute, it is not possible to give effect to such recommendation or advice or any part thereof-

(i) the Institute shall, without delay, communicate its opinion with reasons therefor to the Council; and

(ii) the Council may, after consideration of such opinion, modify or revoke its earlier recommendation or advice, or may issue fresh recommendation or advice on the same subject.

Provided further that the recommendation or advice so modified or issued afresh, as the case may be deemed to be a direction under clause (a) and shall be complied with accordingly.

The only exception to this kind of allegiance to BARC is BSRI because the Act of BSRI does not contain this clause at all. In other words, BSRI is not bound to comply with the request/advice/order of BARC.

The governance of BARC is directed by the BARC Act 1996. This Act provides for certain directions to administer the Council which are detailed in the following chapter.

5. ROLE OF BARC IN RESEARCH MANAGEMENT AND ITS COORDINATION MECHANISM

5.1. Research management by BARC

The passage of the Bangladesh Agricultural Research Council Act 1996 has expanded its role in terms of research management to a considerable extent.

1. The objectives of the Council are to undertake research in different areas of agricultural science through the institutes and associate Institutes, by coordinating, planning, monitoring and evaluating the agricultural research programme undertaken by them.

2. With a view to carrying out this purpose, BARC has been authorized to perform the following functions:

(a) Identify and prioritize, the areas/topics of agricultural research, keeping in view of the national agricultural policy (NAP).

(b) Formulate such essential agricultural research plans as would provide the institutes appropriate dimensions in their research programs.

(c) Advise the government in respect of the problems and prospects of agricultural research and about use of the external assistance in the Agriculture sector.

(d) Examine, evaluate and recommend the research proposals of the institutes to be funded through their own research budgets before being placed in the Board Meeting.

(e) Examine, evaluate and approve the budgets of such research proposals and its execution process as would be carried out by any institute or associated institute on the basis of assistance given by the Council either in the form of contract or any other mode(s).

(f) In order to ensure that the standard of research quality is maintained, the Council has been entrusted to perform the following activities:

(i) Monitor the progress of research activities of each institute as per schedule set in the approved research programmes and proposals;

(ii) Appoint external panel of experts to review the targeted research programmes and accomplishments of each institute and associate institutes at an interval of every five years;

(iii) Review from time to time the research programmes and accomplishments of each institute by internal panel of experts.

(g) Establish and operate new research institutions, research centres, research stations, information centre, museum, herbarium, germ-plasm and plant introduction centres and assist other organizations in setting these up.

(h) In order to give appropriate shape to the system, advise the government or the relevant institute, as the case may be, in respect of rationalizing the number, location and scope of research stations or research centres, library, information centre, museum, herbarium, germ-plasm and plant introduction centres and other establishments.

(i) Monitor the transfer of agricultural technology at the field level and take timely steps and, where appropriate, advise the concerned authority to remove the bottlenecks in the dissemination of research findings and technology and their application and use at field level by the Institutes and Associate Institutions.

(j) Subject to the provisions of this Act, determine the terms and conditions of employment of the staff and officers of the Council.

(k) Undertake necessary steps for higher studies and training in agricultural research and technology for officers and staffs of the Council, Institutes and Associate Institutes.

(l) Determine, in the light of the government policy, the need for participation in international conferences, seminars and workshops by scientists of Council, Institutes and Associate Institute and take necessary steps.

(m) Maintain contact with agricultural research institutes or agricultural research organizations of other countries to ensure the effectiveness and utility of their innovations and equipments in Bangladesh agriculture through rapid testing, adaptation and use.

(n) Carry out ex post evaluation of all research projects and other activities of the Institutes and, in appropriate cases, of Associate Institutes and give them necessary advice and direction.

(o) Take any other action or actions as may be required to accomplish the above acts and to give effect to the purpose of this Act.

5.2. Research coordination by BARC

BARC, as the apex body of the National Agricultural Research System (NARS), is responsible for reviewing and coordinating the research agenda of the ARIs, establishing national research priorities and strengthening research capabilities of ARIs.

The co-ordination mechanism of BARC is simultaneously a complex and a challenging one. BARC has an over-arching role over the ten ARIs but the institutes fall under the jurisdiction of four different ministries (ref. section under NARS institutes). The coordinating role of BARC is made challenging by the fact that the annual research programmes and budgets of the NARS institutes are reviewed by the Executive Council of BARC, while the financial resources are disbursed to the ARIs from the Ministry of Finance (MoF). Moreover, coordination of research of the NARS institutes by BARC is constrained in a number of ways, viz:

(1) The autonomous institutes of NARS are functionally scattered under different ministries and are managed under individual Acts and independent Service Rules.

(2) Review of ARIs' research agenda has absolutely no linkage with the fund allocation by the Ministry of Finance.

(3) The human resource management of the ARIs, both scientists and para-scientists is a function of the individual institutes. Appointment, promotion and transfer of the scientific and para-scientific manpower are carried out within the institutional boundary, and,

(4) The research facilities and infra-structures of each individual institute viz. Regional Agricultural Research Stations (RARS) and Research Station (RS) are independently managed by each institute. This system limits the right of common and rational use of these facilities by the NARS institutes. This practice is a wasteful duplication of wealth as well as managerial rigidity of counter productive nature.

5.3 Prospects, challenges and weaknesses of BARC

The enormous potential of BARC in improving the quality and quantity of research across NARS could not be fully accomplished due to myriads of inherent weaknesses and daunting challenges in the system described in the foregoing section. At present over 2000 scientists belonging to ten ARIs are working for the NARS. Several Universities and NGOs and Public/Private Research Centres BIDS, CPD, BRAC etc. are also conducting research on diverse agricultural problems on a very limited scale. Large number of research institutes coupled with modest number of equipments and other facilities have created enormous opportunities for a rapid progress indeed. But the expected development has not yet been achieved.

The inherent limitations and weaknesses of NARS have not been improved or removed substantially although a series of Office Orders, Ordinances and Acts have been formulated and implemented for BARC and ARIs. Even the much adored last Act of BARC (Act No. 7 of 1996) has genuine limitations to fulfill the desired changes required in the organizational structure of NARS. Many reports, specially the Implementation Completion Report of the World Bank-funded Agricultural Research Management Project (ARMP)[49] bears testimony to the importance of addressing the unfinished agenda like institutional reforms including governance and autonomy of the NARS institutions, their unification under one ministry,[50] funding mechanisms and sustainability of funding for research.

While reviewing the Acts of ARIs it has been discovered that the Acts of at least six ARIs (BARI, BRRI, BJRI, BINA, BLRI and FRI) there is some kind of BARC's authority over these ARIs. BSRI, though autonomous, its Act does not include the clause of allegiance to obey BARC's directions or advice. But on the other hand, three of the 10 ARIs viz. BTRI, BFRI (Forest) and SRDI being as good as Government Department, have very little to offer to the unified and joint effort of BARC and six other ARIs to technology generation and dissemination.

Lastly, there is no provision for establishing accountability by BARC in case of non-compliance by an ARI which is pledge-bound to comply with or give effect to any direction or recommendation issued by BARC. Therefore, the four ARIs (BFRI-Forest, BTRI, BSRI and SRDI) not bound by that clause have complete freedom to neglect any direction or recommendation of BARC. Absence of some kind of administrative as well

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49 Shaikh, M.A.Q. (Team Leader) *et al.* 2001. Consulting Report on Preparation of Implementation Completion Report, Agricultural Research Management Project (ARMP), Bangladesh Agricultural Research Council, Dhaka.

50 Shaikh, M.A.Q. 2001. The need for administrative reorganization of the Ministry of Agriculture and re-orientation of its related components for improving food production, Bangladesh Agriculture 1(1): 60-64.

as financial control of BARC over the ARIs of the NARS has remained to be the weakest issue in its entire endeavor of research management and improvement, thereby curtailing its potential and efficiency to a great extent.

The above analysis emphasizes the rationale for reformulation of the BARC Act 1996 for improving the coordination mechanism of research by BARC through a divergent group of agricultural research institutions belonging to four different ministries and having different governing systems. It can be envisaged that the amended BARC Act would facilitate introduction of some dramatic reforms including rationalization of organizational structure, uniform administrative and financial rules, uniform service rules for the NARS scientists and strengthening of BARC itself.

5.4. Decentralization of authority across the NARS

Decentralization of authority so far has been most minimal indeed. The rules and regulations of the Government are still prevailing upon BARC as well as the ARIs. As mentioned earlier, the four out of seven institutes viz. BARI, BRRI, BINA and BJRI, are somewhat more "autonomous" than the other three i.e. BLRI, BSRI and BFRI (Fisheries). This is because the BoMs of the former four ARIs are chaired by their Directors General and the BoMs have been authorized to provide direction for internal management of these institutes within the framework of their Acts, Service Rules and budgets. The extent of decentralization of authority enjoyed by this group of ARIs can be described as the maximum in the NARS.

The presence of Ministers as Chairmen in the BoM meetings of the other three "autonomous" ARIs viz. BLRI, BFRI (Fisheries) and BSRI amptly demonstrates the curtailment of decentralization. Government control is manifested clearly in the overall management of these ARIs. Since BTRI is run under the directions of the Tea Board, decentralization in this ARI is highly limited. BFRI (Forest) and SRDI are Government Departments and hence decentralization of authority is almost absent in these ARIs.

Decentralization of authority in case of BARC is also limited. The Executive Council (EC) of BARC in discharging its power and functions is constantly responsible to the Governing Body of BARC and follows the instructions as is given to it by the latter body from time to time. In fact, instruction of the GB is very much binding upon the EC to implement because GB is the highest decision-making body and EC is the executing and implementing authority.

Financial decentralization for the ARIs is even more strict. The autonomous and the 'pure' government ARIs are managed strictly following the regulations specified in the governmental financial rules. Financial autonomy of these autonomous ARIS are confined to the authority of allocating fund to their organs like RARS, RS etc. Spending and auditing are strictly governed by the rules and regulations existing in the Government departments.

The foregoing analysis delineates the state of centralization of management in vogue across the NARS. The situation with each of the ARIs is also dismal. For example, the spans of control of Director General of BARI and those of Director (Research) are very

large, very much unmanageable.[51] The latter does not have any financial authority. Scientists approach Director (Research) for technical purposes and for financial to DG and others. Duality of control of this sort is present across all the organizations of NARS with minor differences. The picture remains the same down the line; the Heads of Divisions also have very little financial authority. Thus, the system of rigid centralization, lack of adequate delegation of authority and, above all, the duality of control have created a critical kind of management problem.

6. MODE OF RESOURCE ALLOCATION BY GOB AND, INVOLVEMENT OF BARC IN RESOURCE ALLOCATION AND INSTITUTE MANAGEMENT

6.1 Financial resource allocation

Financial resource allocation for the NARS institutes and that of BARC is done following the same old fashion as before liberation. The mode of resource allocation to the autonomous ARIS is as follows:

6.1.1 Revenue Budget

Revenue Budget is prepared by the authorities of each ARI and is sent to the MoA, where the budget is generally reduced to some extent. The MoA sends the budget to the Ministry of Finance where it is further reduced. In fact, there is no hard and fast rule about financial resource allocation. The MoF, depending on the financial situation of the country in a particular year, decides whether the revenue budget for the various agencies of the Government would increase over or decrease from the previous year's budget. The rise or fall of the revenue budget is indicated by a certain percentage point. "The revenue budget this year will rise/fall by 10%". This sort of direction becomes applicable to the revenue budget of all the public sector agencies. The research agency heads are used to hear such statements in the yearly budget meetings in the MoF.

For the last few years, however, a lump sum amount is allocated for research to each of the NARS institutes including BARC over and above their revenue budget. It is clear that financial allocation is not dependent on the volume of work or quality of performance i.e. achievement of an ARI. But it is only logical that the budget of a research institute should be fixed on the basis of its research programme and performance as well as national priority.

In fact, it is astonishing that there is no column for "Research" in the format of the MoF. There is provision for allocating fund for salary, contingency, fuel etc but to allocate money not for "research". The best way, of course, would have been to allocate block grants to BARC. BARC, in turn, would allocate fund on the basis of the priority, volume and quality of research programmes.

At present, linkage of research review at BARC and research fund allocation by Ministry is virtually absent. Since the annual research programmes and budgets of the NARS institutes are reviewed by the Executive Council of BARC, financial resources should also be disbursed to the ARIs by BARC instead of the Ministry of Finance.

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[51] Prasad, C. 2001. Consultancy Report on Review of the NARS Governance and Effectiveness of NARS since 1996 Act, Bangladesh Agricultural Research Council, Dhaka

6.1.2 Development Budget

Development budget is prepared by an ARI if these is a need for starting a new programme of research requiring extra manpower, equipment, facilities, fund etc. The institute is required to send it to the MoA. The MoA, after scrutiny sends it to the Planning Commission/External Resources Division (ERD). The project is further evaluated at the ERD and finally passed in the Meeting of the Executive Committee of National Economic Council (ECNEC). The Development budgets are for a specific period of time (4-5 years) and stops at the end of the Project. Sustainability of research, if needed, or the management and utilization of the developed technology often becomes a problem due to non-availability of fund.

6.2 Human resource allocation

Each organization has an organogram of its own which has been approved after thorough scrutiny by various Ministries like MoA, MoF, Ministry of Establishment etc. A long process of scrutiny and approval is followed after an ARI submits requirement of additional manpower. These are called revenue posts. On certain occasions, posts are created in the revenue head to accommodate the personnel of a terminated Project. This also requires a long and arduous struggle like creation of new revenue posts in ARIs.

6.3 Logistics, equipments, infrastructures and facilities

Allocations for vehicles, equipment, infrastructure development and creation of new facilities are normally obtained through inclusion of these items in development projects.

The sub-section (d) of section 8 (objectives and functions of the Council; BARC Act 1996) specifics that "the Council shall examine, evaluate and recommend the research proposals of the institutes to be funded through their own research budget before being placed in the Board Meeting. On the other hand, BARC is authorized to examine, carry out technical evaluation and approve the budget of such research proposal and its execution process as would be carried out by an institute on the basis of assistance given by the Council either in the form of contract or any other mode. But involvement of BARC in the allocation of these items is almost nil indeed.

6.4 Research scientists of NARS (Number and Educational Qualifications)

Bangladesh NARS can boast of quite a large number of highly qualified scientists in the apex body BARC and the ten ARIs under its umbrella. However, many of the scientific posts have remained vacant due to non-employment in due time and exodus of scientists to foreign countries resulting from minimum prospects of career development through higher degree specialized training and lack of timely processing of promotion cases.

Institute-wise number and the educational attainment of the NARS scientists are shown in Table 2. It is discernible from the table that there is a provision for 1808 scientific posts, in the whole of NARS, while 1423 are in employment now. About 20% of the positions i.e 385 are lying vacant. Since agricultural research requires a joint effort of a group of scientists to solve a particular problem, vacancy in scientific posts have been counteracting the process seriously.

Secondly, out of the existing 1423 scientists, only 343 are having Ph.D. degree. In other words, only about 24% of the scientists have Ph.D. degree, indicating significantly

lower educational attainment of the NARS scientists. Quality of research output is bound to be negatively affected if the situation is not improved through meticulous planning and implementation of a modest human resource development programme for the NARS within a short period. Embarking upon an immediate programme for filling up the vacant posts, providing higher degree as well as giving promotion to the deserving candidate is an over due issue.

Table 2. Institute wise number and educational attainment of scientists

Organization	Chief Scientific Officer, (CSO)/ Chief Res. Officer (CRO)			Principal Scientific Officer, (PSO)/ Divisional Officer (DO)			Senior Sci. Officer (SSO)/Sr. Research Officer (SRO)			Scientific Officer (SO)/Research Officer (RO)			Total Scientists			No. Scientists having Ph.D. degree
	Prov.*	Ext*	Vac.*	Prov.	Ext.	Vac.	Prov	Ext.	Vac.	Prov	Ext.	Vac.	Prov.	Ext.	Vac.	
BARC	16	9	7	24	13	11	14	9	5	10	6	4	64	37	27	19
BARI	24	24	0	87	70	17	236	226	10	351	317	34	698	637	61	125
BRRI	22	18	4	41	36	5	93	78	15	77	54	23	233	186	47	69
BJRI	11	9	2	31	23	8	46	34	12	56	48	8	144	114	30	19
BINA	12	5	7	18	17	1	25	16	9	36	32	4	91	70	21	35
BSRI	16	6	10	26	22	4	23	14	9	46	25	21	111	70	41	12
BFRI (Fisheries)	4	4	0	4	3	1	22	17	5	48	40	8	78	64	14	26
BLRI	5	3	2	5	4	1	17	10	7	26	19	7	53	37	16	13
SRDI	4	0	4	19	12	7	41	29	12	134	90	44	198	131	67	12
BTRI	3	3	0	7	6	1	10	2	8	15	13	2	35	25	10	4
BFRI (Forests)	2	0	2	19	13	6	27	13	14	54	26	28	103	52	51	9
Total	119	81	38	281	219	62	554	448	106	853	670	183	1808	1423	385	343

*Reconstructed from: Siddiq, M.A. 2009. Consulting Report on Enhancement of Research Institutional Efficiency: Human Resource Development Plan: 2009-2025, PIU, National Agricultural Technology Project, BARD, Dhaka * Prov. = Provision, Ext=Existing; Vac=Vacancy*

6.5 Reforms for enhancing efficiency

BARC, to fulfill its mandate, organizes review of the ARIs through formation of Review and Evaluation Committees for each. The last such review and evaluation has been carried out during 2000-2001. The reforms suggested by the Committees are not uniform across the ARIs. The main suggestions include: Reforms in mandate, organogram, changes in staff structure, research priority, human resource management (HRM), human resource development (HRD) dissemination of developed technologies etc.

6.6. Investment trend in agricultural research (Total, Capital, Operational and donor support)

Investment trend in agricultural research in the recent past has been rather erratic. A review of the yearly budget of the ARIs of NARS for the period 2006-07, 2007-08 and 2008-09 reveals very little difference from year to year except increases for BARI, BRRI and BJRI. The investment trend during the last three years for the ARIs like BARI, BRRI, BJRI, BSRI and BFRI (Forest) are presented in Table 3 as examples.

Sporadic increase in capital and operational budgets of some ARIs in certain years do not show any continuous positive or negative trends in any of these heads. Similar is the case for donor support trends. The situation reveals the lack of the realistic, sustainable and systematic supportive investment trend in the whole agricultural research sub-sector of the country.

Table 3. Investment trend in some selected Agricultural Research Institutes of the Bangladesh NARS.

(In lakh Taka)

Institution	Year	Total budget (Tk.)	Amount of Tk. as		
			Capital	Operational	Donor support
BARI	2006	8505.00	5160.00	3345.00	00
	2007	11346.00	7128.00	4218.00	50.00
	2008	17002.90	5164.00	11838.90	75.00
BRRI	2006	2376,40	492,00	1874.40	-
	2007	2682,19	651.70	2030.49	-
	2008	2848.73	302,85	3545.49	-
BJRI	2006	1405.48	121.84	1288.64	-
	2007	1825.62	294.95	1530.67	-
	2008	1774.74	311.06	1463.68	-
BSRI	2006	1084.02	846.53	-	166.49
	2007	1108.71	955.54	-	153.00
	2008	106329	993.29	-	70.00
BFRI (Forest)	2006	970.00	-	970.00	29.76
	2007	1230.95	7.00	1223.95	46.94
	2008	1199.19	1162.25	3694.00	23.40

Source: Directors/Officers-in charge of these 5 institutes

7. INSTITUTIONAL GOVERNANCE (RESEARCH MANAGEMENT AND GOVERNANCE AT THE ARI LEVEL)

7.1 Sources of administrative regulations

It has already been mentioned that 6 ARIs out of the ten are autonomus organizations. The internal governance of these ARIs is conducted following the doctrines enshrined in the "Bangladesh Service Rules (BSR)". These rules are, to some extent, modified ones inherited from the British and Pakistan periods. The highest policy making authority of the ARIs is either the Board of Management or Board of Directors already described under 4.2.2.

7.2 Method of priority fixation of research

Priority fixation of research at the ARIs, in general, is carried out on the basis of the national priority as well as the needs and problems faced by the farmers in various parts of the country.

The national priorities are gathered from the NAP and from the priority list prepared by BARC at certain intervals through workshops etc. Priority fixation at each ARI is finalized through workshops/discussion meetings involving its Heads of Divisions and Senior Scientists and other stakeholders like representatives from DAE, Ag-University, BARC, other ARIs and NGOs.

The need based and problem oriented priorities are identified mainly from experience gathered by the institutes scientists from their efforts in Adaptive and Action Research/Demonstrative research. The latter type of research, as is well-known, is conducted with a view to (i) promoting the technologies as well as (ii) gathering the scientific or methodological feed backs.

7.3 Research planning process

Research planning process in the ARIs is, in general, an annual exercise. The process involves. Research Review Meetings (RRM) where representatives from DAE, BARC, NGO, BADC etc are invited[52]**.** At BARI a two-tier system is followed. Such meetings are first held at the Regional Agriculture Research Stations (RARS). The Annual Research Programmes thus chalked out is presented at the Central Research Review Meeting (CRRM) held the Headquarters. Scientists from NARS institutes, universities, BARC, DAE, BADC and MoA are invited in the CRRM. But, regrettably, personnel of some of these organizations, specially BARC, DAE, BADC and MoA remain absent from many of the CRRMs**.**[53]

Long term research planning (e.g. Five Year Research Plan) in almost all the ARIs are carried out following more or less the same procedure. The process, essentially includes threadbare discussion at each ARI about the national and location-specific priorities as well as the demands of the farming community articulated by the DAE staff.

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52 Proceedings of a joint workshop involving Director (Research)/Teacher/Officer in Charge of Research of ARIs and Universities responsible for research Planning and Management held at SAARC Agriculture Centre, Dhaka in October, 2009.

53 Rahman, M.L. (Team Leader), 2001. Review and Evaluation Report of Bangladesh Agricultural Research Institute, Vol. I. Main Report, Bangladesh Agricultural Research Council, Dhaka.

The discussants include representatives from BARC, DAE, BADC, Ag- Universities, and, on some occasions, farmers and NGO personnel. The draft Five Year Plan is then submitted to BARC for approval. The draft plan is reviewed at BARC and is approved with some modifications.

7.4 Management of outreach programmes/installations

There is no uniformity among the ARIs about the outreach installations in terms of their nomenclature and the designations of the incharges heading them. The names of the outreach installations across the NARS include: Regional Agricultural Research Stations (RARS), Research Stations (RS), Research Sub-Stations (RSS), Multi-Location Trial Sites (MLTS) etc. Rank of scientists heading these establishments range from Chief Scientific Officer (CSO), Principal Scientific Officer (PSO), Senior Scientific Officer (SSO) and even Scientific Officer (SO) depending on their size, experimental capacity, infrastructure and, number of scientists and other staff employed in the establishment. Scientists of various disciplines are deputed there.

Budgets for the establishments are determined from the headquarters and the funds are allocated quarterly in a year. The expenditure is audited regularly in each quarter by the Accounts Division of the concerned ARIs. Performance evaluation of the scientists and other staff are done as well as their casual leaves are granted by the Head of the establishment.

7.5 Performance evaluation (individual scientist)

Performance of each individual scientist is evaluated through filling up the proforma of Annual confidential Report (ACR) at the end of each year. The format has been developed by GoB and all ARIs utilize the same format for evaluating an individual scientist. The format has many objective type of points rather than subjective ones.

The points for judging the performance of a scientist include degree i.e. MS/Ph.D. research capability, devotion to work, seriousness, publication etc. Obviously, it is difficult to provide proper weightage against some of the objective issues. Individual liking or disliking may, at times, influence the superior officers' judgement. The format needs improvements to accommodate more subjective issues.

7.6 Leadership development

The ARIs normally do not have a tradition of leadership development. Normal promotion to higher posts, assignment to special jobs etc help in bringing out the latent qualities for leadership in a scientist. Obviously, this is a significant shortcoming of the ARIs.

7.7 Private sector involment/partnership with ARIs

Private sector (PS) involvement in agricultural research in the country has not flourished as much as in some other developing countries of the region[54]**.** Very recently, a few PS companies producing agricultural inputs like seed, organic and mixed fertilizers

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54 Farouk, S.M., Shaikh, M.A.Q., Hassanullah, M, Elias, S.M., Awal, M.A. and Zaman, W. 2003. Consulting Report on, "An Alternative Support System for Agricultural Technology Generation and Dissemination, Department for International Development (DFID) (UK), Dhaka.

and others processing agricultural products have been producing and promoting some new knowledge/technologies.

In fact, PS is more/or only in the service sector with obvious interest of making money. On the other hand, NGOs are neither generating much knowledge nor producing technologies. They are rather borrowing technologies from the public sector ARIs and disseminating to the end-users. The NGOs carry out demonstration of improved varieties/technologies in the farmers' fields for increasing production of crops, vegetables, livestock, fisheries and forestry[55]. On the policy level, the GoB priorities on agricultural research include development of some research programmes involving NGOs and PS enterprises. Nevertheless, BARI, BINA ad BAU have set examples of forming partnership with NGOs and Private Sector Enterprises (PSE) for research. NGOs like BRAC and PROSHIKA have been producing tissue-cultured seedlings and disease-free potato seeds. Efforts of the PSEs and NGOs can be augmented considerably if joint-venture R & D can be arranged with the ARIs.[56] Introduction of some policy and institutional reforms, introducing rules on their easy access to public sector research products, relaxing procedures to release their new technologies, allowing them intellectual property rights (IPR)[57] and other measures is expected to accelerate PS investment in agricultural research.

A review of more than 100 studies[58] has shown very high rate of returen to investments in agriculture. Efforts to sell the information that investments in agricultural Research Development results in huge success has remained quite minimal in Bangladesh till the recent past. It was made explicit as late as in December 2003.[59] The outcome of such propaganda has shown positive impacts in the recent past.

7.8 Human Resource Development (HRD) (Higher studies/training opportunities and support)

There is no human resource development programme in the individual ARIs. The institutions do not have any funds allocated for the purpose from the GoB. Scholarships are provided by BARC when it gets donor support through projects. The last such opportunity was available when BARC obtained the World Bank supported "Agricultural Research Management Project (ARMP)" which ended in 2001. Each of the ARIs obtained 3-7 scholarships for higher studies leading to Ph.D. degree. Scholarships for

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55 Shaikh, M.A.Q. (Team Leader) et al., 2001. Consulting Report on Evaluation of Agricultural Technology Transfer through GO-NGO/Private Organizations Partnership Project (ATTP), Bangladesh Agricultural Research Council, Dhaka.

56 Shaikh, M.A.Q., 2005. National Scientist, Consulting Report on Crop Sector Development and Diversification in Bangladesh , Research & Extension Component (Chapter 8), Japan International Cooperation Agency (JICA), Dhaka

57 Byerlee, D. and Alex, G.E. 1998. Strengthering National Agricultural Research System, Policy Issues and Good Practices, The World Bank, Washngton, D.C., USA.

58 Evenson, R.E. and M.W. Rosegrant, 1993. Determinants of Productivity Growth in Asian Agriculture, Post and Future AAEA Pre-Conf. Workshop on Post-Green Revolution Agricultural Development Strategies; What Next? July 30-31, Orlando, Fla.

59 BOI/MoA SEDF, 2003. Agri-Invest 2003 Bangladesh, Board of Investment, Prime Minister's Office, Dhaka

obtaining higher training is also highly limited. Some scientists gather foreign scholarships or Assistantships through individual initiatives. Number of such opportunities is meagre indeed. As a result, only 343 out of 1423 scientists of NARS have Ph.D. degree.[60]

It is obvious from the above information that so far, higher education leading to Ph.D. and post-doctoral training have been dealt with utter negligence by the authorities and in a piece-meal manner. Before NATP there was no short-term and long-term national programmes for developing the requisite member of scientists with M.S. and Ph.D. degrees from abroad or from within the country.

Secondly, not all the NARS institutes get equal opportunities for getting the donor-supported scholarships. BINA, a leading and highly successful ARI, was denied any scholarship from the World Bank on the plea that nuclear techniques are being utilized at BINA for agricultural research. The country was deprived of some improved technologies which BINA could have developed. At that juncture of time BINA's contribution was among the top ARIs. It is difficult to understand how the GoB could agree to such a pre-condition when it was taking loan from WB. The GoB should have asked for a clearance from the FAO/IAEA Joint Division for Agricultural Research at the IAEA, Vienna. Intentions of both the donor and the recipient about the issue is not clear. BARC's role in this particular issue is also not beyond criticism. It is suspected that BINA's case was not explained properly by MoA and BARC. After all, the ARMP money was a loan and not a dole that the donor's condition had to be abided by. Contrarily, special arrangements could have been made by the MoA to provide a few scholarships to BINA scientists per year.

Importance of quality staff and quality technicians to generate knowledge and technology through quality research needs no emphasizing. The sooner the GoB realizes this, the better it will be for the country. Under the circumstances, the foremost strategy should dictate the necessity of conducting a thorough assessment of capacity needs for higher education and training in each institute of NARS. This should be followed by formulation and phase-wise implementation of a National HRD Programme.[61] Very recently, BARC has initiated such an assessment through its NATP Project[62]. But the available fund is too meager to meet the huge demand for qualified scientists in view of the urgent research needs to cope with the impacts of climate change as well as globalization effects like trade liberalization, IPR regimes and WTO regulations.

7.9 Research extension linkage

Research-extension linkage has remained significantly weak so far. Some ARIs hold seminars/training workshops etc to impart training and update knowledge of the

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60 Siddique, M.A. 2009. Consulting Report on Enhancement of Research Institutional Efficiency: Development Plan 2009-2025, National Agricultural Technology Project, PIU, BARC, Dhaka.

61 Shaikh M.A.Q. 2010. National Scientist, Sector Report on Knowledge Generation and Management in Agriculture, Formulation of the National Medium-Term Priority Framework (2010-2015) for Bangladesh, FAO, Dhaka.

62 Siddique, M.A. 2009. Enhancement of Research Institutional Efficiency: Human Resource Development Plan 2009-2025, National Agricultural Technology Project (NATP: Phase-1), PIU, BARC, Dhaka.

extension officers about the developed technologies. Some ARIs do not have even technology dissemination Division. Another mechanism of linkage is through attendance of scientists in various meetings like Agricultural Technical Committee (ATC), Research Institute Coordination Committee (RICC) and the National Agricultural Technical Coordination Committee (NATCC) meetings.

Inspite of these efforts dissemination of technologies to the farmers have not been quite smooth.[63] Dissemination of a particular technology depends upon the overall prioritized programmes of the DAE, DLS and DoF.[64] As a result, hundreds of technologies did not reach the end-users.[65]

The existing weak linkage among the trio i.e. Research-Extension-Farmer is a serious problem. This weakness limits the realization of the full potentials of new technologies. The Technology Transfer and Monitoring Unit (TTMU) of BARC was created for facilitation of primary extension. But the TTMU is almost inoperable due to its structural shortcoming as well as lack of human and financial resources. The Unit should be raised to the status of a Division headed by a Member Director and requisite number of specialized extension-oriented scientific staff should be appointed by.[66] Adequate amount of fund should be provided to this newly created Division of BARC alongside logistic and other supports for its proper functioning as a harbinger and an emissary at the same time. In addition, BARC Act should have clearer message for ARIs and DAE/DLS/DoF/DF about BARC's authority in this matter.

7.10 Education (Link with the Agricultural Universities)

The BARC and the 10 ARIs under it have no functional relation with the Agricultural Universities of the country. One and, perhaps, the main reason for this is that the Universities belong to the Ministry of Education. BARC, therefore, has no authority over these universities. If the universities had some kind of accountability to BARC, at least about research fund, then the situation could have been somewhat different. Arrangements can be made by MoA with the Ministry of Education to provide lump sum grant to BARC for financing research in the Agricultural Universities.

Since Universities are considered to be seats of basic research, new ways and mechanisms should be established through partnerships between the ARIs and the universities. Such linkages would facilitate positive impacts on sustainable development through new innovations in the most modern technologies including those in the Biotechnology as well as Information and Communication Technology sectors. The only and the thinnest linkage of BARC with the Universities is through competitive research grants where the latter can bid.

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63 Shaikh, M.A.Q. 2010. National Scientist, Sector Report on Knowledge Generation and Management in Agriculture, National Medium-Term Priority Framework (2010-2015) for Bangladesh, FAO, Dhaka.

64 Shaikh, M.A.Q. 2005. National Scientist, Consulting Report on Crop Sector Development and Diversification in Bangladesh, Chapter 8, Research & Extension Component, Japan International Cooperation Agency (JICA), Dhaka

65 MoA, 2004. Actionable Policy Briefs and Resource Implications, Agriculture Sector Review, Ministry of Agriculture, GoB, Dhaka

66 Shaikh, M.A.Q. 2010 National Scientist, Sector Report on Knowledge Generation and Management in Agriculture, National Medium-Term Priority Framework (2010-2015) for Bangladesh, FAO, Dhaka.

The example of the Indian Council of Agricultural Research (ICAR) is very much pertinent here. ICAR, through over 90 All-India Coordinated Research Projects (AICRP), has research linkage with 28 State Agricultural Universities (SAU) and one Central University. These Universities conduct ICAR-funded research in over 300 Research Stations.[67] By this way, ICAR has been fulfilling its objective number 1, (when it was established as a Society called Imperial Council of Agricultural Research in 1929:

(1) "To undertake, aid, promote and coordinate agricultural and animal husbandry education, research and its application in practice, development and marketing."

Involvement of BARC in funding knowledge generative research in the universities and establishing adaptive research cooperation among the ARIs in the one hand, and universities on the other, is a dire need of the day. In addition, BARC along with the ARIs may take initiative to change the university curricula for accommodating the most important demand led issues of agriculture. Universities may also be requested by BARC to produce a specific number of graduates in a specified discipline for manning a special type of research envisioned for immediate future. Impact of climate change and sea level rise on agricultural production in the country in 1920- may be a relevant issue.

7.11 Linkage with similar research installations

Linkage with similar research installations. Linkage, in other words, cooperation or coordination of one ARI of the NARS with other similar organizations is very limited and even absent in some cases. The most visible linkage among various institutes of NARS is limited to yearly invitation of senior scientists of one institute by another institute in the Annual Review Meeting (ARM). Recently, BARI and BRRI have entered into an agreement called "Rice-wheat consortium" thereby allowing testing of each others materials in their experimental fields. The objective is to develop a production package using the two crops for a profitable end. Collaboration with some NGOs have started in the recent past through signing of memorandum of understanding (MoU) for transfer of some technologies (mainly varieties) of the ARIs by the latter. Some seed companies have also signed MoU with a few ARIs. Linkage among the ARIs through coordination and cooperation would certainly result into better performance of their research endeavours.

7.12 Management Information System (MIS)

A survey of the ARIs with regard to use of MIS revealed different responses from different institutions. MIS is totally absent in some, partially practiced in some and fully practiced in only one e.g. BRRI. All the ARIs mentioned lack of trained manpower and lack of computers as constraints in practicing MIS and expressed positive response to a query whether another round of MIS training course by BARC would be of benefit. It is now upto the policy makers how to address the issue.

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[67] ICAR, 2006. Handbook of Agriculture, Indian Council of Agricultural Research, New Delhi

8. REVIEW/EVALUATION/MONITORING

8.1 Programme review, institutional review and frequency of reviews

8.1.1 Programme Review

The research programmes are reviewed mostly on yearly basis in almost all the ARIs except at BFRI (Forest) where four to six-monthly reviews are also carried out to accommodate the seasonal variations. These reviews are regular phenomena and, in fact, conducted simultaneously with the research planning exercise. Research Programme Reviews review of the institutes are finally sent to BARC Council Meetings where those are approved after thorough discussion.

However, the 5-years Research Programmes are reviewed after every 5 years. The reviewers include Chief scientists of the concerned ARIs, Chief Scientists of other ARIs of NARS, BARC and other stakholders.

8.1.2 Institutional Review

Institutional review is performed after every five years. In fact, one of the mandates of BARC is to review the NARS institutes once after every 5 years. However, BARC can accomplish this task only if it has donor funding through projects. The reason behind this, of course, is fund constraints. Getting an ARI reviewed requires quite a handsome amount of money. The Review Team consists of highly experienced, eminent and very senior retired research scientists of the NARS institutes and teachers of universities. Number of reviewers varies from 5-7 depending on the size of the institute. The review work encompasses the mandate, infrastructure, human resource management and human resource development, funding, auditing, general administration, research programmes, mode of implementation of research programmes, research achievement and transfer of technologies.

8.1.3 Follow up of Review

As a follow up research reviews, the yearly and five-yearly research programmes are modified and updatd. The thoughts, criticisms and recommendations are considered at meetings in the ARIs keeping fund facilities, manpower and scientific advancement under consideration. However, as a follow up of institutional review, very little changes are brought about in the research programmes, administrative mechines and infrastructural readjustments. This is because there is no follow up action by BARC afterwards to ascertain whether the authorities of the institution in question has carried out any changes, reformations etc. Follow up action by BARC should be an in-built mechanism along with the institutional review programme itself. BARC's inaction/inability to take action against an ARI for non-compliance of any recommendation stems from its loose cooperative and coordinating relationship with the ARIs. The situation could have been different if research funds to ARIs would go from BARC instead of the MoA directly.

8.1.4 Monitoring of Research Programmes During Implementation

Most ARIs have regular monitoring programmes to oversee the progress and quality of research carried out in the Central as well as Qutreach Stations. Heads of Divisions and Senior Scientists of the concerned Divisions of the ARI visit the laboratory, greenhouse and field experiments. Number of such monitoring visits vary depending on the commodity of research, season and other relevant considerations. On certain occasions, scientists from BARC and some relevant ARIs are also invited by the concerned ARI in its of monitoring exercises.

As a follow up of monitoring, the scientists involved in conducting an experiment alter the mode of investigation or add or delete a new dimension in data collection and so on and so forth.

9. INCENTIVE STRUCTURE

By definition, 'Incentive structure' means "that which incites to action or inciting as to action; stimulating, provocative etc. In the present treatise, various components of financial and other benefits that are provided to a scientist in lieu of the services rendered to the public sector agricultural research institutions are described.

9.1 Basic salary structure

The Incentive structure includes basic salary, house rent, medical allowance and other benefits. The basic salary scale of Govt. bodies and autonomous bodies are shown in Table -4

Table 4. Basic pay scale of NARS scientists

Post	Scale of pay (TR) (2009)
Scientific Officer	11000 - 20370
Sr. Scientific Officer	18500 - 29700
Principal Scientific Officer	25750 – 33750
Chief Scientific Officer	29000 - 35600
Director (Res.)	33500 – 39500
Director General	40000 (Fixed)

Other benefits like Festival bonus, Recreation leave etc are shown in detail in Table 5.

Table 5. Total incentive structure of NARS scientists compared to some other services in Bangladesh

Organization	Equivalent designation	Salary scale (Taka)	Other benefits				
			House rent *	Medical Allowance	Festival Bonus **	Recreation leave ***	CPF ****
NARS ARIs (Govt. body)	Scientific Officer	11000-20370	40%	500 Taka	Yes	Yes	No
NARS ARIs (Autonomous)	Scientific Officer	11000-20370	40%	500 "	Yes	No	Yes
Agricultural University	Lecturer	11000-20370	40%	500 "	Yes	No	No
DAE	AEO/SMS	11000-20370	40%	500 "	Yes	Yes	No

** 40% of basic pay (If residing in govt. quarters, 7.5% deduction from basic pay*

*** Equivalent to one basic pay for each of the two Eid/Puja or other religions Festivals;*

**** One month's recreation leave with basic pay once after every three years.*

***** CPF = Contributory Provident Fund (10% of the basic pay is deducted from the incumbent and 10% equivalent is deposited by the ARI every month to the incumbent's account.*

9.2 Age of retirement and retirement benefits

Age of retirement of the NARS scientists is 58 years. All of them have to go on Leave Preparatory to Retirement (LPR) from the next day of completing the 57 years of age. During this one year leave period, the incumbent is paid full salary for the first six months and half salary for the rest six months. S/he goes to full retirement from the first day of the 59th year of his/her age.

Retirement benefit differs between the scientists of the autonomous ARIs and those ARIs treated as government organizations. The former group, instead of getting pension, gets gratuity which is calculated on the basis of the total number of years the incumbent has served in the organization (s). The other benefit is "leave encashment". Every employed is entitled to get 20 days earned leave per year. If the relevant employee did not avail the total entitled earned leave during his/her service, financial benefit is given for the number of the unavailing leave days.

The scientists of the ARIs which are treated as government departments get pension as long as they live, including basic salary, medical and festival allowances. The spouse of the deceased incumbent continues to receive pension till death. In addition, in the absence of the spouse, the underage children continue to receive pension till they are 18 years of age.

9.3 Human resource management (Recruitment and Promotion Process)

9.3.1 Recruitment Process

Recruitment process in the NARS organizations is more or less similar. For appointment of scientists, normally advertisement is made in daily newspapers by each

organization. The applications for appointment are first screened by a committee of the institute. The eligible applicants for the posts of scientific officers (entry point) are called for a written examination. Applicants passing the written test are screened again through a viva voce test. The candidates securing the highest marks in the two tests are appointed.

The vacant posts of SSO, PSO and CSO are filled up following a different process. A certain percentage of the vacant posts are filled through promotion of scientists from respective lower grades. The percentage varies from ARI to ARI, normally being 50% through promotion and 50% through lateral entry via a vice voce examination. The viva voce examination for appointment of SSO and PSO are held at of research and administration as well as the Heads of Divisions. The D.G. chairs the interview board meetings. The interview board meetings for appointment of CSOs are chaired by the Executive Chairman of BARC.

The process, on the face value, seems to be transparent but, in reality, it is not so because a lot of outside pressure does exist and very often recruitments are based through such pressures thereby curtailing the very potential of an ARI. A joint and unified recruitment system would pave the way for a clean, transparent and unbiased recruitment of scientists.

The centralized recruitment system followed by the Indian Council of Agricultural Research (ICAR) and the Bankers' Recruitment Committee of the Bangladesh Bank recruiting young officers for the public sector bank like Sonali, Rupali, Janata, Agrani bank etc. can avoid some of the constraints encountered for transparent appointment of officers.

9.3.2 Promotion Process

The Service Rules of each ARI of the NARS are different from those of the others. There are specific requirements for promotion of a scientist to upper grade from lower grades. The requirements include educational attainment, research achievement, number of years served in the present position, number of publications, grades obtained in the Annual Confidential Report etc.

Promotion from SO to SSO and SSO to PSO is given by the administration of the respective ARI following the system specified in its Service Rules. Promotion from PSO to CSO is done through a Promotion Committee Meeting at the BARC under the Chairmanship of the Executive Chairman (EC) of BARC.

Promotion of a scientist to the next higher grade is not an easy process in all ARIs. In most ARIs, the members of posts in the higher grades are much smaller than those in the lower grades. Therefore many scientists, although being eligible for promotion, do not get promotion due to faulty structure of the Organogram and remain in the same post for 10-15 years.

Lack of opportunities for career development through higher studies and training coupled with denial of promotion due to shortage of posts in higher grades have been the cause of mass exodus of experienced scientists to foreign countries. Number of such scientists is over 400. This exodus must be stopped through appropriate measures for ensuring higher studies and training as well as restructuring the Organogram. In addition, steps should be taken to bring back those scientists from abroad.

9.4 Career advancement scheme/process

The NARS ARIs do not have any scheme or process for career advancement of scientists after recruitment.

9.5 Sabbatical leave

BARC, in the past, had a programme of Sabbatical leave through which scientists/teachers used to avail this leave from their employing organizations and work on specific scientific techniques in other organizations either for learning or for teaching. However, the process was discontinued for unknown reason. The most important benefit of the process is horizontal diffusion of an important research method without much cost.

9.6 Prize and reward system

Prize and Reward system is indeed a positive incentive for encouraging scientists to achieve more efficient and effective results. Such a system introduces an atmosphere of competition among scientists as well as creates some kind of urge in scientists to assart their best possible dedication to work. Unfortunately, most of the ARIs do not have such a system except BARI and BINA. BARI and BINA have provisions for awarding gold medals, crests, and certificates of merit to scientists showing extra-ordinary, significant or substantial contributions to research and development, respectively. All the three categories of performance have some financial benefits along with the rewards. As per the Service Rules these two institutes are supposed to hold these award ceremonies more often than what is practiced now. Service Rules of all the NARS ARIs should include prize and Reward System.

9.7 Technology marketing

The institutes of Bangladesh NARS do not have any programme of technology marketing except BSRI. This, perhaps, is due to the notion that the ARIs have been established to provide service to the farmers, not for earning money. BSRI has been marketing Stevia and Hydrose free gur (brown sugar). The technologies developed by the ARIs should be patented and/or registered with MoA. Any organization/company intending to utilize the technology will have to buy the patent or take a license from the concerned ARI in lieu of the patent price or the license fee – depending on the nature of technology. The foremost technology to be patented and the patent sold for higher price would be the high yielding crop, vegetable, fisheries, livestock varieties.

The beneficial aspects of technology marketing system by ARIs may be as follows:

- It will create opportunities for establishment of technology based industries,
- Introduction of benefit sharing with scientists i.e. ensuring a certain percentage of the benefit earned through such a marketing system to the scientists would naturally attract their devotion to work.
- It would be beneficial for improvement of the efficiency of the organization if a certain percentage of its total budget could be borne by the organization itself,
- Cost sharing by an organization with the Government fund is expected to improve the accountability of both the individual and collective endeavours.

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NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN BHUTAN

Appendix B

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN BHUTAN

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Research of Bhutan (CoRRB)

December, 2010

Contants

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1. INTRODUCTION

1.1 Agriculture in Bhutan

Bhutan is one of the founding member countries of the South Asian Association of Regional Cooperation (SAARC). She lies in the foothills of the Eastern Himalayas (latitudes 26°47'N to 28°26'N and longitudes 88°52' to 92°03'E) at altitudes of 100-7500 masl.

At the macro-economic level, Bhutan is doing extremely well with an average GDP growth rate of 7 to 8 % over last two decades. The GDP in 2003 was over Nu. 28.5 billion with a per capita GDP of US $ 834, one of the highest in the South Asia (RGoB, 2005). However, the Household Income and Expenditure Survey in 2000 shows that our rural farmers earn US $ 0.80 a day, indicating that our farmers are poor and live in poverty as measured against the international poverty line of US $ 1 a day. There is income poverty in our rural areas where 79% of our population lives (CSO, 2001).

Poverty alleviation is today a high priority international agenda. In 2000, all 191 United Nations Member States pledged to eradicate poverty by 2015. As millions of poor people die from hunger, world poverty is today equated to crime against humanity.

The enhancement of rural income is a specific development goal of RGoB since the Fifth Five Year Plan. Development has always been rural focused where majority of our marginal population reside. Ministry of Agriculture the key agency mandated with rural development always had poverty alleviation as its inherent objective by pursuing food security and improving the livelihood of rural mass as it's key policy objectives over the past decades.

Today the agricultural sector of Bhutan is the source of livelihood for about 69 % of the population. It contributes 26 % of the Gross Domestic Product, of which about 8 % come from livestock and 7 % from forestry (RMA, 2005). Most agricultural lands are scattered around small, remote settlements on hill slopes and valley bottoms. Thus a limited access to markets is coupled with a low potential for mechanization. Proneness to natural disaster (monsoon floods and land slides) further marginalizes the highly integrated, diverse and labor-intensive farming systems.

With the loss of some of the most productive agricultural lands to urban development and a ceiling imposed on the use of forested lands, the country is faced with the challenge of swiftly moving its agricultural sector from a largely subsistence-based agriculture to a semi-subsistence cash economy, not least in order to ensure the national objective of food security.

Presently the rural population has to make a living on an average income of less than half of that of the urban population (DoP, 2004). While the nation as a whole – and a burgeoning semi-urban middle class in particular – is finding new sources of income and wealth in energy-export, tourism and public sector, the socio-economic gap between rural and urban population is growing wider, posing unwanted prospects of social and political divide for the longer future. On the country-side, rural urban migration creates shortages of labor, subsequently increasing its cost. This makes access to markets and appropriate technologies for mechanization all the more important.

Consequently, the Ministry of Agriculture has embarked on the concept of strategic focus on, Production Accessibility and Marketing (PAM), promoting organic agriculture and high-value & low volume produce, so to capture a share of international niche markets.

In this overall context the Council for RNR Research of Bhutan (CoRRB) at the Ministry of Agriculture is tasked with coordinating and supporting the research and extension (development) activities necessary to satisfy the present urgent technological needs of the farming population.

CoRRB plays a key role in the RNR sector development. Given the resource constraints, we are conscious of that research is no luxury for Bhutan, therefore research has to be relevant, focused, efficient and effective, and impact oriented and most importantly pro poor. Therefore concerted efforts both by CoRRB and the departments during the agenda setting and prioritization will be vital to come up with relevant and useful research results.

1.2 Background of RNR Research systems of Bhutan

Up to the early 1960s research in Natural Resource Management was left to innovative Bhutanese farmers who experimented with new production methods and new plant and animal species and plant varieties. Activities of such informal research had a strong impact on the Bhutanese farming system with introductions such as mithun, chilli, maize and potato. The first documented government sponsored research activities started in the mid 1960s, after the inception of the first development plans in 1961. Early activities focused largely on agriculture.

Unfortunately these early activities are poorly documented and lacked follow up and continuity See table 1 for the chronological events.

2. THE NATIONAL AGRICULTURAL RESEARCH SYSTEMS (NARS) IN BHUTAN - COUNCIL FOR RNR RESEARCH OF BHUTAN (CORRB) -

2.1 Vision, Mission, Goals and Mandates of CoRRB

Vision

An effective RNR1 Research system that will contribute towards the enhancement of socio economic prosperity of the farming communities on an environmentally sustainable basis.

Mission

Generate appropriate technologies for increasing productivity and profitability contributing to the enhancement of food security and rural income.

Goal

- Generate technologies which are relevant to the farming communities for ensuring
- food security and enhancement of income
- Effectively communicate the research findings to the client organizations
- Build partnership with relevant stakeholders for developing frontier research

Table 1. Summary of major events, relating to research in natural resource management for consecutive Five Year Plans (Chronological presentation of research in Natural Resources Management (Roder, 2005)

Plan period	Major events relating to research
1961-66 (1)1	• Establishment of the Department of Agriculture (1961) and build up of a network of research stations including Khangma, (Tashigang), Yusipang (Thimphu) and Nasphel (Bumthang), with technical guidance and resources provided by the Indian Government.
66-71 (2)	• Establishment of a network of livestock farms: Samtse (1969), Wangchutaba, and Lingmethang. Compared to the agriculture system these farms had limited research activities. • Systematic research activities in the agriculture farms resulted in release of species/varieties still important today, especially apple, potato and wheat.
71-76 (3)	• First bilateral and international projects (Helvetas, FAO) with some research components.
76-82 (4)	• Agriculture research stations were changed to production farms and their research mandates were withdrawn. • Modest research in agriculture and livestock was continued through projects. Release of technologies (species, seed production, establishment, management) for fodder development.
82-87 (5)	• Establishment of Centre for Agricultural Research and Development (CARD) Wangdue (1982). • Emphasis on commodity based research (rice, potato). • Initiated intensive interactions with international research centres, especially CIP and IRRI. • CIP country program (1982).

[1]*First Five Year Plan Period*

Mandates

The main mandate of CoRRB is to harmonize and prioritize research agenda with national development priorities; formulate research and extension policy in consultation with line departments; clear all RNR research program in the country; forge links and networking with national and international institution such as agriculture research institutes, higher education institutes, farmers organizations, etc; package and provide RNR technologies to line departments; promote agriculture in schools; maintain & strengthen RNR integration concept in research & technology dissemination; and provide agro-meteorological services. Besides the routine and regular adaptive and applied

[1] RNR = Renewal Natural Resources includes Agriculture, horticulture, livestock, forestry, soil, water, and any other natural resources

research programme, CoRRB will more and more dwell into research topics of nationally (and internationally) strategic importance. CoRRB will identify such priority research themes and commission research. Some of the possible themes based on emerging trends could be, viz: Climate change and it's implications on wetland and hydro power generation, Wet land protection, Costing Environmental services, Impact of Rural urban migration on agriculture development etc.

2.2 Organization

Since 2003, RNR Research is organised in a Council model, therefore RNR Research is organised and managed by the Council for RNR Reserach of Bhutan (CoRRB). In essence CORRB is operating as a variant of a Managing Council. CoRRB as a Managing Council plans, organizes, manages and directs the RNR research programme. It carries out research programme through its own network regionally based RNR Research Centres and sub centres in collaboration with other organizations. It administers the day to day activities of the RNR RCs. Experience has shown that this model is quite effective, however organizationally the vision of CoRRB is to grow itself into a real Council wherein it will have the responsibility for coordinating, funding and managing research programs with a comfortable level of autonomy for planning and executing research, optimizing use of available resources.

CoRRB under the Ministry of Agriculture is the apex national organization in the field of RNR research in Bhutan. The following are the vision, mission and goal of CoRRB as the apex RNR research organization. See organogram of MoA in annexure 1

2.2.1 CoRRB secretariat

CoRRB is the secretariat to the Council of the RNR Research of Bhutan The Secretariat is headed by the Director who is also the Member Secretary to the Council. The secretariat with advise from the Council will implement the policy and strategic decisions of the Council meetings. The CoRRB secretariat shall be the parent organization to direct, coordinate and manage the research programs of the various RNR research centers. See organogram of CoRRB in annexure 2.

The Council is the supreme policy and decision making and approval body. The Secretariat through the Council have the executive authority to manage, administer, direct and control the national research fund, coordinate research and extension through its respective divisions and oversee the administration of national meteorological services system of Bhutan. The secretariat comprises of professionals capable of technical analysis of data and information for policy formulation, research programs planning and institutional development such as fund raising; monitoring and evaluation. Thus it provides leadership in strategic thinking and planning on matters of research themes taking into account the development trends in RNR sector.

The Council is assisted by various permanent and ad-hoc bodies and committees to provide direction and guidance on policy and planning, technical and scientific and financial matters concerning the RNR research and extension effort.

The CoRRB secretariat comprises of the following Divisions and sections. i) Information Management Section ii) Research Division iii) Research Communication Division iv) Farming Systems Division.

In the field there are four RNR Research centers strategically located to cover all regions of the country. Each of these Research Center have one or more sub centers.

2.2.2 Mandates of CoRRB Secretariat

- Formulate research policies and long term research plans in consultation with line departments & PPD
- Coordinate RNR research
- Mobilize and manage research funds
- Provide research policy and management direction to Research Centers
- Develop and package technology for dissemination by line Departments
- Monitor and evaluate the planned programs of the research centers
- Function as the national repository on research activities and technologies generated and other related information
- Maintain administrative database on manpower, institutions and equipment.
- Coordinate the standardization of research protocols for quality control & to avoid duplication, and compile research outputs. (Act as a "clearing house" through the Scientific Technical Committee)
- Prepare a consolidated annual progress report for submission to the Ministry and relevant stakeholders.
- Develop and strengthen linkages with relevant national and international organizations
- Develop and manage the HRD master-plan for RNR research system
- Organize regular meeting on:
  - The Council
  - Scientific Technical Committee (STC)
  - Variety Release Committee (VRC)
  - National Seed Board (NSB)
  - Extension Coordination Committee (ECC)
  - Research Management Committee (RMC)
  - Annual National Sectoral Research - Extension Workshop (ANSREW)
- Ensure development of effective information & communication media on research & development
- Coordinate and organize Agriculture Education Program
- Provide agro-meteorological data

2.2.3 Divisions and RNR Research centres of CoRRB

2.2.4 Information Management section (IMS)

This section is headed by the Chief Research Officer (Planning). The functions of this section are as follows:

- To monitor and evaluate the planned program of the council in consultation with the respective divisions.

- To act as the focal point for releasing the council M&E related information to national and international organization and donors.
- To generate document, storage, retrieval and dissemination of scientific knowledge, information and technology for use in the field.
- To create and maintain functional databank on related resources (manpower, institutions and equipment) and programs for resource monitoring and management of the council, to assist in judicious deployment and management of its resources.
- To develop and maintain database to monitor inputs and its delivery mechanism.
- To conduct cost-benefit analysis of the council's program
- To conduct field verification from time to time so that the progress reported conforms to result achieved or impact made in the field.
- To prepare annual council report for submission to Policy and Planning Division.
- To represent CoRRB in the MoA M&E forum.

2.2.5 Research Division

The Research Division is headed by the Chief Research Officer (Research). The division has four sections headed by DCRO viz. Forestry, Field crops, Livestock and Horticulture. The main functions of the Research Division are primarily to formulate research policies, long term research plans, coordinate RNR research at national level, mobilise and manage research funds, act as a referral centre for research information at national level, provide strategic technical and scientific advice to line departments and other agencies of the RNR Sector. Each of these sections will be designated to be focal points for the respective research centers. The functions of Research Division:

- To develop strategic master plan for agriculture research in Bhutan
- To set Research programme agenda
- To mobilize and manage research funds
- To coordinate Research programme
- To scrutinize Research protocol
- To provide Research guidelines
- To monitor and evaluate research programmes/activities
- To establish and strengthen linkages (national and international)
- To coordinate and organize, RCC, NSB, VRC, STC
- To develop the HR capacity of the agriculture research system

2.2.6 Research Communication Division (RCD)

RCD is headed by the Chief Research Officer (communication). RCD will have three sections each headed by the Deputy CRO, viz: Extension support & Technology Packaging, Agriculture Education and promotion (SAP, NFE), Information and Communication. The functions of Research Communication Division are:

- To package technologies and other publication (extension materials, RNR Journal, reports, newsletters, Brief communications)

- To carry out extension and social research (Extension methods and methodology studies, Adoption Study)
- To research and develop strategy and methodology for effective dissemination of information.
- To maintain database for all available technology (generated and local) and facilitate its access and distribution.
- To coordinate Research Outreach programme (Technology Parks, Adopted village)
- To coordination of Technical and Methodological training (Skills on pruning/training of fruits plants, basin making, Farmers groups)
- To implement School Agriculture and Non formal education programme

2.2.7 Farming Systems Division

The Farming Systems Division is headed by the Chief Research Officer (Farming Systems) assisted by a Deputy Chief Systems Analyst. The functions of the Farming Systems Division are:

- To provide broad guideline/strategic directions to the Farming Systems programme
- To conduct necessary and timely monitoring of field activities
- To conduct research covering aspects related to climate change, agro-meteorological tools, socio-economics research, agro-ecological zonation

2.2.8 Renewable Natural Resources Research Centres (RNR RCs)

CoRRB has four major region based Renewable Natural Resources Research Centres (RNR RCs). Each RNR RC is responsible for leading a national research program and for implementing research in a specific mandate region. These RNR RCs are further supported by one or more research sub-centers and outreach centers. Research programme is based on a 4 by 4 matrix as detailed in table 2.

Table 2. National mandates, Research centres, sub-centers and regions

National Mandate	RNRResearchCenters	Research subcenters	Region (with Districts)
Forestry	Yusipang, Thimphu	Drala, Chukha	Western Region: Thimphu, Paro, Haa, Chukha and Samtse
Field Crops	Bajo, wangdue	Mithun, Tsirang	West-Central Region: Wangdi, Punakha, Gasa, Dagana and Tsirang
Livestock	Jakar, Bumthang	Bhur, Sarpang	East-Central Region: Bumthang, Trongsa, Zhemgang and Sarpang
Horticulture	Wengkhar, Mongar	1. Lingmithang, Mongar 2. Khangma, Trashigang	Eastern Region: Mongar, Trashigang, Lhuntshi, Trashi Yangtsi, Pema Gatsel and Samdrup Jongkhar

2.2.9 Research Sub-Centre

Each Research Centre, because of its geographic location, can not deliver the required services in all the Dzongkhags covered by the respective RCs. Further, the Dzongkhags are located at different altitudes, the need for varieties varies. As a result of this, each RC has a sub centre except Wengkhar which has three sub centres. At the moment, they are not fully manned because of the lack of resources. Therefore, efforts will be made to man them properly in the tenth plan. Among all the Sub centres, we will strive hard to upgrade the Sub centre Bhur to provide with more qualified man power as it is the only centre which will work for the technologies required for the low lying areas of the country.

2.2.10 Outreach Centre

Outreach Centre can be defined as geographically expanding research coverage and therefore are located strategically. Outreach Centre facilitates further the research coverage of the main centre. The role of Outreach Centre is to: generate locally relevant technologies, support local extension agents, popularize technologies with frontline demonstrations.

The Outreach Centres are located strategically to cover a certain sizeable geographic area. These outreach centres have research capacity to design, implement, and analyse trials results. It also enjoys some degree of autonomy from the main centre so that they can respond to the local needs.

2.3 Research Areas

An indicative but not exhaustive Research areas are sorted according to the four main sectors, agriculture, horticulture, livestock and forestry, as well as concerns of inter-sectoral importance (i.e. RNR systems, post-harvest technology and farm infrastructure, socio-economic and policy studies). A large part of this agenda corresponds with an agenda for poverty alleviation. A major need for an increased focus on socio-economics is indicated, in particular the conduct of impact assessments.

2.3.1 Field crops sector

Areas for RNR research in the field crops sector include staple cereals (rice, maize, wheat, barley, buckwheat, millets) as well as oilseeds and grain legumes. Particular emphasis on the diversity of crops involves research on minor crops, wild relatives of crops, the domestication of particular wild crops and the improvement of local cultivars for rain fed conditions. Further emphasis are given to organic and non-chemical methods of pest- and disease control. Main objective is to identify technologies for sustained increases in production by means of introducing improved and new varieties and increasing cropping intensity while maintaining soil fertility.

2.3.2 Horticulture sector

Areas for RNR research in horticulture sector encompass the wide variety of fruit and nut crops, vegetables, root and tuber crops, mushrooms, floriculture, medicinal and aromatic plants, plantation crops as well as spices and condiments. Accordingly, the

thrust of research in horticulture is to broaden the genetic base of horticultural crops, improve production technologies, produce seeds and plants, assess potentials for integrated use of organic and inorganic use of fertilizers and develop irrigation systems. Further, assessments of distribution of pests and diseases and the respective level of crop losses are to be met with corresponding strategies for integrated pest management.

2.3.3 Livestock sector

Areas for RNR research in the livestock sector include animal health, breeding and feed and fodder. Research on animal health contributes by undertaking epidemiological research backed by extensive animal health care networks. Animal breeding aims at improving stock by conserving and upgrading indigenous genetic resources through selection, artificial insemination and the use of biotechnology. Research on native fodder resources is to increase resources by developing pastures through the improvement and introduction of productive species of grasses, legumes and fodder trees. In addition, applicable animal recording schemes are developed in order to improve livestock management systems in general.

2.3.4 Forestry sector

Areas for RNR research in forestry sector include nature conservation, conifer management, broadleaf forest management, reforestation, social forestry, non-timber forest products, wood products and forest protection. Particular emphasis are on the regeneration characteristics of timber in broadleaf and conifer forests and on the impact of collection on particular non-timber forest product species and their natural propagation. Further, impact assessments of silvicultural practices, analyses of choice for species and plantation techniques in particular degraded areas and climatic zones, as well as impact assessments of grazing on natural regeneration are carried out.

2.3.5 Farming Systems Sector

Areas under this group cut across the above four sectors.

Farming systems research areas involve interdisciplinary perspectives and cooperation amongst professionals of different disciplines, including soil science, water management, GIS and economics. Research on integrated crop and livestock production systems and a systems perspective on watershed management are also key areas.

2.4 Stakeholders of CoRRB

Ultimate stakeholder of CoRRB is the countrywide farming population. According to its mandate, CoRRB’s main stakeholders are the three major departments within the Ministry of Agriculture, the Department of Agriculture (DoA), the Department of Livestock (DoL) and the Department of Forests (DoF).

Table 3. List of agencies (MoA) carrying out research on specific RNR subjects

SN	Name of agency/Location	Parent Organization	Main Area of Research
1	National Biodiversity Centre (NBC), Serbithang, Thimphu	Non Departmental	Bio-diversity
2	National Plant Protection Centre (NPPC), Semtokha, Thimphu	Department of Agriculture	Plant protection (pest and diseases)
3	National Soil Service Centre (NSSC), Semtokha, Thimphu	Department of Agriculture	Soil and land management
4	National Mushroom Centre (NMC), Semtokha, Thimphu	Department of Agriculture	Mushroom
5	National Post Harvest Centre (NPHC), Bondey, Paro	Department of Agriculture	Post harvest
6	Agriculture Machinery Centre (AMC), Bondey, Paro	Department of Agriculture	Farm mechanization
7	National Centre for Animal Health (NCAH), Serbithang, Thimphu	Department of Livestock	Animal Health
8	National Feed and Fodder Development Programme (NFFDP), Jakar, Bumthang	Department of Livestock	Livestock feed and fodder
9	National Livestock Breeding Programme (NLBP), Serbithang, Thimphu	Department of Livestock	Animal breeding
10	National Warm Water Fishery Centre (NWWFC), Gelephu, Sarpang	Department of Livestock	Fishery
11	National Cold Water Fishery Centre (NCWFC), Haa	Department of Livestock	Fishery
12	Ugyen Wangchuk Environmental and Foresry Institute (UWEFI), Jakar, Bumthang	Department of Forestry	Environment and forestry
13	Nature Conservation Division (NCD), Thimphu	Department of Forestry	Nature (plant and animal) Conservation

The following entities under various agencies of MoA also conduct research in certain specific areas as per their mandates. CoRRB as the apex body for RNR research in body will in due course of time mainstream all research. Currently, CoRRB is trying to keep track of all the research that are being carried out by other agencies outside its direct purview. Agencies carrying out research on specific RNR subjects are listed in table 3.

2.5 Achievements of RNR Research

RNR research has made notable contribution towards technology generation to fulfill food security and enhance income generation of the rural population. Apart from conventional technological progress made, substantial researches has been carried out in management of common-property resources, capacity building of rural farmers and facilitate technology-uptake pathways which has both direct and indirect benefit to rural poor. The following are some highlights of the Research's contrition in 9th FYP and before.

2.5.1 Productivity increase

Table 4. Productivity increase in some major crop commodities over the years

	1989	2000	2004
Paddy	424	811	1166
Maize	296	631	1679
Wheat	268	456	553
Potatoes	3540	3045	5606
Apples	721.6 kg/ac = 7.21 kg/tree	26kg/tree	24kg/tree
Citrus	788.8 kg/ac =7.8 kg/tree	33 kg/tree	32kg/tree

2.5.2 Paddy Case - Improved cultivars and management technologies

15 rice varieties have been released for various agro ecological zones. Around 16 technologies on different management and production aspects (production technologies, establishment methods, nutrient management, diseases and pest's management, weeds management) were also generated. (Shrestha,2004)

Impact of Rice research and development

- Increase in national rice output by 5,000-10,000 t/year
- Net returns from improved technologies valued at 58 m to 118 m annually
- HYVs grown by 60% of hh, covering 35% of the rice area
- From 1989-97, production increased by 58%; area decreased by 9%
- Adoption of improved mgt practices (weed control, seedling production, fertilizer use etc)
- 68% hh self-sufficient in rice

2.5.3 Forestry Case - Contribution of research to decision-making in forest resources management.

Cordyceps sinensis, a high value high altitude medicinal plant was a restricted species as of 2003. The research estimated a revenue loss between US $ 4 to 12 million to foreign poachers due to the policy restriction on its collection. The legalization of

Cordyceps is today one of the main sources of cash income for the people living in the high altitude areas in the north. The total annual harvest of Cordyceps sold was calculated to Nu.6 million in 2005 (MoA, 2005).

2.5.4 Livestock case

The introduction of high yielding fodder oat varieties has helped farmer to overcome the acute shortage of fodder in winter. This has improved health and productivity of livestock thereby assisting in improving livelihood.

Improved fodder species (cocksfoot, Italian rye grass and white clovers) has helped to boost milk production by many folds in livestock intensive areas such as Bumthang. Researches on animal genetics have improved the knowledge base on cattle, yak, horse, sheep types of Bhutan for future conservation and sustainable utilization.

3. INSTITUTIONAL GOVERNANCE

3.1 Coordination and Management

3.1.1 The Council of CoRRB

CoRRB is governed by the Council with Hon'ble Minister and the Hon'ble secretary of Ministry of Agriculture as it's President and vice President. The Council is supported by various Technical Committees, viz: Scientific Technical Committee(STC), Research Management Committee (RMC), Extension Coordination Committee (ECC) and Variety Release Committee (VRC) and the CoRRB Secretariat.

The Council is the highest decision making body with regard to policy decision, direction and clearance. See annexure 3 for its member composition and ToR.

3.1.2 Scientific Technical Committee (STC)

STC provides technical guidance on scientific matters concerning RNR research and development. It can also propose/suggest broad/thematic research and development needs of the RNR sector. It also ensures collaboration between Research and other agencies, promote ownership of research by agencies, and avoid duplication of research by agencies in the Ministry of Agriculture. See annexure 4 for its member composition and ToR

3.1.3 Extension Coordination Committee(ECC)

ECC supports the CoRRB in matters related to cross cutting research and extension themes. ECC has the over riding mandate to facilitate the coordination and integration of RNR Extension services and strengthen the research extension linkages amongst the various agencies of the MoA viz: CoRRB, DoA, DoL and DoF and other relevant agencies. ECC functions as a technical committee with CoRRB. The Director of CoRRB chairs the Committee meeting. See annexure 5 for its member composition and ToR

3.1.4 Variety Release Committee(VRC)

VRC coordinates and conducts the release of new varieties of crops, fodder and trees. A minimum of one meeting a year is being held depending on the availability of new proposals. Special meetings are also called on need basis. Once the varieties are released, the seeds are made available to Druk Seed Corporation for multiplication as it is

mandated to provide seeds and planting materials for the farmers. See annexure 6 for its member composition and ToR

3.1.5 Research Management Committee (RMC)

RMC is the steering committee dealing with both technical and management issues of the research system. It has the Program Directors of the four RNR RCs, the Chiefs of the two divisions (Research Division and Research Communication Division), the Chief Agrometeorologist as it's members. The committee is chaired by the Director of CoRRB. The Chief Research Officer is the member secretary. It meets twice in a year. See annexure 7 for its member composition and ToR

3.2 Research Agenda setting - Research Planning process

The Royal Government Five Year Plan Strategy documents for the different research programs (field crops, horticulture, livestock, and forest) outline the broader research issues and needs.

Based on this framework, the annual research agenda and activities are drawn. The RNR RCs in collaboration with the technical departments organize annual meetings of researchers, extension personnel and central agency staff to review past activities and plan for the future.

3.2.1 Annual National Sectoral Research Extension Coordination Workshops (ANSRECW)

These ANSRECW are annual events which constitute the basis of the research programme planning. Every year four such workshops are held, one each for Horticulture, Field Crops, Forestry and Livestock sectors. The objectives of the ANSERCWs are to: review/monitor and plan research and extension collaborative activities; exchange information on emerging technologies and research needs; provide forum for agreeing on activities/budgets planned by central programs and projects for the region; and provide forum for clarification on policy issues, if any.

These workshops are attended by the District extension heads and Researchers of the concerned sector. Relevant participants from central agencies also attend.

The coordination and organization of these workshops including the agenda setting are jointly done by the respective Department and RNR RC concerned.

3.2.2 Annual Research Programme Coordination Meetings(ARPCMs)

Annual Research Programme Coordination Meetings(ARPCMs) are annual events held for the four research programmes viz: Horticulture, Field Crops, Forestry and Livestock. These ARPCMs are however attended only by selected participants mainly the concerned researchers.

The objectives of the Annual Research programme coordination workshop are to: monitor progress, coordinate and plan national research program activities on an annual basis; to peer review and guide the junior researchers; and to provide a forum for scientific presentation for researchers.

3.2.3 Enhancing Research Efficiency using a Standard Research Protocol

Research protocol is an essential part of any research project which helps to formalize ideas and gain feedback from others through peer review, acts as a manual for members of research team to ensure adherence to the prescribed methods and also to monitor the progress of research outputs. Currently, the use of research protocol varies from one research center to another and also from program to program. The systematic evaluation and endorsement of research protocols is also weak. Such a situation leads to duplication of research resources, poor management and monitoring of research activities.

In the future, all Research Centers should adhere to prescribed Research Protocol format (see annexure 8) while proposing new research activities. Research protocols shall be evaluated and endorsed for implementation by a technical committee of relevant experts in the RCs headed by the Program Director. Such protocols shall be submitted to CoRRB for archiving.

All research proposals emanating from other agencies of the MoA shall follow the prescribed format while submitting to CoRRB. For such protocols, CoRRB shall be the approving authority upon recommendations from the Scientific Technical Committee (STC).

An inventory and database of the research protocols shall be maintained by the respective research programs, while the Research Communication Division of CoRRB will archive the database at the national level. This will avoid activity duplication and also act as a management tool for monitoring the research activities.

3.3 CoRRB as the "Clearing House" for RNR Research within MoA

There are agencies outside CoRRB but within MoA, which undertake research activities. Such research, understood as "peripheral research" as contrasted to "core research" which is done within the CoRRB, compliments research and helps to utilize CoRRB's limited human and financial resources more judiciously. The problem at present, however, is that there is no institutionalized mechanism of knowing who does what outside of CoRRB. This may lead to duplication of research efforts and hence a waste of time and scarce resources, inferior research quality stemming from not following standard procedures and protocols etc. Therefore, establishing a focal agency for facilitating, streamlining and monitoring of research has become essential. Given the mandate, CoRRB will act as the "clearing house" for all research undertaken by MoA. In order to fulfill its mandate, the following recommendations are made:

- CoRRB should focus its research on production and management aspect in four important programs (forestry, livestock, field crops and horticulture), extension, and RNR systems.
- Other agencies within MoA can also take up research on these subjects but should avoid duplication. Agencies outside CoRRB can focus research on areas like socio-economic, marketing and pricing, community mobilization and other social aspect.

- CoRRB, STC shall act as a Clearing House, approving research agendas and protocols, streamlining RNR related research conducted by MoA
- Any agencies/researchers outside of CoRRB wishing to conduct research related to RNR topic should develop a research protocol to meet the standard developed by CoRRB and should submit to STC for endorsement
- Any foreign students conducting their research works related to RNR sector should draft their research protocol in line with CoRRB's standard and submit for approval from the STC.

3.4 Research publications

3.4.1 Journal of RNR Bhutan

Scientific publication of research results is indisputably an integral part of the research and development process. However, apart from the technical and other periodic reports produced from the RCs, the turnout of scientific papers in the local, national, regional or international journals will be encouraged.

The publication of articles in journals is to be linked to the career advancement of a researcher. Depending on his/her level, a researcher publishes a minimum of the articles given in the table 5 below.

Table 5. Minimum publications requirement by RNR Researchers

Researcher Qualification Level	National Journal	Newsletter
PhD	3	5
MSc	2	5
Diploma	Co-Author	Co-Author
Certificate		Co-Author

CoRRB publishes the Journal of RNR Bhutan on annual basis. It is the premier Journal that publishes scientific papers. The Journal is distributed widely both in-country and overseas.

There is also a system of awarding prize and award for the best paper in the Journal issue. This is mainly to promote and encourage the researchers and others to write quality papers. This also serves as one means of incentives to the researchers.

3.4.2 Publication of RC Newsletters

Where the access to digital and virtual information is limited, the printed newsletters are still a major source of information to the majority of our field extension staff. Although a conventional mode of information sharing, it is still the convenient, preferred and relatively cheap way of reaching the remote and far-flung parts of the country. Newsletters provide new research information to the extension colleagues, while it helps to channelize valuable feedback and field issues to the research system. Hence they have an important role to play as part of extension communication.

All the four RNR RCs publish newsletters on quarterly basis. The following is the schedule of the newsletter publication as depicted in table 6.

Table 6. Schedule of RNR RCs newsletter publications

Research Centre	Issue Release Month
Jakar	January and July
Wengkhar	March and September
Yusipang	April and October
Bajo	June and December

The publication of the newsletter is centrally coordinated by CoRRB HQ with RCs provisioning for the required budget.

3.4.3 On line digital compendium

Although individual agencies maintain records of research and extension materials but such information may not be routinely updated. Records are available with individual agencies only and access to it by outsider is difficult, as it is not digitalized. Since the information on research work and available extension material are not readily available there seems to be duplication of efforts at various level. Also, there is no proper system for maintaining records of research publications and extension materials.

To address such problems CoRRB initiated online digital compendium in December 2005. It contains information on research carried out in four primary sectors (Horticulture, Field crops, Livestock and Forestry) and some research output and recommendation.

Recently, Ministry of Agriculture has started an interactive website called VERCON, the project support by FAO which supports the interaction between research and extension and flow of information. VERCON web provides information on available production technologies in RNR sector. It also contains interactive forum where user (extension workers and farmers) can post queries and seek advice from the experts.

As highlighted above CoRRB would like all the agencies (within and outside MoA) to provide the report of their research or and extension materials produced to CoRRB in print and digital format for record as a part of the agreed research protocol. At the same time, RCD have to make efforts to make all the available information access through web. Further, a good computerized system to maintain archives of all publication at both RC and CoRRB HQ level will be put in place.

3.5 Human Resource Development(HRD)

Capacity assessment and development within the national RNR/agricultural research system are continuously carried out. A specific focus of capacity development is the organizational capacities of research service providers and the individual capacities of researchers. The following are some programmes that pursue the HRD in the RNR

Research. Studies on the present competences available in the research system, compare it to the projected requirements in the future and prepare a resource development plan on that basis.

- Both general and specific HRD shall be pursued. Expanding HRD towards Ph.D studies for quality research. Opportunities for researchers to pursue higher studies in their specific fields may be expanded towards Ph.D degrees, in particular for senior researchers, in order to undertake quality research.
- Consistent up-gradation of deserving diploma holders (and lesser degrees) is needed in order to create competitive incentive & reward and increase human resource efficiency.
- Developing internal capacity to conduct priority setting for research. In order to develop internal research management capacity there shall be regular (yearly) Learning-for-Action exercises for priority setting in agricultural research.

There shall be focus on increasing human resource efficiency by further developing present human resources. The expansion of staff to cover increasing workloads and new subject matter areas shall be pursued.

Currently CoRRB has about 260 staff. See annex ?? for the staff list as of 2009

3.6 Networking and strengthening linkages

Building and maintaining institutional linkages and networks with all the relevant stakeholders of research is of paramount importance for CoRRB. It will aim to improve linkages in the following manner:

- Innovative and practical linkages with technical departments and other agencies, both incountry and overseas, will be established and strengthened. CoRRB will endeavor to join regional and international research-extension bodies/association to establish cooperation, build local research capacity, participate in strategic research and thus build a vibrant and sustainable research system.
- CoRRB will strive to enhance technical cooperation and working relationships with line departments and other stakeholders through increased interactions, joint implementation of projects where possible, sharing of expertise and resources etc.
- Establishment of formal links with national research organizations, both RNR and non-RNR, will assist in facilitating flow of information and co-ordination.
- Cross visits to RCs, other research sites etc among the program coordinators shall be encouraged to improve information sharing, technical interaction, and monitoring
- Institute technical forum (annually) comprising of researchers from respective programs to have interactive technical sessions to learn and share knowledge among the researchers

- Joint visits to RNRRCs by Heads of CoRRB and line Departments annually/ periodically will inculcate a sense of ownership of the program and improve the quality of research work. Such visits will also enhance research-extension linkage which is often said to be poor in the current Research System.

As of now, CoRRB has professional linkages with the following regional and international institutes and agencies (see box 1).

Box 1. International linkages of CoRRB

Indian Council of Agricultural Research (ICAR); Nepal Agriculture Research Council (NARC), International Centre for Integrated Mountain Development (ICIMOD), International Rice Research Institute (IRRI) ; International Livestock Research Centre (ILRI), International Centre for Agroforestry (ICRAF), International Development of Research Centre (IDRC); International Centre for Potato (CIP); International Centre for Wheat and Maize (CIMMYT), World Wild life Fund (WWF);

University of Vienna, Austria; University of Hiroshima, Japan; Jinju National University, Republic of Korea; Swiss Development Agency; Helvetas, Netherlands Development Organization, SNV; Japan Overseas Cooperation (JICA), International Centre for Agriculture Reserach Development (CIRAD). La Mont Observatory, Columbia University, Agency for overseas development Denmark (DANIDA), German Technical Development (GTZ),

European Union (EU) ; United Nations Development Fund (UNDP); World Food Programme (WFP); Food and Agriculture Organization ((FAO).

3.7 Incentive Structure

Though RNR Research in Bhutan is organised as Council, the staff of the RNR Research system are however still very much governed by the same rule - Bhutan Civil Service Rules. The incentives and benefits including salary structure and retirement benefits, the promotions and other awards are all governed by the same rules for all civil service personnel including the research staff. The current salary structure since 2006 for civil service is shown in table 7.

The research staff are placed in all positions ranging from Executives and Specialists at the highest level to the operators at the lowest rung of the civil service positions.

Table 7. Bhutan Civil Service Salary Scale (2006)

		Pay Scale in Nu.		
Grade	**PCS (Positions)**	**Min**	**Increment**	**Max**
1	EX/ES-1	33,970	680	44,170
2	EX/ES-2	28,500	570	37,050
3	EX/ES-3	24,090	480	31,290
4	P-1	18,970	380	24,670
5	P-2	16,755	335	21,780
6	P-3	14,690	295	19,115
7	P-4	13,080	260	16,980
8	P-5	10,710	215	13,935
9	S-1	9,855	200	12,855
10	S-2	8,930	180	11,630
11	S-3	8,160	165	10,635
12	S-4	7,240	145	9,415
13	S-5	6,700	135	8,725
14	O-1	6,355	130	8,305
15	O-2	5,970	120	7,770
16	O-3	5,425	110	6,540
17	O-4	5,040	100	6,540
GSC-I		4,790	95	6,215
GSC-II		4,560	90	5,910

Exchange rate (average at 2009 rate) US $ 1 = Nu. 47

Positions types:

- EX/ES – Executive/Specialist positions
- P – Professional
- S - Supervisor
- Operational

3.8 Investment in Research

The investment in RNR Research has been quite adequate given the limited national resources. To give a comparative picture of the investment in RNR Research, the following expenditures (current and capital) per program for major programmes of

Ministry of Agriculture for 2003/04-2007/08 and the budgeted appropriations for 2008/09 are shown in Figure 1.

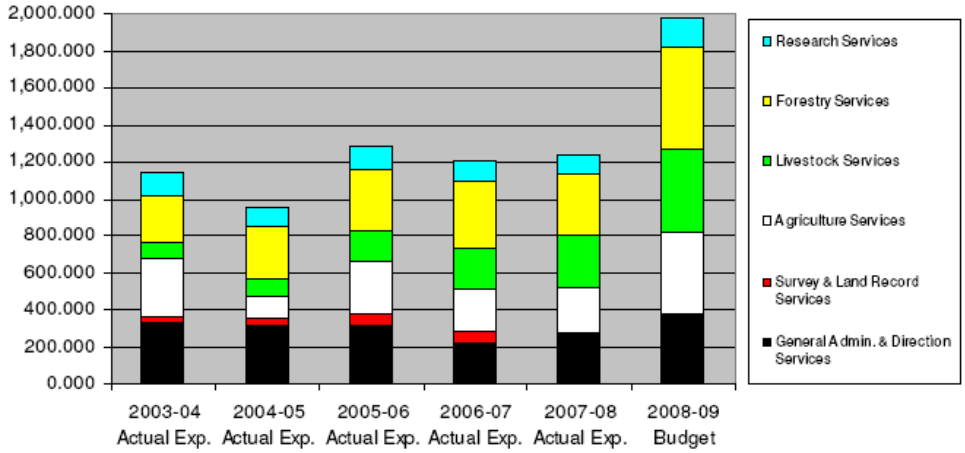

Figure 1. MoA Total Expenditures per Program, 2003/04-2008/09 (Mill. Nu.)

Figure 1 shows that MoA's total expenditures have varied somewhat during the five-year period, but with a roughly constant level from 2005/06 to 2007/08. The total budget for 2008/09 is approx. Nu. 729m (60%) higher than the total expenditures in 2007/08. Survey & Land Record Services were established as an autonomous entity in 2007/08.

The relative expenditure share per program is shown in Figure 2.

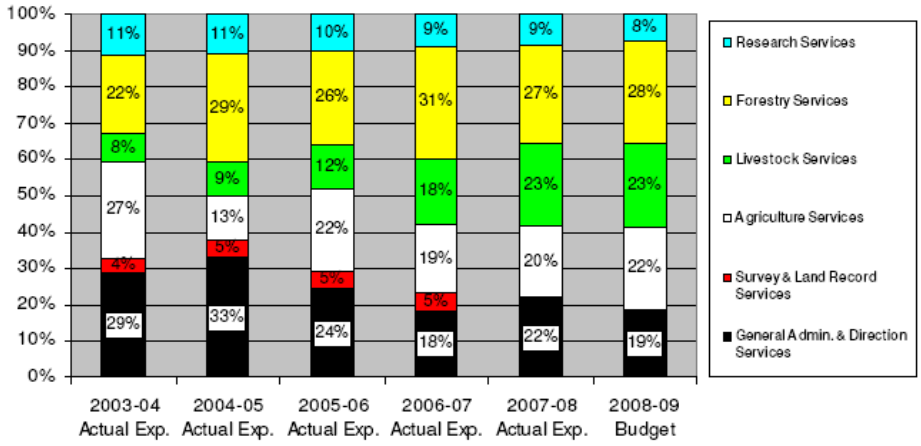

Figure 2. MoA Total Expenditures per Program, 2003/04-2008/09 (%)

The RNR Research programme (programme number 25), which is one of the 29 priority programmes of the Ministry of Agriculture has been allocated 4.9 % of the RNR sector budget(see figure 3) for the 10th Five-Year Plan (2007/2008 – 2012/13).

The budget breakdown for the 29 identified programs of the RNR sector is illustrated in the Table 8.

Table 8. Program-wise Budget Allocation

(Amount in Million Ngultrum)

Program Code	Programs	Indicative Costs
MoA/01	Commodity/Cereal Development	60.000
MoA/02	Post Harvest Management	99.500
MoA/03	Integrated Pest Management	30.000
MoA/04	Irrigation and Water Management	70.500
MoA/05	Seed and Plant Development	20.000
MoA/06	Horticulture/Casho Crop Development	118.850
MoA/07	Organic/Natural Agriculture	24.500
MoA/08	National Medicinal and Aromatic Plants	40.450
MoA/09	Integrated Soil Fertility & Sustainable Land Management	266.000
MoA/10	Rural Access	516.090
MoA/11	Farm Mechanization	60.696
MoA/12	Extension Coordination and Information Management	12.000
MoA/13	Feed & Fodder Development	23.076
MoA/14	Livestock Health and Laboratory Services	145.492
MoA/15	Livestock Breeding and Input Supply	146.670
MoA/16	Livestock Production	442.640
MoA/17	Targeted Highland Livelihood Support	34.760
MoA/18	Participatory Forestry Management	83.200
MoA/19	Non-wood Forest Resources Development	65.000
MoA/20	Forest Resources Development	89.850
MoA/21	Watershed Management and Plantation	123.000
MoA/22	Forest Protection	243.040
MoA/23	Nature Conservation	190.000
MoA/24	Forestry and Environmental Education	170.550
MoA/25	RNR Research	214.850
MoA/26	Rural Development Training	14.520
MoA/27	Agriculture Marketing	114.870
MoA/28	Bio-security and Quality Assurance	117.185
MoA/29	National Biodiversity Conservation	89.220
	Grand Total	**3,625.509**

Table 9. Agency-wise Budget Allocation

(Amount in Million Ngultrum)

Sl. No.	Department/Agency	10th FYP Outlay
01	Department of Agriculture (including spillover of farm roads)	1318.586
02	Department of Forest	02 964.640
03	Department of Livestock	792.638
04	CoRRB	198.650
05	BAFRA	117.185
06	National Bio-Diversity Center	89.220
07	Agriculture Marketing Services	114.870
08	Rural Development Training Center	14.520
09	Information and Communication	16.200
10	HRD	395.000
	Grand Total	**4021.509**

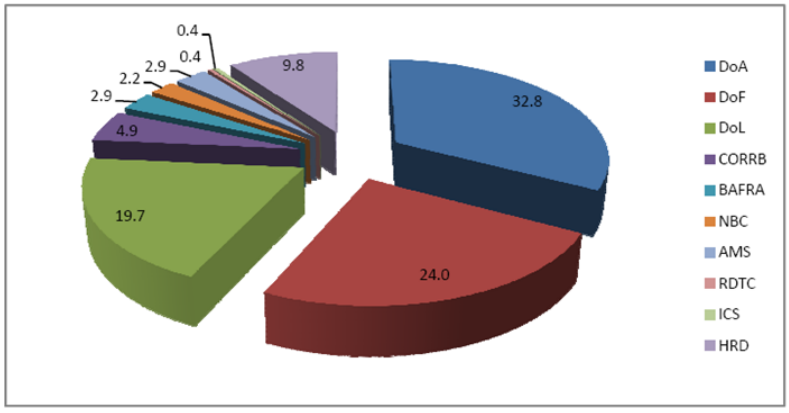

Figure 3. Agency-wise Budget Allocation in percentages

4. WAY FORWARD

The long term strategies include CoRRB working towards financial sustainability and enactment of Research Act enabling CoRRB to become a statutory body.

4.1 Achieve Financial Sustainability

The main funding for research will come from the government. Other funding sources will include financing by stake holders and other private sources, traditional donors, foreign direct investment and through payment for services. The following key strategies shall be pursued:

- **Negotiation for core RNR research Fund**: The Council through PPD of MoA will negotiate directly with the MoF for funds for research from Government

sources or from major donors. The Council will approve and allocate funds for core funding of public sector research institutes, for various competitive grant schemes under its control, and for special research studies that the Council may commission in its own right.

- **Acquisition of funding:** Acquisition of funding for specific activities and programs is to be undertaken using logical and specific matrix-type outlines including goal hierarchy, objectively verifiable indicators, means of verification, detailed time-frames and budgets.
- **Establishment of a trust fund:** To achieve the vision of growing the RNR research system into a competent and autonomous system that is capable of responding to the ever-evolving needs, CoRRB will endeavour to have its own fund. This will make research system more sustainable, reduce dependence on donors and may even lead to cofinancing by clients. This trust fund could be fuelled by revenues generated from consultancy services, sale of farm produce from RNR RCs, sale of publications.
- **Diversification of funding and donors:** Proposals for general projects and programs relating to overall CoRRB activities will be pursued and further proposals, aiming at the diversity of funding and donors will be an on-going task. In the long run MoA should encourage private entrepreneurs (engaged in RNR sector business) to fund some research activities of their interest.

4.2 RNR Research Act

A RNR research act will be drafted and enacted. CoRRB will then become a statutory entity under the RNR Research Act. Guided by the Act, National Agriculture Research Strategy will be developed. The main policy orientation will be provided by MoA.

4.3 Clearing House for all RNR research in the Country

In the long run CoRRB would also like to encourage agencies out side MoA and private firms wishing to undertake RNR related research to follow research protocol adopted by CoRRB and get their proposal endorsed by CoRRB.

5. References

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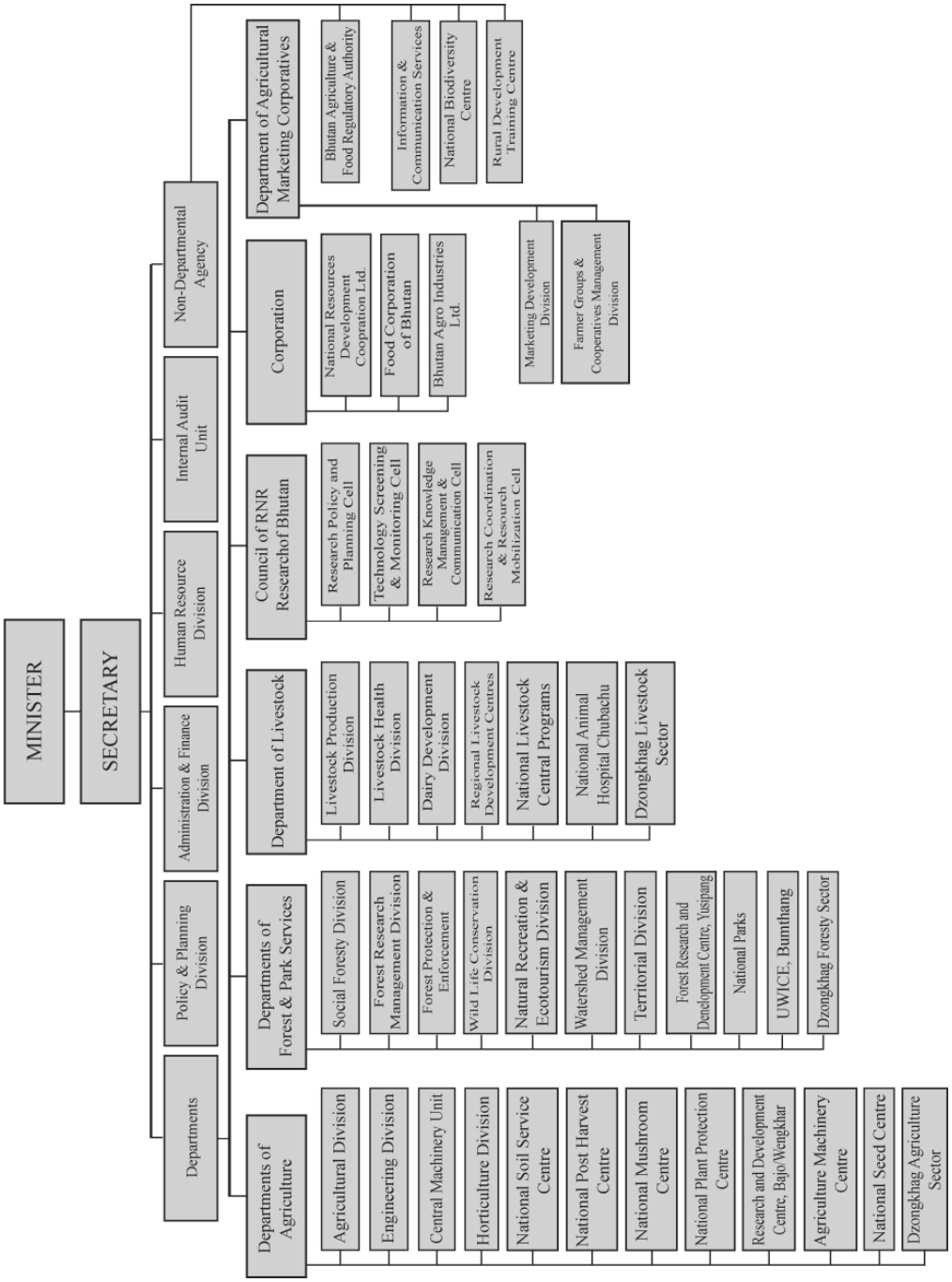
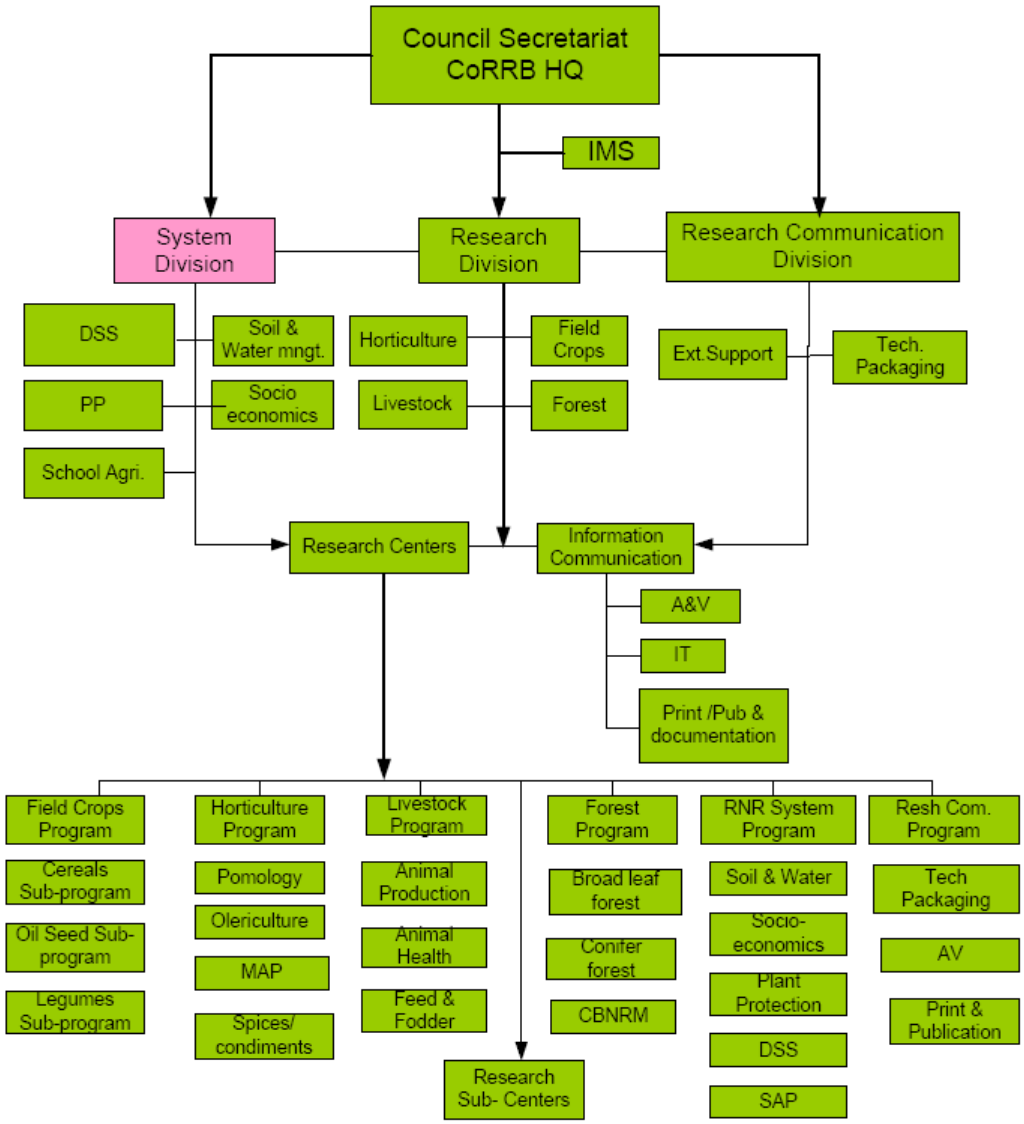
ANNEXURE 1. ORGANOGRAM OF MINISTRY OF AGRICULTURE OF BHUTAN



ANNEXURE 2. ORGANOGRAM OF CORRB



ANNEXURE 3. THE COUNCIL FOR CORRB

– Terms of Reference and Composition

Mandates of the Council

- Approve and guide CoRRB secretariat with regards to research policies on identified RNR research thematic areas
- Approve global work plan and budget
- Endorse the proposal for resource mobilization and utilization
- Review progress and provide direction
- Ensure institutional linkages amongst stakeholders for RNR research systems
- Promote linkage between the national and external research systems
- Manage Human resource at professional level
- Ensure that the technology generated is transferred effectively through the extension system to the beneficiaries

Membership composition of the Council

Permanent members:

1. Hon’ ble Minister, Ministry of Agriculture - President:
2. Hon'ble Secretary, MoA – Vice President
3. Director, DoA, MoA
4. Director, DoF, MoA
5. Director General, DoL, MoA
6. CPO, PPD, MoA
7. CHRO, HRMD, MoA
8. PD, NBC, MoA
9. CMO, AMS, MoA
10. Director, CoRRB, MoA - Member Secretary

Associate members:

1. Research Department, RUB
2. Centre for Bhutan Studies
3. Ministry of Economic Affairs
4. National Environment Commission
5. Food Corporation fo Bhutan
6. Dzongda/MoHCA - Affiliate member
7. Farmer Groups/Cooperatives
8. RNR entrepreneur
9. Bhutan Agriculture and Food Regulatory Authority
10. Member of Parliament

MEETING FREQUENCY AND QUORUM OF THE COUNCIL

Frequency

- General meetings – two in a year. Attendance by all the members - both permanent and affiliate.
- Working meetings - as and when need arises with only Permanent members. Such GC working meetings could also be called by any one of the Permanent members. Such a system will enhance the building up of ownership of research by all concerned agencies.

Quorum

- Two thirds of the members present. However, in circumstances when the members are unable to attend, meeting can be held with proxy members after getting approval from the President.

ANNEXURE 4. SCIENTIFIC TECHNICAL COMMITTEE

- Terms of Reference and Composition

Scientific Technical Committee (STC) was instituted to assist the CoRRB to provide technical guidance on research programmes. The main function of the STC is to provide technical advice and support to the Council for CoRRB. Particularly, it will ensure collaboration between Research and other agencies, promote ownership of research by agencies, and avoid duplication of research by agencies in the Ministry of Agriculture.

One of the members will chair the Committee on rotational basis. The Chief Research Officer (CRO) of CoRRB is the Member Secretary of STC. A minimum of two meetings a year will be held. Special meetings could be called on need basis. The followings are the members of STC.

Current members of STC:

1. A Specialist, DoA
2. 2 Specialists, DoL
4. 2 Chief Forest Officer, DoF
5. Senior Conservation Officer, NBC
6. Specialist, Whengkhar, CoRRB
7. Specialist, Yusipang, CoRRB
8. Programme Director, Jakar, CoRRB
9. Principal Research Officer, CoRRB
10. 2 Chief Research Officers, CoRRB
12. Specialist, NPPC

Terms of Reference

- Review and recommend RNR Research Policy for endorsement by the Council.
- Provide technical advice to guide RNR research agenda setting and prioritization.
- Advise CoRRB on strategic and opportunity research (medium-long term) areas of national interest
- Review RNR Research Proposals submitted by Departments/Agencies and CoRRB and advise
- CoRRB for issue of technical clearance for undertaking research.
- STC will develop guidelines for screening proposals for submission to STC. The STC will deal with research of national importance, long term, academic and exploratory in nature.
- Provide advise and facilitate the enhancement of research needs including human, physical and financial resources for the RNR research system
- STC members should facilitate linkages between Department/Agencies and CoRRB. The members will communicate information on research conducted in

their respective Department/Agencies to the STC and CoRRB through their Departments/agencies.

- STC should be a facilitating body for encouraging research rather than being impediments to research system.
- STC will play an important role to improve linkage between Research Institutions (CoRRB) & Departments/Agencies.

ANNEXURE 5. EXTENSION COORDINATION COMMITTEE

- Terms of Reference and Composition

ECC has the over riding mandate to facilitate the coordination and integration of RNR Extension services amongst the various agencies of the MoA viz: CoRRB, DoA, DoL and DoF and other relevant agencies. ECC functions as a technical committee with CoRRB. The Director of CoRRB chairs the Committee meeting

Member Composition

1. Chief Agriculture Officer, DoA
2. Chief Livestock Officer, Livestock production Div, DoL
3. Chief Forest Officer, Social Forestry Division, DoF
4. Chief Planning Officer, PPD, MoA
5. Chief Marketing Officer, AMS, MoA
6. Chief Human Resource Officer, HRMD, MoA
7. Programme Director, ICS
8. Head of Extension & Communication Faculty, CNR
9. Chief Research Officer (Communication), CoRRB - Member Secretary
10. Any other deemed necessary will be invited.

Terms of Reference

- Review and develop extension policy and operational framework.
- Advise and recommend solutions on extension related issues to the Ministry and related agencies.
- Review and propose innovative extension programme, methodologies and approaches
- Contribute to strengthening linkages between research, extension and central programme through appropriate mechanism.
- Represent RNR Extension in both national and international fora/institution

Conduct of the Meeting

Minimum of three meetings in a year will be conducted. Additional meeting can be conducted based on need. All session should be endorsed by a minimum of 2/3 quorum of designated members. The meeting will be attended only by the designated members.

ANNEXURE 6. VARIETY RELEASE COMMITTEE

- Terms of Reference and Composition

The main function of the VRC is to coordinate and conduct the release of new varieties of crops, fodder and trees. Director, CoRRB is the chairperson and Chief Research Officer, CoRRB the member secretary. VRC has the followings as the members.

1. Director, CoRRB - Chairperson
2. Chief Agriculture Officer, DoA - Member
3. Chief Horticulture Officer, DoA - Member
4. Chief Livestock Production Officer, DOL - Member
5. Chief Forest Officer, SFD, DOF - Member
6. Chief Extension Communication Officer, CoRRB - Member
7. Program Director, Forestry Research Program - Member
8. Program Director, Field Crops Research Program - Member
9. Program Director, Livestock Research program - Member
10. Program Director, Horticulture Research program - Member
11. Program Director, NPPC, DoA - Member
12. Representative from DSC - Member
13. Representative from BAFRA - Member
14. Chief Research Officer, CoRRB - Member Secretary

Terms of Reference

- Establish and adopt procedures for release of variety.
- Scrutinize the variety release proposals and recommend to the National Seed Board (NSB) for formal approval/ notification.
- Propose to NSB for de-notification of obsolete varieties from the production at breeder seed stage while allowing their completion of chain at foundation and certified seed stages, unless the continuation of variety is detrimental to the national interest.
- Establish guidelines for considering varieties introduced from public and private program, and determine whether to recommend them or marked them as suitable or unsuitable for notification

ANNEXURE 7. RESEARCH MANAGEMENT COMMITTEE - TERMS OF REFERENCE AND COMPOSITION

The main function of the RMC is to coordinate the research programme of the various research centers. In particular, coordination is needed for those research programme that are not sector specific, eg. NRM, farming system, water management. Director, CoRRB chairs the committee meetings.

Members of RMC:

1. 3 Chiefs of Division at CoRRB HQ
2. Chief, IMS, CoRRB
3. 3 SROs, CoRRB
4. Program Officer, SAP, CoRRB
5. 4 Program Directors, RNR RCs, Yusipang, Bajo, Whengkhar, Jakar

Terms of Reference:

- To coordinate research programs implementation
- To ensure implementation of research policies and long-term research plans
- To ensure and facilitate resource deployment including HRD
- To ensure consistency in implementing crosscutting research issues

Minimum of two meeting a year will be held. Special meetings could be called on need basis.

ANNEXURE 8. STANDARD RESEARCH PROTOCOL

1 TITLE

The title should be informative, specific, and concise emphasizing the main points of research study.

2. BACKGROUND

2.1 Literature Review:

Present brief review of existing literature and show what has been done and identify gaps in knowldege/information in the study area

2.2 Statement of Problem

This constitutes the scientific justification for the need to carry out research to generate further knowledge to solve the problem. The statement must be written clearly and concisely making a convincing argument that there is no sufficient knowledge available to explain the problem and its possible alternative solution

3. RESEARCH OBJECTIVE AND HYPOTHESIS

Clearly state research hypothesis and research objectives. Research objective simply the operationalisation of the answers and/or hypothesis formulated by the researchers. The objectives may be split into general or specific objectives. However, emphasise what is unique and innovative in the research.

4. MATERIALS AND METHODS

4.1 Experimental Sites/Location

Clearly specify where the research will take place. Some research could be on-station, on-farm or mixture of both. Some may involve multi-location trials including visiting houses or rural farmers. These need to be clearly indicated.

4.2 Experimental Design and Data Analysis

Methodology should include the study design and the techniques used to carry out the experiment. The researcher should clearly indicate type of experimental design (eg. Split-plot Design, Completely Randomised Block Design, etc) and type of statistical software to be used for analysis of data (eg. SPSS, GenStat, SAS, etc).

4.3 Ethical Issues

Not all research will require ethical consideration. However, when the sample unit of the research involves animal and human subjects due consideration should be given on ethical issues in the following aspects:

Known benefits and risks or advantages for the subjects in the study should be communicated

Indicate any special treatments that subjects will receive through their participation in the study

Indicate how the information obtained from the participants will be kept confidential

Justify on the inclusion / exclusion, as appropriate, of certain segments of population based on economy, ethnicity or racial group etc.

5. IMPLEMENTATION PLAN / TIME FRAME

Need to have clear time schedule for implementation of research activities including the start and completion date.

6. FUNDING

State the facilities, equipment and other resources needed relating to what your institute/agency can provide and what percentage of funding is required to implement the proposed study. Indicate whether your organization, or maybe other organizations or donors will cover the part/whole of research cost. The proposed budget should be credible, realistic, and clearly reflecting your research plan.

7. EXPECTED OUTCOME AND RESULT DISSEMINATION

Specify clearly the expected outcome of research and possible application of your research. Also state clearly how how the result will benefit a specific sector, society, or economic and environmental implications.

8. PROPONENT

Write clearly the name of the lead researcher and contact address including e-mail address

9. REFERENCES

Sd.

Approving Authority

ANNEXURE 9. STAFF LIST OF CORRB

Work Station :	**CoRRB HQ**	
Name	**Position**	**Qualification/Specialisation**
Dr. Tashi Samdup	Director	Ph D Livestock Production
N.K. Pradhan	Specialist (Plant protection)	M.Sc. Entomology
Tseten Rabgay	Chief Research Officer (Information Management)	B.Sc. Agriculture
Dorji Dhradhul	Chief Research Officer (Communication)	M.Sc. Agriculture Extension
Kailash Pradhan	Deputy Chief Research Officer	M.Sc. in Agriculture System
Karma Dorji	Deputy Chief Research Officer	M.Sc. Horticulture
Chencho Dukpa	Deputy Chief Research Officer	M.Sc. Agriculture
Jamyang Phuntshok	Research Officer	M. Sc in Agro meteorology
Bal Bdr.Rai	Senior Research Assistant	Diploma in Agriculture
Ugen Lhendup	Research Assistant II	Diploma in Agriculture
Kinley Dem	Research Assistant II	Diploma Forestry
Work Station :	**RNRRC Jakar**	
Dr. Jambay Dorji	Program Director	B.Sc.V & AH
Livestock/Animal Husbandry		
NB Tamang	Principal Research Officer	M.Sc Animal Production.
Kelzang Wangchuk	Senior Research Officer	M.Sc. Agri
Gyem Tshering	Senior Research Assistant	Dipioma in Agriculture
Karma Dorji	Senior Research Assistant	Diploma in A.H.
Chhogyel Samdrup	Senior Research Assistant	Class IX
Ugyen Lhendup	Senior Research Assistant	Diploma
Dawa Lhapa Sherpa	Senior Research Assistant	Diploma
Gyem Thinley	Senior Research Assistant	Diploma
Prasad Bhujel	Research Assistant II	Diploma (Livestock)
Samten Nidup	Research Assistant II	Diploma (Livestock)
Benoy Gurung	Research Assistant II	Diploma CNR
Dhurba Kumar Mongar	Livestock Production Supervisor	Certificate
Pema Thinley	Research Assistant II	Forestry course
Field Crops		
Wangda Dukpa	Deputy Chief Research Officer	M.Sc.Agriculture
Deki Pem	Senior Research Assistant	Diploma in Agri.
Neelam Pradhan	Senior Research Assistant	Certificate in Agriculture
Gem Lhamo	Research Assistant II	Diploma in Agriculture
Khandu	Laboratory Assistant I	Certificate in Agriculture

Forestry		
Dorji Dukpa	Senior Research Assistant	Diploma in Forestry
Prem Bdr. Rai	Senior Research Assistant	Certificate in Forestry
Norbu Gyeltshen	Senior Research Assistant	Diploma in Forestry
Tshewang Dorji	Lab Assistant	Certificate in Forestry
Phurba Thinley	Laboratory Assistant	Certificate in Forestry
Sangey	Laboratory Assistant	Certificate in Forestry
Farming Systems		
Tshering Dhendup	Research Assistant I	Diploma in Forestry
Research Communication		
Dawa Dakpa	Assistant Research Officer	B.Sc
Rabgyel Dukpa	Senior Research Assistant	Diploma in Agriculture
Horticulture		
Dorji Wangchuk	Principal Research Officer	PG Diploma in Agriculture
Sangay Dorji	Research Officer	Certificate in Agriculture
Tsheten Lhundup	Senior Research Assistant	Diploma in Agriculture
Ugen Wangdi	Research Assistant I	Diploma in Agriculture
Yeshey Dorji	Research Assistant II	Diploma in Agriculture
Ganga Ram Ghalley	Research Assistant II	Diploma in Livestock
Tsering Dorji	Research Assistant II	Diploma in Agriculture
Ugyen Tshering	Laboratory Assistant I	Certificate in Agriculture
Namgay	Laboratory Assistant II	Certificate in Agriculture
Work Station: RNRRC Bajo		
Sangay Duba	Program Director	M.Sc. Agronomy
Field Crops		
Mahesh Ghimirey	Principal Research Officer	M. Phil Biodiversity
Sangay Tshewang	Research Officer	B.Sc. Agriculture
Neten Dukpa	Senior Research Assistant	Diploma in Agriculture
Legjay	Senior Research Assistant	Diploma in Agriculture
Cheku Dorji	Senior Research Assistant	Diploma in Agriculture.
Lhab Gem	Research Assistant II	Diploma in Agriculture
Chandra Bdr. Tamang	Research Assistant II	
Horticulture		
Gyambo Tshering	Deputy Chief Research Officer	M.Phil Horticulture
Dawa Delma	Senior Research Assistant	Diploma
Sonam Chhophel	Senior Research Assistant	Diploma
Dawa Dukpa	Research Assistant I	
Lungki	Research Assistant II	Diploma in Agriculture

Pasang Dorji	Research Assistant II	Diploma in Agriculture
Tshering Yangden	Laboratory Assistant I	Certificate in Agriculture
Forestry		
Dr. Mani Ram Moktan	Principal Research Officer	Ph.D in Forestry
Purna Bahadur Gurung	Senior Research Assistant	Diploma in Forestry
Yograj Chhetri	Research Assistant I	Diploma in Forestry
Rinzin Dorji	Research Assistant I	Diploma in Forestry
Livestock		
Dr. Jigme Dorji	Research Officer	B.Sc.V & AH
Jimmy Dorji	Senior Research Assistant	Diploma in Animal Husbandry
Leela Maya Dahal	Research Assistant I	Diploma in Animal Husbandry
Sangay Tshering	Research Assistant II	Diploma in Animal Husbandry
Dal Bdr. Rana	Research Assistant IIII	Certificate in Animal Husbandry
Farming System		
Thinley Gyamtsho	Deputy Chief Research Officer	M.Sc. NRM
Sangay Wangdi	Deputy Chief Research Officer	M.Sc
Yeshey	Assistant Research Officer	Diploma in Agriculture
Aita Kumar Bhujel	Assistant Research Officer	Diploma in Agriculture
Tanka Maya Pulami	Senior Research Assistant	Diploma in Agriculture
Kinzang Dorji	Research Assistant I	Certificate in Agriculture
Jigme Norbu	Research Assistant I	Diploma in Agriculture
Yeshi Zangpo	Research Assistant II	Diploma in Agriculture
Kinga Lham	Research Assistant II	Diploma in Agriculture
Research Communication		
Singey Phub Dy.	Chief Research Officer	M.Sc. Agriculture Extension
Prajapati Nepal	Assistant Research Officer	Diploma in Agriculture
Work Station:	**RNRRC Wengkhar**	
Tayan Raj Gurung	Specialist III	M.Sc Agriculture Systems
Horticulture		
Duptho Wangchuk	Research Officer (OIC)	Diploma in Agriculture
Loday Phuntsho	Sr. Research Officer	B.Sc Horticulture
Kinley Tshering	Sr. Research Officer	MPhil in Soil Science
Pema Wangchuk	Research Officer	MSc. Horticulture
Sonam Gyeltshen	Research Officer	B.Sc. Horticulture
Gyelpo	Research Officer (OIC)	Diploma in Agriculture
Dhanapati Dhungyel	Research Officer	Diploma in Agriculture
Phuntsho	Sr. RA (OIC)	Diploma in Agriculture
Khampa	Sr. RA	Diploma in Agriculture

Gyeltshen Tshering	Sr. RA	Diploma in Agriculture
Karma Tenzin	Research Assistant I	Diploma in Agriculture
Ugyen Norbu	Research Assistant I	Diploma in Agriculture
Thinley Penjor	Research Assistant II	Diploma in Agriculture
Sonam Tashi	Research Assistant II	Certificate in Agriculture
Chheko Dukpa	Research Assistant II	Certificate in Agriculture
Pema Gyeltshen	Laboratory Assistant I	Certificate in Agriculture
Lotay Jamtsho	Laboratory Assistant II	Certificate in Agriculture
Field Crops		
Tirtha Bahadur Katwal	Principal Research Officer	M.Sc. Potato Agronomy
Dorji Wangchuk	Research Officer	
Nar Bdr Adhikari	Assistant Research Officer	Diploma in Agriculture
Sangay Wangdi	Sr. Research Assistant	Diploma in Agriculture
Namgay Wangdi	Research Assistant I	Certificate in Agriculture
Purna Bahadur Biswakarma	Research Assistant II	Certificate in Agriculture
Research Communication		
Lhap Dorji Dy.	Chief Res. Officer	M.Sc.Agriculture Extension
Domang	Assistant Research Officer	Diploma in Agriculture
Sangay Jamtsho	Research Assistant II	Diploma in Agriculture
Farming Systems		
Tshering Penjor	Senior Research Officer	M.Sc.Agri.
Meena Devi Dhungyel	Assistant Engineer II	Diploma in Civil Engineering
Pema Thinley	Research Assistant II	Certificate in Animal Husbandry
Chokey Nima	Research Assistant II	Diploma in Agriculture
Kelzang Lhaden	Research Assistant II	Diploma in Agriculture
Forestry		
Purna Bdr.Chettri		Ph D (on going)
C. B. Rai	Research Officer	
Jambay Gyeltshen	Sr. RA	Diploma Forestry
Yangchen Lhamo	Research Assistant II	Diploma Forestry
Dorji	Research Assistant I	Diploma Forestry
Migma Dorji Tamang	Sr. Research Assistant	Diploma in Forestry
Livestock		
Dr. MP Temsina	Principal Research Officer	M.Sc. Animal Production
Pema Wangchuck	Sr. Research Assistant	Diploma Animal Health
Meenuka Rai	Sr. Research Assistant	
Nar Bahadur Rai	Research Assistant II	Certificate in Animal Health

Work Station:	**RNRRC Yusipang**	
Dr. Lungten Norbu	Specialist III	Ph.D in Forest Management
Forestry		
Dal Bdr. Chettri	Senior Research Officer	Diploma Forestry
Dr. Kinley Tenzin	Dy. Chief Research Officer	PhD Conifer Forest
Sonam Tashi Dy.	Chief Research Officer	M.Sc. Forestry
Dr. Pema Wangda	Sr. Research Officer	PhD Forestry
Kunzang Choden	Research Officer	M.Sc (on going)
Tshewang Dorji	Research Officer	B.Sc.Forestry
Kinley Rabgay	Research Officer	BSc. Forestry
Kencho Dukpa	Assistant Research Officer	Diploma Forestry
Tek Bahadur Rai	Sr. Research Assistant	Diploma Forestry
Cheten Thinley	Research Assistant I	Diploma Forestry
Dawa Tshering	Research Assistant I	Diploma Forestry
Kuenzang Dhendup	Research Assistant I	Diploma Forestry
Dorji Gyeltshen	Research Assistant I	Diploma Forestry
Dorji Namgyal	Research Assistant I	Certificate Forestry
Norbu Zangmo	Research Assistant II	Diploma in Forestry
Udai Kumar Pradhan	Research Assistant II	Certificate Forestry
Livestock		
Tshering Gyeltshen Dy.	Chief Research Officer	Certificate in Animal Husbandry
Bolanath Sharma	Dy. Chief Research Officer	Diploma in Animal Husbandry
Harilal Nirola	Research Assistant II	Diploma in Animal Husbandry
Santaman Rai	Research Assistant I	Diploma in Animal Husbandry
Yonten	Research Assistant II	Certificate in Animal Husbandry
Krishna Kr. Rai	Research Assistant II	Diploma in Animal Husbandry
Horticulture		
Tshitila	MAP Specialist III	M.Sc.Agriculture
Kesang Tshering	Principal Research Officer	M.Sc. Horticulture
Pema Yuden	Dy. Chief Research Officer	M.Sc. Horticulture
Kinlay Tshering(Mrs)	Dy. Chief Res. Officer	M.Sc. Horticulture
Namgay Thinley	Sr. Research Officer	B.Sc. Horticulture
Tshewang Namgay	Research Officer	B.Sc Horticulture
Sonam Wangmo	Research Officer	B.Sc. Horticulture
Karma Pelden	Assistant Research Officer	Diploma in Agriculture
Dhurba Das Chettri	Assistant Research Officer	Certificate in Agriculture
Tshering	Assistant Research Officer	Diploma in Agriculture
Pema Yangzom	Assistant Research Officer	Diploma in Agriculture

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Thinley Pem	Laboratory Assistant II	Certificate in Agriculture
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Hema Devi Nirola	Sr. Research Assistant	Diploma in Agriculture
Kalpana Rai	Sr. Research Assistant	Diploma in Agriculture
Padan Lal Giri	Research Assistant I	Certificate in Agriculture
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Jigme Wangdi	Principal Research Officer	M.Sc.Agro Forestry system
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NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN INDIA

Appendix C

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN INDIA

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One of the essential components that ensure required capability to meet the needs of the increasing population through increased production is an effective agricultural research system. It should be strong for sustaining a dynamic development program and provide for change, often dramatically to meet the emerging technological needs and changing socioeconomic milieu. The size and organization of the research system have to be compatible with nation's development objective and available resources. It should be cohesively structured to meet the requirements of policy planning for agricultural development and meet the challenges that latter imposes.

The National Agricultural Research System (NARS) of India mainly comprises institutions of the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), which are under the public sector domain. The other public sector units like agricultural faculties/ institutes/ colleges in Central/ State Universities, Central Ministries and Departments, Krishi Vigyan Kendras and Departments of Agriculture in the States and other related departments are components of the Indian NARS. Besides, some private units like seed companies, fertilizer industries, pesticides companies, dairy and poultry units, etc. are also closely associated with the Indian NARS.

The present country paper on '*National Agricultural Research System Management in India*' provides an overview of structure of agricultural research and development, governance system, review/ monitoring mechanism and incentive structure existed. This paper is the outcome of SAARC Agriculture Centre (SAC), Dhaka, Bangladesh, initiatives taken during 2009 to document the NARS diversity in member countries.

I am grateful to Dr P. K. Joshi, Dr B. C. Barah (former Directors, NCAP), and Prof. Ramesh Chand, Director, NCAP, for providing all the necessary support, and encouragement to complete the country report. I sincerely thank to Dr Mruthyunjaya, (former National Director, NAIP), New Delhi, for going through the paper and providing comments. Thanks are also due to Mr. Umesh Singh, for assistance during preparation of paper. A word of appreciation goes to Dr B. S. Aggarwal for his patience in editing the paper. Needless to say, there remain errors, lacuna and omission, which is my sole responsibility.

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EXECUTIVE SUMMARY

The National Agricultural Research System (NARS) of India mainly comprises institutions of the Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs), which are under the public domain. The other public sector units like Agricultural Faculties/ Institutes/ Colleges in Central/ State Universities, Central Ministries and Departments, Krishi Vigyan Kendras and Departments of Agriculture in the States and other related departments are components of the Indian NARS. Besides, some private units like seed companies, fertilizer industries, pesticides companies, dairy and poultry units, etc. are also closely associated with the Indian NARS.

Historically, Indian NARS started developing from the beginning of the 20th century. Agricultural Colleges and Bacterial Laboratory were established to undertake organized scientific research on problems related to crops and livestock. Notwithstanding that agriculture is a state subject in India, the Union Government through ICAR, make efforts to empower the national agriculture system. In addition, various central commodity committees like Central Cotton Committee (1921), Indian Lac Committee (1931), Central Tobacco Committee (1945), Central Oilseeds Committee (1947), etc. were also established to deal with research in respect of particular crop commodity.

After independence, the research system in India has undergone some major changes. *First*, a number of SAUs were established, and the first among them was Govind Ballabh Pant University of Agriculture and Technology at Pantnagar in the erstwhile Uttar Pradesh in 1960. There are now 45 SAUs spread across different states of India. There is one Central Agricultural University in Meghalaya, catering the needs of North-Eastern states of India. The ICAR has established its own 97 institutions (comprising 5 National Institutes, 44 Central Institutes, 17 National Research Centres, 25 Directorates and 6 National Bureaux) to undertake basic and strategic research in agriculture and allied activities. *Second*, to strengthen the agricultural research and development (R&D) system, ICAR was reorganized first in 1965 to bring centrally-sponsored research activities relating to crops, commodities, animal sciences, and fisheries under one umbrella. The second reorganization of ICAR took place in 1973 to give it greater autonomy and flexibility in operation, management and recruitment. This paved the way for creation of Department of Agricultural Research and Education (DARE) in the Ministry of Agriculture to provide ICAR necessary linkage to deal directly with the Central and State Governments on one hand, and the International Organizations on the other without going through the Department of Agriculture and Cooperation of the Ministry of Agriculture, Government of India. The Director General of the ICAR became the ex-officio Secretary (DARE) to the Government of India. The other reforms processes like rationalization of the number of research management positions at ICAR Headquarters, strengthening of ICAR-Industry interface to promote commercialization of technologies, institutionalizing IPR protection, creation of National Fund for Strategic Agricultural Research, etc. based on the recommendations of committees/ groups set up by the Union Government over time.

To strengthen the R&D programs in agriculture, a number of initiatives were taken over the years. In the late-1970s, an innovative program called National Agricultural Research Project (NARP) was launched with the World Bank support to strengthen the regional research capability of the SAUs. Besides, a few other programs / innovations were introduced to make the Indian NARS more vibrant and effective towards meeting peoples' need. These included Institution Village Linkage Program (1995), National Agricultural Technology Project (1998), National Agricultural Innovation Project (2006), etc.

The ICAR manages agricultural research through its own research institutions, supporting network projects, awarding scholarships, fellowships, etc. The research priority is decided through a rigorous process involving Working Groups, set up by the Planning Commission (highest planning body in India), and eight Regional Committees constituted by the ICAR. In addition, several other bodies like Research Advisory Committee (RAC), Management Committee (MC), Quinquennial Review Team (QRT), and Institute Research Council (IRC) help in prioritizing research agenda of the respective institutes.

The Indian NARS is represented by about 22,000 scientists (precisely 21869), and 96% of them being in the public sector institutions. The skill level of the system is very high, and more than two-thirds of the scientists are Ph.D. degree holders. The scientists/ faculties are recruited through an open system and purely on merit. In the case of ICAR, an independent body called Agricultural Scientists Recruitment Board (ASRB) selects the required position on behalf of the Council. In the case of SAUs and other institutions also, personnel are selected through an open system and based on merit.

There has been a quantum jump in the total government spending in agricultural research and education (R&E) in India. It increased from Rs 1875 million in 1981 to Rs 7704 million in 1991, to Rs 25446 million in 2001 and Rs. 43200 million in 2007. During 2005-06 to 2007-08, the share of Central and states in R&E expenditure was 54% and 46%, respectively.

Functioning of ICAR has been reviewed periodically to enhance its capacity and to respond to highly dynamic needs of the agricultural development in the country. The RAC, MC and IRC also help in improving the efficiency of respective institutes and in turn the system efficiency. The role of private sector is becoming important day-by-day in the agricultural R&D. The performance of an individual scientist is judged based on professional and general assessment (including health status and integrity).

The ICAR provides incentives to its scientists for acquiring higher qualifications and for retaining talented scientists by providing prestigious positions, awards and scholarships and relaxation in age. Several prizes and awards are given to institutions and individuals to enhance the performance and job satisfaction of its employees and help the organization achieve its potential. Presently, ICAR gives 17 awards in different categories, of this 8 awards are given annually, and 9 are given biannually to recognize the agricultural scientists and institutions.

NATIONAL AGRICULTURAL RESEARCH SYSTEM IN INDIA[†]

BACKGROUND

Agriculture including crop and animal husbandry, inland and marine fisheries, agro-forestry and agro-processing provides the base for food and livelihood security of India. It also supports the economic growth and social transformation of the country. Agriculture is the largest private sector enterprise in India with more than 100 million farm holdings, and is one of the world's largest agrarian economies. It is the lifeline of Indian economy and will continue to so in foreseeable future (Rai 2008). Agriculture sector (including allied activities) in India accounted for 15.7% of GDP (at 2004-05 prices) in 2008-09, compared to 18.9% in 2004-05, and contributed about 10.2% of total exports in 2008-09 (GoI 2010). Traditionally, agriculture has been the largest employer in India and even today provides direct employment to about 234 million people (cultivators and agricultural labourers). It provides raw material for several agro-based industries in India. Besides providing food and nutritional security, the sector provides social security in the form of employment and income, alleviating poverty, improving gender equity, maintaining ecological and environmental security, etc. The contribution of agriculture to India's security at the time of economic sanctions and in strengthening the national sovereignty is well recognized. Yet, it continues to remain an unorganized sector in the country.

The climate of India is highly diverse, ranging from tropics in the south to warm, temperate subtropics in the north. The extreme east receives very high rainfall, while in the extreme west, the rainfall is very low and erratic. Nearly one-third of the country receives an annual rainfall of less than 750 mm. In India, about 60% of agriculture is rainfed and prone to vagaries of monsoonal aberrations like drought. The arid zones occupy nearly 320,000 sq. km area mainly in the states of Rajasthan, Gujarat and Haryana. In addition, a cold desert spread over 84,000 sq. km area exists in the cold regions like in Ladakh.

Nearly one-sixth of the land area has serious limitations for crop production such as erosion, aridity, waterlogging, acidity, salinity, and alkalinity. It is estimated that nearly 80 million hectares of cultivated area require soil conservation measures. The problems of salinity and waterlogging have appeared within a few years of the introduction of irrigation. An estimated 7 million hectares of land are affected by salinity and alkalinity, the majority of which occur in the potentially fertile irrigated areas of the Indo-Gangetic alluvial plains.

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India has an estimated 176 million hectares of surface water and 57 million hectares of ground water potential. As against an ecologically safe level of 33%, only about 23.3% of the land area is under forest cover (FAO 2009). About 2 million people, mostly in the North-Eastern Hill Region, follow shifting cultivation involving 11 million hectares of land causing serious environmental degradation and ecological imbalance. Indiscriminate destruction of forests coupled with irrational use of soil and water resources have resulted in land degradation at an alarming rate of 1.5 million hectares every year.

India through adoption of modern agricultural technologies has moved from an era of chronic food shortages and 'begging bowl' status during the 1960s, when its annual food imports were around 8-10 million tonnes, to a level of food self-sufficiency, buffer stocks and even food exports from 1990s. With reference to 1950, the productivity gains are nearly 3.3-times in foodgrains, 1.6-times in fruits, 2.1-times in vegetables, 5.6-times in fish (aquaculture), 1.8-times in milk and 4.8-times in egg production at present (Rai 2008). Despite the significant increase, livestock and fisheries potential remain largely under-exploited compared to that of food crops. The Indian Council of Agricultural Research (ICAR), which is the flagship of the Indian National Agricultural Research System (NARS), was awarded the 'King Baudouin Development Prize International' for the best agricultural institution in the world in 1988 in recognition of its significant research contributions, and for research excellence in 2004 as a major partner of NARS led Rice-Wheat Consortium in association with CGIAR institutions. His Excellency, the then President of India, Shri K R Narayanan, in his address to the nation on 15 August 1997, on the occasion of the 'Golden Jubilee of India's Independence', had cited self-sufficiency in foodgrains production as one of the most outstanding achievements of the post -Independence era.

The country paper on '*National Agricultural Research System Management in India'* has been developed as part of the SAARC Agriculture initiative to understand the *NAARS in SAARC Countries – An analysis of System Diversity*. The paper is organized as follows: the governance system of agricultural research and development encompassing historical development, organizational structure, and establishment of present NARS has been dealt in Section I. The organization of NARS describes institutions involved in NARS, role of Council in research management, coordination mechanism, mode of resource allocation, method of fixing research priorities, research planning process, recruitment process of scientists, linkage with state research installations and investment trend in research has been described in Section II. The following Section on institutional governance encompasses reforms for enhancing efficiency, management of outreach programs, private sector involvement, performance evaluation (individual), leadership development, research–extension linkage, education link with agricultural universities and management information system, etc. The Section IV. covers review/ evaluation/ monitoring mechanisms, institutional reviews, composition of review panel, frequency of review, monitoring of research programs, follow up of monitoring. The last section on incentive structure includes salary structure, incentive structure, HR management, sabbatical leave, pension facilities, technology marketing and prize and reward system, etc.

GOVERNANCE SYSTEM OF AGRICULTURAL RESEARCH AND DEVELOPMENT

One of the essential components that ensure required capability to meet the needs of the increasing population through increased production is an effective agricultural research system. It should be strong for sustaining a dynamic development program and provide for change, often dramatically to meet the emerging technological needs and changing socioeconomic milieu. The size and organization of the research system have to be compatible with nation's development objective and available resources. It should be cohesively structured to meet the requirements of policy planning for agricultural development and meet the challenges that latter imposes.

Historical Background

India's independence was born in the backdrop of the great Bengal famine. Famines were frequent during the colonial period. Most of the steps to improve agriculture were then taken on the basis of the recommendations of the Famine Commissioners in 1878 and 1898, and the mission of Dr J. A. Voelcker in 1889-90, the Imperial Government of that time decided to develop an agricultural research and extension system in India. The Famine Commission Report of 1880 led to the creation of the Department of Agriculture at the Centre as well as in the provinces with the primary tasks of undertaking scientific research and improvement in agriculture, apart from managing famine relief. The foundation of agricultural research in India was laid in 1890s by Dr J. A. Voelcker, the Consulting Chemist to the Royal Agricultural Society of England. His recommendations led to the appointment of an Imperial Agricultural Chemist in 1892, Imperial Mycologist in 1901, and Imperial Entomologist in 1903. This was the beginning of inducting scientists into agriculture. Most importantly, his work was instrumental in the establishment of the Imperial Agricultural Research Institute (IARI) in 1905 at Pusa, in the Darbhanga district of Bihar, with the help of a donation of £ 30,000 made by Mr. Henry Phipps of the United States of America. Following a severe earthquake in Bihar, the headquarters of IARI was shifted to New Delhi in 1936.

Subsequently, to conduct research and teach agricultural sciences six agricultural colleges were established in Pune, Kanpur, Sabour, Nagpur, Coimbatore, and Lyallpur (now in Pakistan). Organized scientific research on the problems of livestock started in India with the establishment of the Imperial Bacteriological Laboratory at Pune, and it became the precursor of the present-day Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh). This was preceded by the establishment of Veterinary Colleges at Bombay, Calcutta, Madras, and Lahore (now in Pakistan).

With the Constitutional amendments of 1919, the responsibility of agriculture was transferred to the State Governments. On the recommendations of the Royal Commission on Agriculture (1928), the Imperial Council of Agricultural Research was established as a Registered Society on 16 July 1929, which was funded mainly through a lump sum grant from the Government and the proceeds from the cess levied on certain agricultural commodities exported from India. After India's independence in 1947, the Imperial Council of Agricultural Research was renamed as Indian Council of Agricultural Research (ICAR) on June 10, 1948.

In addition to the ICAR, a number of Central Commodity Committees were established to deal with research in respect of particular crop / commodity. These Committees were semi-autonomous bodies financed by grants from the Government of India, or by income from the cess levied on a particular commodity, but functioned independently. The Indian Central Cotton Committee was established in 1921 and set the tone for an organized research on the basis of a network. Its success subsequently led to the establishment of a number of other Commodity Committees, viz. Indian Lac Committee (1931); Indian Central Tobacco Committee (1945); Indian Central Oilseeds Committee (1947); Indian Central Arecanut Committee (1949), and Indian Central Spices and Cashewnut Committee (1958).

After independence, the NARS in India has undergone some major changes. First, a number of State Agricultural Universities (SAUs) were established on the recommendations of the first Joint Indo-American Team in 1955. The first SAU was established in 1960 at Pantnagar in Uttarakhand, erstwhile part of Uttar Pradesh, and other Indian States followed suit. At present, there are 45 SAUs, spread across different States of India. There is one Central Agricultural University located at Imphal in the Manipur State. In addition, there are five Central Universities having strong agricultural faculty/ departments. Likewise, four National Institutes of the ICAR are also involved in higher education at the postgraduate level in agricultural sciences. These are: (i) Indian Agricultural Research Institute (IARI), New Delhi; (ii) Indian Veterinary Research Institute (IVRI), Izatnagar, Bareilly (Uttar Pradesh); (iii) National Dairy Research Institute (NDRI), Karnal (Haryana); and (iv) Central Institute of Fisheries Education (CIFE), Mumbai, (Maharashtra). These institutes have the status of deemed universities, and offer their own degrees and diplomas in agricultural and allied areas.

Second, on the basis of critical reviews and specific policy issues emanating from the recommendations of various Review Committees, the ICAR was reorganized first in 1966 to bring centrally sponsored research activities relating to crops, commodities, animal sciences, and fisheries under one umbrella. The Commodity Committees were abolished and the related Research Institutes along with those under the Ministry of Food and Agriculture, Government of India were merged with the ICAR so that problems of agricultural research could be viewed in totality. The rules and bye-laws of the Council were revised to make it functionally more effective, and technically more competent and autonomous. The Governing Body of the Council was reconstituted, making it pre-eminently a body of scientists and those with interest in or knowledge of agriculture/ rural development. An eminent agricultural scientist was appointed as the Executive Head of the ICAR and was designated as Director-General.

Though the reorganization of ICAR in 1966 increased its responsibilities, the Secretariat of ICAR continued to be an attached office of the Department of Agriculture, Government of India, thus limiting its effectiveness. In particular, the personnel policies and recruitment system were not found appropriate. Later, the second reorganization, following the appointment of another Review Committee in 1973, conferred on it greater autonomy and flexibility in operation, management and recruitment. A new, but small, Department of Agricultural Research and Education (DARE) was set up in the Ministry of Agriculture, Government of India, to provide the ICAR necessary linkage to deal

directly with the Central and State Governments on the one hand, and the International Organizations on the other, without going through the Department of Agriculture. The Director General of the Council concurrently became the ex-officio Secretary (DARE) to the Government of India.

The composition of the Council was modified so as to restrict the membership and make it a more business-like body with the Minister of Agriculture as its president. The Governing Body was also restructured and made more effective with the Director General as its Chairman. The country was divided into eight agro-ecological zones and Regional Committees were set up for each of these zones. To broad base the decision-making process at the Institute level, Management Committees were set up under the Chairmanship of their respective Directors. A new personnel policy was evolved and an All India Service called Agricultural Research Service (ARS) was created in 1975 to facilitate optimum utilization of the available manpower. Consequently, a new Agricultural Scientists Recruitment Board (ASRB), with an eminent scientist as its full-time Chairman and assisted by two scientists as Members, was established to recruit scientists to various positions in the ICAR.

To ensure complementarity in the research programs of different institutions and provide a mechanism for joint evaluation of new technologies by the scientists through multi-locational testing, a novel concept of All India Coordinated Research Projects was evolved. The first one, the All India Coordinated Maize Improvement Project, was launched in 1957. The concept was later extended to other crops, commodities, animal species, and several other areas of research.

In late-1970s, an innovative program known as National Agricultural Research Project was launched in 1979, with funding support of the World Bank, to strengthen the regional research capabilities of the Agricultural Universities in undertaking location-specific and need-based research on the basis of identified agro-ecological zones. Besides, a few other programs/ innovations were introduced to make the NARS more vibrant and effective and to meet people aspirations. Institution Village Linkage Program (1995), Agricultural Human Resource Development Project (AHRD), National Agricultural Technology Project (NATP) in 1998; and National Agriculture Innovation Project (NAIP) in 2006, are a few other mega initiatives of NARS in India, which made Indian agriculture more vibrant and effective.

Establishment of Institutions- Acts, Ordinance

With the Constitutional amendment in 1919, agriculture, veterinary and allied sectors became the States subject. States having the responsibility of agricultural development established facilities for research and extension in their respective regions. As a result, only the national level Institutes remained attached to the Central Government without any coordinating agency at the national level. Later in 1928, the Royal Commission on Agriculture examined the status of agriculture and rural economy in India. This Commission, which perceived the critical role of research in agricultural development, the Imperial Council of Agricultural Research, was formed on 16 July 1929. The ICAR was registered under the Registration of Societies Act XXI of 1860.

Soon after the India's independence, a number of Commissions, Committees, and Study Teams reviewed critically the prevailing agricultural status in the country and the structure and functioning of the related teaching, research and extension institutions.

University Education Commission under the Chairmanship of Dr S. Radhakrishnan made a far reaching recommendation of setting up Rural (Agricultural) Universities in India on the pattern of the Land Grant system of Agricultural Universities in the USA. The Commission made a number of concrete suggestions for the overall organizational structure, management and functioning of these agricultural universities including arrangements for strengthening agricultural experiment stations and involvement of faculty members and students in extension education and demonstration programs.

In pursuance of the recommendations of the University Education Commission and other expert committees and teams, the first Agricultural University was established at Pantnagar (the erstwhile undivided state of Uttar Pradesh) in 1960. A blue print for the structure and functioning of such a university had already been prepared by Dr H. W. Hannah in 1956, who was appointed as Dean of the University subsequently. It was indeed foresighted contribution since the blue print provided useful guidelines for establishment of a university not only at Pantnagar, but also came handy in the subsequent years as a document for the preparation of a Model Act for setting up other agricultural universities in India.

The emergence of private sector in India coincides with a wide-spread recognition of the need for reforms of ICAR. This has been stimulated by tightening of public funding for research, a need for better dissemination and uptake of technologies, a desire for improved client focus in research, and a need for capacity building in frontier areas of agricultural sciences. The growth of the private sector offers opportunities that potentially could assist in addressing these issues through three types of public-private sector interactions; private distribution of public technologies; private purchase of public research services and technologies; and public-private collaborative partnership (Hall *et al.*, 2002).

Organizational Structure

As per the Constitution of India, agriculture is a state subject. However, Government of India provides financial assistance to States of both financial and personnel for development of the sector. The existing structure of agricultural research system in India is shown in Figure 1.

The ICAR at the national level and the Agricultural Universities at the state level are the two main streams of agricultural research in India. Besides two main streams of research, some general universities and other agencies like scientific organizations related to agriculture, government departments, voluntary organizations, private institutions, etc. participate in the nation's research, education and extension efforts in agriculture. Agricultural Scientists Recruitment Board (ASRB) is another important entity of ICAR Society. The Board functions independently and has the responsibility for recruiting ARS scientists and other posts. The Board renders assistance to the Council in personnel matters, and advises Council on disciplinary matters relating to personnel recruited either by the Council or ASRB itself.

Reformation and Development

Presence of effective and strong agricultural research system is a must for meeting the demand for food production, capable in sustaining dynamic development programs

and provide for change, often dramatically, to meet the emerging technological needs and changing socio-economic milieu. The size and organization of research system have to be compatible with nation's developmental objectives and available resources. It should be cohesively structured to meet the requirements of policy planning for agricultural development and meet the challenges by imposed by the sector (Balaguru and Raman 1988)

The present agricultural research system in India has been developed over years of experience and experimentation, and has undergone some major changes in concept, organization and functions. Since independence, it has made rapid strides, in both concept and implementation, towards becoming an effective system in the country.

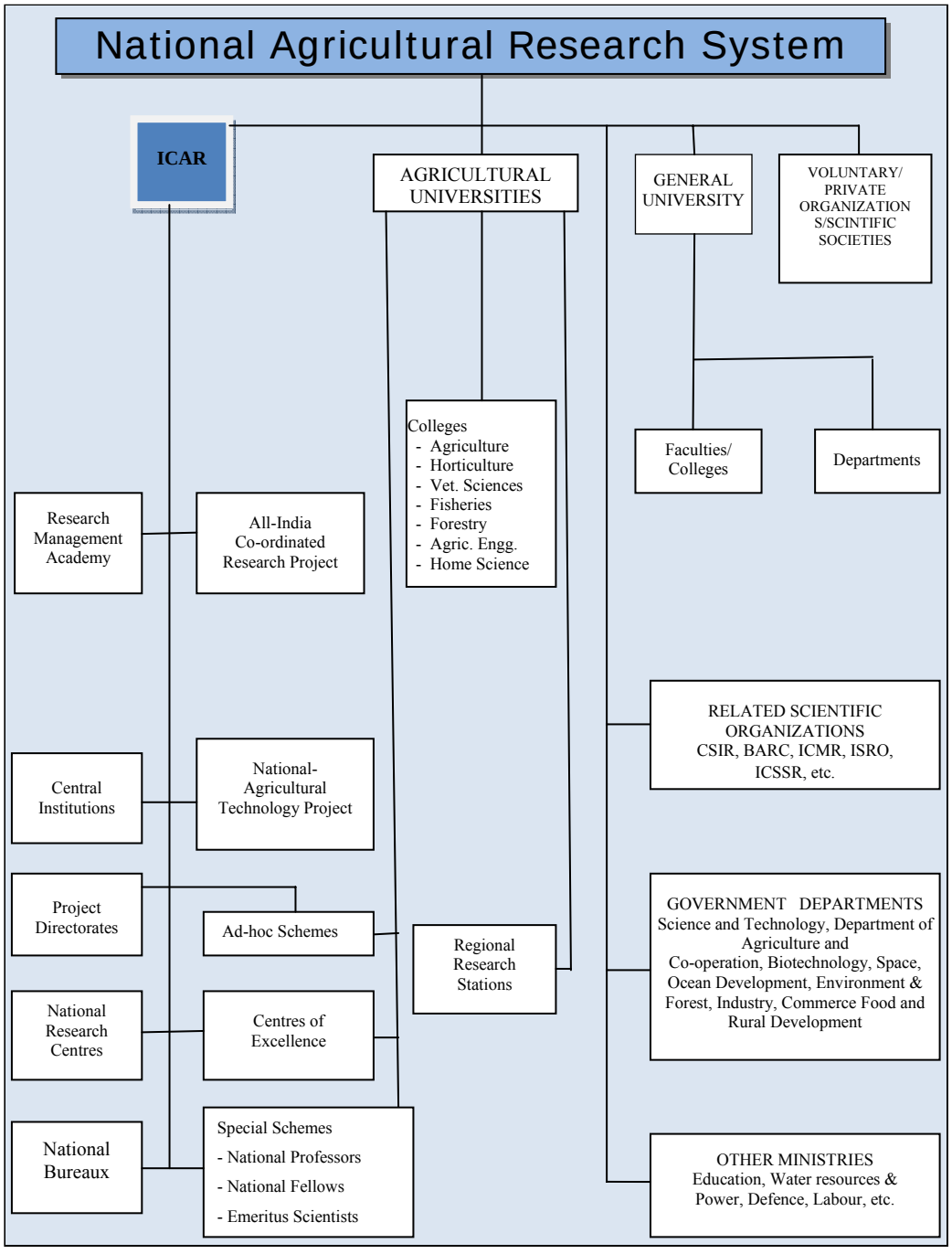
In the present system, the ICAR was started as a central agency on 16 July 1929. Despite agriculture lying with States, the ICAR undertakes nation-wide coordination of activities carried out by the Central Institutes and State Research Centres. Since the ICAR had limited control over the conduct of agricultural research in the country, the research efforts were fragmented, isolated, often duplicated and distributed in several functionary systems and Ministries (Balaguru and Raman 1988).

To strengthen and tackle research problems at the national level, network project called All-India Coordinated Research Projects (AICRPs) were initiated in 1957. Presently, 78 AICRPs are operating with the support of ICAR dealing with various crops/ commodities/ resources/ regions, etc.

Another development in NARS of India was launching of National Agricultural Research Project (NARP) in 1979. This was introduced to strengthen agricultural research at the regional level. The Agricultural Universities having state-wide mandate for education, research and extension did not have a strong base for regional research. The SAUs largely depended on the financial resources from the state governments and partly ICAR for developing University main campus, thereby neglecting the regional research needs. Considering this, the ICAR launched NARP with the financial assistance from World Bank. NARP was the first major efforts of the ICAR towards strengthening of the regional research capabilities of Agricultural Universities. Under the project, the country has been divided into 126 agro-climatic zones with 120 zones in 17 major states and six zones in the North-Eastern Regions (comprising states of Arunachal Pradesh, Manipur, Meghalaya, Mizorum, Nagaland, Sikkim, and Tripura).

Farming system approach was core of NARP, and it laid greater emphasis on multi-disciplinary approach to problem solving. The project established a close linkage between research and extension at the grass-root level. Notably NARP helped in strengthening regional research capability of Agricultural Universities by providing infrastructural facilities like buildings, equipment, etc. and trained human resources. The project was launched in two phases. Phase I of NARP laid emphasis mainly on the rainfed foodgrains and was completed in 1986 with an actual cost of US $ 44 million (81% of the appraisal estimate), approved in 1978.

Figure 1. Organizational Structure of NARS in India



Phase II of the NARP, became effective in 1986 and closed in June 1996 at the final cost of about US $ 98 million. Phase II of program emphasized on horticulture, animal sciences, post-harvest processing and commercial crops in addition to foodgrains and was implemented in many agricultural universities (ICAR 1998a).

Along with significant developments in Indian agriculture in terms of foodgrain production, improving food security, etc., the green revolution technologies (GRTs) also posed several challenges of employment, hunger and poverty, sustaining natural resources, sustaining productivity, etc. to the scientists, and policy makers. These challenges forced the system to assess the strengths and weaknesses of agricultural R&D system and evolve a holistic strategy to strengthen Indian interface for generation and dissemination of new technologies. These led to a new initiative in 1997 called as National Agricultural Technology Project (NATP), with the financial support of the World Bank and the Government of India.

The NATP was conceived in tune with the type and magnitude of challenges facing Indian agriculture, to provide a long-term strategy for meeting these challenges through revitalizing the entire NARS and introducing new models of technology dissemination. The project was intended to develop improved technologies for meeting the challenges of food security, sustainability and rural poverty through improving agricultural productivity, conserving and managing natural resources like land, water, environment and biodiversity. The project was also designed to bring in the needed reforms in technology generation, assessment and dissemination, through upgradation of skills of scientists and extension workers, and at the same time introducing reforms in critical areas of organization and management of NARS, in general, and ICAR in particular. A key lesson from NATP was that that deliberate investments in partnership building and shared governance are required to speed up technology adaptation and dissemination. Another lesson was that while the project undertook an enormous number of activities, mostly successfully, the bigger picture was very clear in the extension component where the project a ctivities were guided by a well-defined conceptual model for collaborative agricultural extension. The challenges, opportunities and the lessons learnt in the NATP provided a useful framework to move forward (ICAR 1998a).

A recent development has been launching of National Agricultural Innovation Project (NAIP) in 2006. This has been initiated to tackle the challenging emerging issues facing Indian agriculture and to consolidate the gains under the completed NATP. Agricultural innovations and diffusion of new technologies are important factors in India's quest for food security, nutritional security, and environmental security as well as enhancement of income and employment. Agricultural research in India has increased the crop productivity manifold and has paid high-payoffs in the past and shall continue to play an

important role in supporting rural livelihoods and accelerating rural growth. On the other hand, the rising population and increasing per capita income are pushing up food demand, which needs to be met through enhanced productivity per unit area, input, time and energy. At the same time, the issues of declining factor productivity and resource-use efficiency have emerged. Also, many promising research findings have not reached the users/ producers, due either to the inadequacies of research design or research results, deficiencies of delivery systems or lack of economic incentives. It is particularly evident in complex environments and in less-favoured areas. In order to address the problem of poverty and hunger, it is critical to redirect and augment resources devoted to agricultural research. Further, to avail the technological breakthroughs in agriculture that are available for commercial use, agricultural research priorities and strategies will have to be revisited and new system-wide approaches need to be developed and adopted.

The NAIP is expected to address the above concerns through a combined effort on changing content and process. Policies and technology options are to be tested by the end-users about their applicability in terms of economic, social and environmental sustainability. In the applied and adaptive research projects, the end-users of innovations need to be involved from the start to the completion of programs and projects. Both indigenous knowledge and new or frontier technologies are to be used to generate the targeted products.

Establishment of Present NARS

The Present agricultural research system in India has been developed over years of experience and experimentation. Since independence, it has made rapid strides, both in concept and implementation, towards becoming an effective system. It has withstood remarkably the test of time by remaining sensitive to the changing needs and challenges. Through the continuous development of newer technologies, the present system is helping the nation to optimize the inputs and exploit the genetic and other resource potential.

In the present system, the ICAR at the national level mainly aids, promotes and coordinates research and education activities in the country. The research and education responsibilities at the state level rest with the SAUs. In addition to these two main streams of research, some General Universities and other agencies like Scientific Organizations related to agriculture, government Departments, voluntary Organizations, Private Institutions etc. participate in the nation’s research efforts.

The ICAR System

The ICAR has the following major objectives: (i) to undertake, aid, promote and coordinate agricultural, animal husbandry and fisheries education, research, and its

application; (ii) to act as a clearing house of research and general information relating to agricultural and veterinary matters; (iii) to maintain a research and reference library; (iv) to do other things considered necessary to attain the above objectives; and (v) to provide consultancy services in the fields of education, research and training in agriculture and allied sciences.

The ICAR is unique in having concurrent responsibility for both research and education in agriculture. As an apex body at the national level, ICAR is responsible for promotion and coordination of agricultural research in the various branches of agriculture and allied sciences in the country. It also directly involved in undertaking research at the national level, basic as well as applied, on diverse problems facing production of crops, animals, fisheries, etc., with the objective of evolving new production technologies suited to different agro-climatic conditions. The Charter of the ICAR also includes extension education, which is carried out through a network of projects and other mechanisms. There were 100 research institutions working under ICAR in 2010-11 (Table 1). These belong to crop sciences, horticulture and plantation crops, soil, water and other basic resources like plants, animals and fish, technological and engineering, animal sciences, social sciences, etc.

The Agricultural Universities System

As agriculture is a State subject, the responsibilities for research, education and extension rest with the State Governments. Prior to 1960, agricultural research in the State, essentially on local problems, was carried out by the State Departments of Agriculture supported by Agricultural Colleges. During the past 50 years, research and education have been transferred to the Agricultural Universities, and the State Departments of Agriculture organize extension services. The Universities are supported by their respective State Governments. ICAR provides financial support and assists their research and education programs.

Table 1. Status of agricultural research system in India, 2010-11

Institutions	Number
1. Public sector	
i) Central	
National Institutes (Deemed Universities)	5
Central / Other Institutes	44
National Bureaux	6
Project Directorates	26
Zonal project Directorates/ Zonal Coordination Units	8
National Research Centres	19
All India Coordinated Research Projects	79
Central Agricultural University	1
Central Universities (with Agricultural Faculty)	5
Krishi Vigyan Kendras	589
ii) State	
State Agricultural Universities	49
Agricultural / Zonal Research Stations	343*
2. Private sector	
Research units/ stations	494

* includes 126 zonal research stations, # relate for the year 2001.

Source: ICAR (2011), Jha and Kumar (2006), and Ghosh (1991)

Considering the recommendations of the University Education Commission, and Study Teams; Agricultural Universities Committee was set up under the Chairmanship of Dr Ralph W. Cummings to prepare guidelines for the establishment of Agricultural Universities in different States, and the ICAR gave necessary support. The first Agricultural University was established at Pantnagar in Uttar Pradesh in 1960, patterned on the Land-Grant System of USA. The Second Education Commission (1964-66) recommended setting up of at least one Agricultural University in each State, which was later endorsed by the National Commission on Agriculture (1976). Many States have established multiple Agricultural Universities to meet regional needs. There are at present 45 Agricultural Universities including the Central Agricultural University in the North Eastern Region (ICAR 2010).

OTHER SYSTEMS

General Universities

Prior to the establishment of Agricultural Universities in India, teaching and research work in the field of agricultural sciences were carried out by the colleges affiliated to the General Universities and the State Departments of Agriculture. With the establishment of Agricultural Universities in different States, these responsibilities were gradually transferred to these Institutions. Still some General Universities in the country which have well developed Departments, or strong Departments like Agricultural Botany, Genetics and Cytogenetics, Economics, Mycology, Fishery Science, Home Science, Physics, Analytical Chemistry, etc. are engaged in basic and applied agricultural research in the country. Few of them also have Institutes/ Faculties/ Colleges of Agriculture/ Home Science to impart education as well as conduct research in agricultural sciences.

General Universities also participate in research activities under different types of schemes and projects such as Ad-hoc Research schemes financed by the ICAR, All-India Coordinated Research Projects of the ICAR, schemes funded by other agencies and fellowships at the post-graduate level. Through these programs, the General Universities have established linkage with the ICAR and Agricultural University system. Joint programs in some specific areas such as plant physiology and biological nitrogen fixation have also been taken up by the ICAR with scientists working in these General Universities. The programs in these Universities have greatly enriched the National Agricultural Research System in India.

Scientific Organizations

Many other scientific organizations in India are also undertaking research related to agriculture. The Council of Scientific and Industrial Research (CSIR), through its network of National and Regional Research Laboratories provides research support to the agricultural research system through work on areas like agro-waste utilization, farm machinery and power, instrumentation, biotechnology, aquaculture, fisheries, post-harvest technology of agricultural produce, development of pesticides and other agro-chemicals, agro-technology for medicinal and oil bearing plants, etc. The Bhabha Atomic Research Centre (BARC) carries out research on the development of new plant varieties and preservation of agricultural produce. It also supplies radioisotopes for use in research by the ICAR and Agricultural Universities.

The Wasteland Development Board is engaged in activities that would result in increased afforestation for ecological restoration and would benefit agriculture in areas like improved rain water management, soil conservation and assessment of the availability of fuel-wood and fodder. The Forest Research Institute provides necessary research support in the area of forestry to the agricultural research system. The Indian Council of Medical Research's (ICMR) is engaged in research work and surveys on occupational health which have been very helpful in framing ICAR programs in the area of human engineering and safety.

Other Government Departments

Several Central Government Departments, either directly undertake research or support research programs in other Institutions in many areas related to agriculture. Department of Science and Technology (DST) promotes agricultural research in areas like agricultural biotechnology, genetic engineering, post-harvest technology, biogas, etc. by providing financial support to various organizations Like Bose Institute, Indian Institute of Science, Jawaharlal Nehru University, Indian Agricultural Research Institute, reputed General Universities and selected SAUs. The Department of Environment and Forests is engaged in a number of useful studies like climate change, ecological implications of shifting (*Jhum*) cultivation and developmental projects such as dams and canals, ecological impact of desert, and collection of medicinal plants and orchids.

The Department of Ocean Development is involved in assessing the fishery resources in the country and has loaned a sophisticated research vessel to the Central Marine Fisheries Research Institute (CMFRI) of the ICAR as the nodal user Institute for obtaining information in the fishery resources in the exclusive economic zone (EEZ) along the vast coastal areas of the country. Besides financing fisheries research schemes in several universities and research Institutions like the ICAR, it also finance a number of fellowships and scholarships to develop highly trained manpower in fisheries.

The Department of Non-Conventional Energy Sources concentrates on the utilization of solar energy, wind energy and biogas. The department of Meteorology is actively involved in many areas related to agriculture like weather forecasting. The Department of Space through National Remote Sensing Agency and Space Application Centre is collaborating with ICAR mainly for assessing the country's soil and water resources, and vegetation cover. The Department of Electronics has identified the application of electronics as one of its principal thrust areas. The ICAR represents in the Boards of many related Departments like Department of Non-Conventional Energy Sources, Department of Ocean Development and Indian Meteorological Department.

Technological and management institutions are active in the fields of agricultural engineering, soil & water management, post-harvest handling, marketing and export promotion. In addition, institutions like the National Dairy Development Board (NDDB) under the Agriculture Ministry; various Commodity Boards like Silk, Coffee, Rubber, Tea, and Cardamom under the Commerce Ministry; and the Forest Research Institute and Wasteland Development Board under the Ministry of Environment and Forests help in strengthening the agricultural research system in the country.

Various Ministries at the Centre

Ministry of Human Resource Development through technological institutions like the Indian Institute of technology (IITs) are making substantial research contribution in several areas of agriculture, agricultural engineering and allied fields specially in the areas of soil and water management and post-harvest technology. The Ministry of Water Resources has been financing a number of research projects in the area of minor irrigation. The Central Labour Institute under the Labour Ministry is concentrating on aspects like work load, comfort and safety, etc. related to agro-based industries. The Laboratories of the Defence Research and Development Organization under the Ministry

of Defence located in the Himalayan region also carry out research on crops, poultry, fisheries, mushroom, etc.

Voluntary Organization/ Private sector

Several non-governmental organizations (NGOs) and private organizations having the necessary research capabilities are participating in the network projects of the ICAR for multi-location testing of varieties and agro-techniques. The major agricultural transformation in India brought through green revolution had a catalytic effect on the involvement of private organizations in agricultural research dealing in production of agricultural inputs such as seeds, fertilizers, and other agro-chemicals, agricultural machinery and implements.

Involvement of private sector in agricultural research started in mid-1960s. Afterwards several private companies started programs mainly to develop hybrid maize, sorghum and pearl-millet. Research on vegetables started in late 1960s. Private sector research is confined mainly to breeding crop hybrids, certain plantation crops, agro-chemicals, poultry, and agricultural machinery.

Private sector research in seed industry has grown very rapidly. Several private companies are now engaged in the production of hybrid seeds of a variety of crops like cotton, sorghum, pearl-millet, maize, vegetables, redgram, rice, etc., and a small seed export industry has also emerged. Quite a good number of private companies undertaking plant breeding research, and several others are involved in plant protection research. Besides their own research stations, these companies conduct experiments on farmers' fields. They test the bio-efficiency of insecticides and herbicides that are new to India as well as synthesize new compounds. Private research in poultry sector is doing well. Government has introduced exotic birds in commercial poultry industry, and they are being popularized by the private sector and many companies are now actively engaged in it. Many other large industrial concerns are engaged in research on shrimps and shrimp feed.

Some private companies undertake major research and development programs for the improvement of tractors and irrigation pumps. Some companies are even experimenting with non-conventional sources of power. Historically, private companies in the processing and plantation sector have been a very important source of new agricultural technology. Some of the prominent ones include Indian Sugar Mills Association, Southern Planters Association, Textile Mills Association, Silk Industry, etc. Some large firms are involved in research on animal nutrition, plant growth regulators, biotechnology like tissue culture in cardamom, sugarcane, coconut and tea, bio-fertilizers, etc. Research in the area of tree farming including in vitro culture and tree breeding is also receiving attention of private firms. The involvement of private agencies in agricultural research is gaining momentum with greater sophistication in technological development and the prospects of high returns on investment in agriculture

Some of the well-established institutions such as Allahabad Agricultural Institute, Bharatiya Agro-Industries Foundation, Wool Research Association, United Planters Association of South India undertaking short-term, mission-oriented research projects supported by the ICAR for multi-locational testing of varieties and agro-techniques.

ORGANIZATION OF NARS

Institutes involved in the NARS

India has one of the largest agricultural research systems in the world with the largest number of scientific personnel of any developing country except China. The research system includes approximately 22,000 scientists (Jha and Kumar, 2006). Although the total number of scientists engaged in agricultural research in India looks very impressive, it compares less favourably with many developed countries.

The present agricultural research system comprises essentially two main streams, the ICAR at the national level and the Agricultural Universities at the State level. Besides, several other agencies such as General Universities, Scientific Organizations, and various Ministries/ Departments at the Centre, and also Private sector participate directly or indirectly in NARS activities.

The ICAR system

Although agriculture is a State subject, ICAR has established many Central Research Institutions over the years to meet the agricultural research needs of the country. These are essentially meant for: (i) implementing research mandates extending beyond the administrative boundaries of the States; (ii) pursuing basic research not undertaken by most Agricultural Universities; (iii) evaluating research results through multi - location testing; and (iv) developing manpower for Agricultural Universities and other agricultural institutions.

Research Institutes of the ICAR

The ICAR is directly responsible for administering 98 research institutes in the areas of agriculture, animal sciences and fisheries. These institutes are established to provide foundation material to meet the agricultural research needs in the following terms:

- To conduct basic research on problems of national importance hitherto not undertaken at most of the Agricultural Universities;
- To play a unique role in the development of manpower for the Agricultural Universities colleges/ institutions, and other agricultural sectors;
- To fulfill the national mandate such as preparation of resource inventories, their catalouging and conservation, which go beyond the regional boundaries of the state, and
- To undertake lead research for evaluation and refinement through multi-location centres of the All-India Coordinated Research Projects.
- Depending upon their research mandate, these institutes are broadly grouped under the following categories and have been listed in Annexure 1.

Research Management Academy: Originally started as Central Staff College for Agriculture, at Hyderabad, in 1976, the National Academy of Agricultural Research Management (NAARM) provides research management training to the agricultural scientists and research managers of the ICAR as well as of the Agricultural Universities. In addition to conducting training programs for different levels of scientists, the Academy also organizes seminars, conferences, and workshops based upon the scientific studies

and reviews. It also has a mandate for bringing out high quality training material and to function as a repository of information in the field of agricultural research and education management. Besides meeting national needs as a premier management institution, the Academy has developed institutional capability to act as a Regional Training Centre in South Asia.

National Institutes: There are four national institutes in India under ICAR. These are: IARI, IVRI, NDRI and CIFE, and their directors directly report to the Director-General of ICAR. They have responsibilities for both research and post-graduate teaching in agriculture, animal husbandry and fisheries. These National Institutes have the status of deemed University and offer their own degrees in various disciplines.

National Bureaux on Resource Conservation: In order to collect, conserve and initiate such measures which would lead to long-term productivity of basic agricultural resources such as plants, animals, fishes, soils, microorganisms, and insects, the ICAR has established six National Bureaux, in each of these areas.

Central Institutes: There are 44 Central Institutes spread across the whole country. Their field of operation includes crops, horticulture, soil/ water, animals, fishes, and social sciences. There are 10 Crop Science Institutes have a general mandate to carry out basic and applied research on all aspects of the crops they deal with and transferring thereof. The 9 Horticultural and Plantation Crops Institutes have a mandate to conduct and coordinate research on crops they deal with. The 10 Resource Management Institutes have the primary responsibility of undertaking research on soil and water conservation for optimizing production of crops under different conditions. The 4 Technological Institutes mainly deal with technological and engineering problems in crop production and quality of commercial crops. The 5 Animal Sciences Institutes have the mandate of breeding animals for higher productivity and suggesting better management practices. The 5 Fisheries Institutes are responsible for conducting studies for assessing production potential of fish and conducting training programs and undertaking research. The 1 Social Science Institute undertakes studies on agricultural statistics, and is involved in building up a database for agricultural research (Annexure 1).

Each institute has a specific mandate for research on either single or multiple crops/ commodities or disciplines. Most of these institutes have sub-stations in different parts of the country, mainly to provide testing facilities under different agro-ecological situations and to conduct research on some of the regional problems wherever the local research infrastructure is not yet fully developed. The institutes have well defined Divisions on the basis of disciplines.

The individual institutes of the ICAR carry out their research activities under the guidance of a Director. They are entrusted with specific responsibilities along with certain amount of autonomy in their operation. The role of the headquarters is mainly that of guiding and facilitating on technical and administrative matters of the institute. Each institute has a 'Management Committee' for looking into its activities and is assisted by the Institute Research Council (earlier called as Staff Research Council) on technical matters. The IARI, IVRI, NDRI and CIFE with deemed University status have Boards of Management, instead.

National Research Centres: In addition to Research Institutes, the ICAR has also established single campus National Research Centres. The basic philosophy behind setting up of these Centres revolves around the need for concentrated attention with a

mission approach for different disciplines working under a senior leader on selected topics which have direct or indirect relevance to resolving national problems related to a particular crop or commodity or species. Unlike Institutes, these centres do not have Divisional setup nor have regional stations. The National Research Centre for Groundnut was the first to be setup by the ICAR and there are now 19 such centres in the country.

Project Directorates: Because of the importance and magnitude of the work involved in research on a single commodity like rice, wheat and poultry, or a group of commodities like oilseeds and pulses, the ICAR has upgraded some of its research infrastructure/projects with added responsibilities, and has designated them as 'Project Directorates'. Except for the size and magnitude of work involved, these are basically the same as the Coordinated Research Projects. Additionally, they do undertake some research besides playing such national service roles like maintenance and supply of germplasm, organizing off-season nursery to promote and speed up research interests, monitoring pests and diseases, forecasting and issuing warning about outbreak of pests and diseases and performing as a lead centre in relation to their respective subject matter. There are 26 project directorates under operation belonging to foodgrains (cereals and pulses), oilseeds, weeds, seeds, water management, horticultural crops (fruits, vegetables, and flowers), medicinal plants, onion and garlic, cattle, animal diseases, poultry, fishery, women in agriculture, and information and publication in agriculture.

Research Schemes/Projects: In addition to its institute-based research, ICAR promotes research schemes/projects in agriculture and allied areas to resolve location-specific problems. It is involved in a cooperative endeavour with other research organizations in carrying out multidisciplinary research programs. Such promotional schemes fall under the following categories.

(a) All India Coordinated Research Projects (AICRPs): These projects have been essentially conceived as an instrument to mobilize available scientific resources for finding effective solutions for the national problems of agricultural production through inter-institutional interactions. The projects are developed as multidisciplinary and problem-oriented projects with major emphasis on multi-locational testing of new materials/production systems. They provide opportunities for scientists working on similar problems in different institutions to interact, discuss and exchange ideas, information, and materials for mutual benefits. They also provide them with facilities for multi-locational testing of improved technologies developed by various subsystems in different agro-climatic regions.

The All India Maize Improvement Project was the first network project launched by the ICAR in 1957 to improve maize production using hybrids. Its remarkable success led to the extension of this approach to all the major crops and other areas like animal sciences, fisheries, soils, agricultural engineering, horticulture, etc. Each project is generally sanctioned for a period of 5 years and is headed by a full-time Project Coordinator with a Coordinating Unit to assist him. These Units are located in either ICAR Institutes or Agricultural Universities, depending upon the location of the project. They are responsible for all the technical, financial and administrative matters as well as for organizing regular workshops. The technical programs of the individual projects are carried out by many cooperating centres located in the participating institutions. Regular

workshops, either annual or biennial, are organized by the individual projects in which the technical programs are finalized. The Project Coordinator is guided and serviced on all matters by the concerned Assistant Director General in the ICAR headquarters.

There are 79 AICRPs (Annexure 2) currently operating at 1,291 operating centres. Of these, 904 Centres are located in Agricultural Universities; 190 in ICAR Institutes; and the rest at other institutions. Crop sciences have 31 projects, and soil science and agricultural engineering have 19 projects, horticultural sciences have 13 projects, animal sciences have 14 projects and one project is on women in agriculture. The expenditures on these projects have increased steadily and nearly one-fourth of the ICAR's budget is now spent on these projects. The complement of staff, determined on the basis of the technical work assigned and the nature of operation, is provided by the participating institutions, but paid for by the ICAR. The expenditure is shared by the ICAR and the collaborating institutions on 75:25 basis.

A high degree of accountability, based on continuous monitoring, is a noteworthy feature of these projects. Outstanding achievements have been made through these projects, and the development of such an approach has been a source of inspiration to many developing countries.

b) National Agricultural Innovation Project

Agriculture is being increasingly driven by market and private sector shall continue to remain the main source of livelihood in India as a majority of population depends on it. On the other hand, the farmer has been facing the problem of rising input costs, declining returns, uncertain markets, increasing role of markets in agriculture and blurring of distinction between the domestic market and international market. Hence, the agricultural research systems which generate technologies, have to conduct the business of agricultural research in an innovative way. The World Bank aided National Agricultural Innovation Project (NAIP) has been conceived to pilot this innovation in conducting agricultural research in India.

Overall Objective of the NAIP

To facilitate an accelerated and sustainable transformation of the Indian agriculture so that it can support poverty alleviation and income generation through collaborative development and application of agricultural innovations by the public organizations in partnership with farmers' groups, the private sector and other stakeholders.

Components of NAIP

The NAIP aims to function through the following four components:

- The ICAR to act as a catalyzing agent for change in the Management of the Indian NARS (Component –I)
- Research on Production to Consumption Systems (PCS) (Component –II)
- Research on Sustainable Rural Livelihood Security (SRLS) (Component –III) and
- Basic and Strategic Research in the Frontier Areas of Agricultural Sciences (BSR) (Component –IV)

The National Agricultural Innovation Project (NAIP) has made good progress in approving and grounding 185 sub-projects (40 under Component-I, 51 under Component-II, 33 under Component-III and 61 under Component-IV) at a total outlay of about Rs 1,017 crore. These sub-projects have very diverse partnership such as ICAR Institutions and State Agricultural Universities, General Universities, Technology and Management Institutes (i.e. IITs, IIMs), CSIR laboratories, other Central and State government departments, private sector institutions and NGOs. For details, please visit NAIP website http://www.naip.icar.org.in

c) Technology Mission in Agriculture

The Steering Group on Science and Technology, constituted by the Planning Commission, Government of India, had identified some Technology Missions under different sectors in the Seventh Five-Year Plan (1985-90). The Technology Mission on Oilseeds (TMO) was set up in April 1986, to increase the production of oilseeds to reduce import and achieve self-sufficiency in edible and non-edible oils. Subsequently, pulses, oil palm and maize were also brought within the purview of the Mission in 1990-91, 1992 and 1995-96, respectively. In addition, the National Oilseeds and Vegetable Oils Development (NOVOD) Board also supplement the efforts of TMOP by opening of newer areas for non-traditional oilseeds. The Technology Mission on Oilseeds concentrates on major oilseed crops like groundnut, rapeseed, mustard, soybean, sunflower, safflower, linseed, sesamum, and niger. It also gives priority to non-edible oilseed crops to meet the requirements of industry. The Mission envisages an integrated approach involving different developmental, scientific, input, banking, and marketing agencies. A total of 180 districts have been earmarked for the purpose.

The Department of Agriculture and Cooperation (DAC) in the Ministry of Agriculture, Government of India and the ICAR are the principal implementing agencies of mission projects. Four sub-missions share the operational responsibilities. These are: (a) Production Technology (R&D) Sub-Mission for which the Director General of ICAR is the Chairman; (b) Input Supply and Production Sub-Mission for which the Additional Secretary to the Government of India is the Chairman, and the Agricultural Commissioner is the Co-chairman; (c) Postharvest Technology and Processing Sub-Mission for which the Scientific Advisor to the Planning Commission is the Chairman; and (d) Pricing, Transport, Procurement and Marketing Sub-Mission for which the Additional Secretary to the Government of India is the Chairman. A quarterly review of all the developmental activities is envisaged to effect mid-term corrections and expert teams review the progress of the Mission.

d) Ad-hoc Research Schemes

ICAR was supporting a large number of short-term, result-oriented *ad-hoc* research schemes by utilizing the Agricultural Produce Cess Fund, which was levied as custom duty at the rate of 0.5 per cent ad valorem on 25 articles of agricultural produce exported from India (now abandoned). The schemes aim at filling critical gaps in the scientific developments and are implemented by the ICAR Institutes, Agricultural and General Universities, Private Institutions and Voluntary Organizations. The topics of the research schemes could be identified by the individual scientists or institutions, or selected out of the recommendations made in the ICAR Regional Committee Meetings, Vice

Chancellor's Conferences, or at similar forums. The schemes were generally sanctioned for three to five years. Some of them were exploratory in nature and have led to the development of country-wide projects. As collection of commodity cess has been stopped, new projects are not being initiated.

To fill the gap of Agricultural Produce Cess Schemes, ICAR has created a new fund called National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA). The fund aims to build capacity for basic and strategic research of national and long-term importance to break yield and quality barriers and make India a global leader in research for development, through the partnership of all research organizations who can contribute towards this objective. The fund strongly encourages collaborative and multi-institutional research based on innovative ideas of scientists for solving advanced scientific and technological problems in agriculture. Scientists from all research institutions universities and private sector with proven research capacity and located in India are eligible to participate.

e) Centres of Advanced Studies

In order to improve faculty competence and develop infrastructure for better research and training, ICAR with the support of UNDP has set up, since 1971, several Centres of Advanced Studies in selected disciplines in Agricultural Universities and ICAR Institutes. These Centres were established to encourage the pursuit of excellence through collaboration between scientists of outstanding ability with their counterparts in similar institutions abroad, and thus accelerate the attainment of international standards in specific fields of agricultural research and education. They also focus on modernizing faculty capability and physical facilities for advanced research and educational programs so as to reduce India's dependence on foreign countries for advanced training in these fields.

These Centres have been able to modernize and consolidate their programs on an interdisciplinary basis, augment their infrastructural facilities, and provide specialized training to their scientists. Interaction with scientific institutions abroad and advanced level training in India and abroad through fellowship program have made it possible to build up a cadre of highly competent professional scientists. These Centres also bring about considerable interaction among scientists within the country by organizing All India Workshops, Seminars and Conferences. So far, 28 such Advanced Centres have been established, with 17 of them located in the ICAR Institutes and the rest in the Agricultural Universities. They have made a proper use of the combined support of the ICAR, UNDP, UNESCO, and FAO. These Centres have become the nuclei for high quality research and training in the concerned disciplines.

f) Special Schemes

In 1978, the ICAR launched a special scheme to identify individuals of outstanding merit known as `Professors of Eminence' and 'National Research Fellows', who could provide leadership in the development of `Schools of Thought' in specific areas by undertaking fundamental research in agriculture and allied areas. Under this scheme, scientists conduct research on specific projects formulated by them in the ICAR Institutes and Agricultural Universities. ICAR with the cooperation of host institutions provide physical and infrastructural facilities liberally for operating their projects, and the

incumbents operate with considerable financial and administrative autonomy. These two schemes have now been re-designated as 'ICAR National Professor' and 'ICAR National Fellow' for mission-oriented fundamental research. At a time, 10 ICAR National Professorships and 25 ICAR National Fellowships are awarded to researchers who have made outstanding contributions in their respective areas. Since 1959, the ICAR has also been operating the `Emeritus Scientists' scheme to support eminent retired scientists, enabling them to continue their research in various fields of agriculture and allied sciences. The scheme provides research grants to retiring scientists of established repute in the ICAR Institutes and Agricultural Universities. At one time, ICAR awards 'Emeritus Scientists' positions to maximum of 50 researchers.

The State University System

Based on the recommendations of the First Education Commission (1949), headed by late Dr S. Radhakrishnan, and the recommendations of the First and second Indo-American Teams, the Government of India decided to establish agricultural Universities in the country, and the first SAU was set up at Pantnagar, Uttar Pradesh, in 1960. To provide a model legal basis to agricultural universities system in the country, the Government of India appointed an Agricultural Universities Committee in 1960. The committee in its report in 1962, proposed guidelines for developing a Model Act by the ICAR and provided the sufficient details regarding the legal framework in the development of agricultural education in India. In developing the Act, the concept was of a mono campus institution within a uniform administrative and supporting system. This Act was not fully implemented. Further, based on the recommendations of the Agricultural Universities Review Committee in 1977, the ICAR took various steps to persuade the state governments to adopt provisions with a reasonable degree of success and ensured uniformity in the Acts of the SAUs.

After 1960, the goal of setting up of one SAU in each state of India and a Central Agricultural University in the North-East region of the country has been achieved. At present, there are 45 SAUs and one Central Agricultural University (Imphal) with around 200 constituent colleges in India (Annexure 3). Four institutes, IARI, IVRI, NDRI, CIFE of ICAR and Allahabad Agricultural Institute, are the deemed universities and four Central Universities have distinct agricultural institutes/ faculties. In addition, Indian Institute of Technology, Kharagpur, and some 100 private colleges affiliated to general universities also provide agricultural education. The NARS of India provides agricultural education facilities in 11 fields of specialization at the under-graduate level and in about 100 disciplines at the post-graduate level and 80 at Ph.D. level. The SAUs with a multi-faculty and multi-campus structure serve as the regional institutions for providing technological support in the development of agriculture in respective states. On the land-grant pattern, agricultural universities have integrated functions of teaching, research, and extension.

The Private Sector

The research in the private sector is mostly done by large industrial houses and is confined to areas where short-to-medium term profits are possible and adequate. Initially

the private sector was involved in dealing with agro-inputs (e.g., pesticides, fertilizers, machinery, etc.), and very few enterprises had in-house R&D capacity. The scenario changed during 1980s, with the growing availability of trained scientists, rapid expansion of markets for agricultural inputs and processed foods, and liberalized policies to support private sector development, in general (ICAR 1998a). The most significant development has been in the seed sector after implementation of the new Seed Policy in 1988, which allowed import of seed materials, as well as majority ownership of seed companies by foreign companies (from 1991). A number of foreign companies entered into the seed market, and several local seed companies have established considerable capacity in seed research (Pray *et al.,* 2001). The private hybrid seeds account for a significant proportion of the market for sorghum, maize, and cotton (Pray *et al.,* 2001, Singh *et al.,* 1995) and the companies with some foreign ownership account for about one-third of this market (Pray and Basant 2001). Developments in biotechnology have further strengthened these trends.

To provide additional stimulus to R&D in the private sector, India has already approved a Bill for the Protection of Plant Varieties and Farmers Rights Act (2000), which will provide intellectual property protection to breeders. At the same time, it gives special emphasis to farmers' rights to save, exchange, and sell seed. India has also amended the Patent Act (1970) to make it compatible with WTO agreements. The Patent (Second Amendment) Act grants provisional product patents that should stimulate research in agricultural chemicals and the animal health sectors (Pal and Byerlee 2003).

Decentralization of Authority

The ICAR is an autonomous organization and promote science based agricultural research, education and extension in the country. The Secretary to the Government of India in DARE functions as the Director-General of the ICAR. Additional Secretary to DARE is the Secretary of ICAR, and the Financial Advisor of the DARE is the Financial Advisor of the ICAR. Generally single-file system is followed between DARE and ICAR. It is generally perceived that the Director-General, if considers necessary, delegate some of his/her administrative powers to any officer of the Council. However, more transparency in this regard can be brought into the system for more smooth and proper functioning of the Council.

In the scientific matters, the Director-General is assisted by 8 Deputy Director-Generals, one each for (i) Crop Sciences, (ii) Horticulture, (iii) Natural Resource Management, (iv)Agricultural Engineering, (v) Animal Sciences, (vi) Fisheries, (vii) Agricultural Education, and (viii) Agricultural Extension. The Deputy Director-Generals (DDGs) keep watch on the research institutions falling in their respective Divisions.

The DDGs are the technical advisors to the Director-General of ICAR. Every DDG (ICAR) ensures effective functioning through periodic visits to the Institute and discussions with Director and scientists of the institute. The concerned DDG serves almost in all respects to the institute and guides in all technical, financial and other matters as well. He serves as Reporting Officer for Director of Institute and Reviewing Officer in Case of Principal Scientists. Next in the cadre are Assistant Director Generals, who give technical and other inputs to institute.

With regard to Institute / NRC/Project Directorate, Director concerned exercises all the powers of Head of the Institute for the purpose of various Rules and Regulations of the Government of India, as amended from time to time and applicable *mutatis-mutandis*. In addition, the Directors of the Institutes exercise powers delegated to them by the Governing Body or any authority of the ICAR for smooth functioning of the institute.

Status of Autonomy & Governance of the Institutions

The Indian Council of Agricultural Research is an autonomous body under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture & Cooperation, Government of India. The Council was established on 16 July 1929, as was registered as a Society under the societies Registration Act 1860. In 1966, the ICAR became the nodal agency for coordinating agricultural research in India. It gained administrative control over various Institutes and Commodity Research Institutes. Institutes of the ICAR are governed under the 8 Divisions of the ICAR. Each Division is headed by a Deputy Director-General and the concerned Research Institutes get guidance on all matters from the respective Division. At the Institute level, Director of the Institute has full control over its activities, including manpower under the rules governing ICAR Society.

Role of Council in Research Management

The ICAR is committed to provide leadership to agricultural research and education in the country. Through its Institutions, the ICAR undertakes basic and strategic research in all important areas of agriculture to address existing and emerging problems of national importance. The Council allocates funds to the Institutes to undertake research planned/ decided by an appropriate body/ Working Group set up by the Planning Commission/ respective Division of ICAR. In addition, the ICAR awards scholarships (in the form of ICAR National Professor, ICAR National Fellow and Emeritus Scientist) to eminent scholars to undertake basic and strategic research in frontier areas. The ICAR also provides short-term fellowships to post-graduate and doctoral students in the form of Junior Research Fellowships and Senior Research Fellowships, respectively, for undertaking quality research in agriculture in frontier areas. The All India Coordinated Research Projects is another mode of conducting agricultural research by the Council.

Mode of Resource Allocation

The ICAR receives public funds for a Plan period (five years) from the Government of India after approval from the Planning Commission, for managing agricultural research, and education in the country. Thereafter, Council allocates funds to its Institutions, and State Agricultural Universities.

Fund requirements for five-year period both under Plan and Non-Plan heads are submitted by each Institute to the concerned Division of the Council. All the 8 Divisions of ICAR submit financial requirements to ICAR, which is aggregated at the ICAR level and submitted to DARE, the main coordinating body with the Government of India. The DARE submits total fund requirements along with its own staff to the Government of India. The approved budget from the Government of India is allocated to the Divisions and further allocated to each institute and some amount to State Agricultural Universities. It has been experienced that the proposed amounts are not approved in toto due to financial constraints and a few programs/activities have been merged with other programs to keep activities on.

Besides, institutions of ICAR also receive fund for research projects from international donor agencies through ICAR. National funding from other central government departments and state governments also come for project based.

Priority Fixation of Research

Research priority of the Indian NARS is decided through a very rigorous process. The Planning Commission of the Government of India, set up Working Group before the start of a Five-Year Plan (FYP) to recommend areas for agricultural research and education in the country. The Working Group, headed by a well known agriculturist, constitutes several sub-groups to identify and suggest topical and future research areas based on the national and international experiences. This forms the basis for fixing research priorities at the ICAR. The ICAR also consults Regional Committees to suggest regional research priorities. In addition, Research Advisory Committee, Management Committee, and Institute Research Council suggest strategic issues that need to be addressed and accordingly the research programs to be pursued during a year or five-year period are finalized.

Research Planning Process

At the national level, ICAR is responsible for planning of agricultural research in India. The research schemes received from the research institutes, agricultural universities and private institutions across the country are technically examined first by the concerned Division at the ICAR headquarters and then put up for consideration before the scientific panels. After the schemes are examined for financial implications by the Standing Finance Committee, these are placed before the Governing Body of ICAR for final approval.

In the ICAR system, once the broad research programs are decided at the divisional level, the responsibility of formulation of individual research projects is left to the institutes. Every year, scientists working in the institutes submit research projects with all details in a standard proforma called as Research Project File (RPF). These are discussed by the Divisional Research Council in large institutes, followed by the Institute Research Council (IRC) which is chaired by the Director of Institute. These projects are evaluated and approved by the IRC which is attended by the scientists of the Institute.

The key to the success of agricultural research efforts of the ICAR system in India has been the in-built mechanism of research monitoring and evaluation. The ICAR has an effective monitoring and evaluation mechanism. At the institute level, these functions are carried out by the Divisions and IRC, and through a comprehensive review by specially constituted Quinquennial Review Team (QRT), expert team from ICAR system, once in five years. Different research schemes of the ICAR are monitored by the Divisions at the headquarters and overall implementations of the plan scheme through Plan Implementation and Monitoring Unit.

Research Scientists

As already noted, the agricultural research in India is largely in the public domain and ICAR and SAUs are the main entities of Indian NARS. Based on the data generated

under the research project entitled '*Census of Scientific Manpower in Agriculture -2001*', Jha and Kumar (2006) have reported the number of scientists as 21,869 in the Indian NARS. The details of research scientists working in various entities of NARS during 2001 are given in Table 2.

It is found that 96% of total agricultural scientists work in public-funded institutions. The ICAR and SAUs employ about 83% of total scientists, while nearly 13% of total scientists are in agricultural colleges, government departments, KVKs, etc. Only 4% of the scientists are employed by the private sector.

Table 2. Distribution of number of agricultural scientists by organizations in India

Particulars	Total agricultural scientists	
	Number	Per cent
Public sector	20921	95.6
(i) ICAR	4539	20.7
(ii) SAUs	13633	62.3
(iii) Other public	2749	12.6
Private sector	948	4.3
All institutions	21869	100.0

Source: Jha and Kumar (2006)

The average age of scientists in the agricultural research system is 44 years (Table 3). Nearly 31% of the scientists are above 50 years of age. With this age structure, the average rate of attrition through 2010 works out to be 3.5% per annum for the system as a whole. Higher average age and higher attrition rate in the public research system have been attributed to faltering recruitment over the past decades or so (Pal and Byerlee 2003).

Table 3. Age, gender and skill level of agricultural scientists in India

Particulars	ICAR	SAUs	Other public institutions	Private institutions	All institutions
Average age (years)	43.8	45.7	42.2	37.5	44.0
Ph.D. holders (%)	75.7	69.6	55.9	36.6	67.7
Research experience (years)	17	18	14	11	17
Women scientists (%)	11.9	11.3	13.8	7.8	11.6
Scientists above 50 years (%)	33.8	32.7	21.4	14.6	30.7
Attrition rate through 2010 (%)	4.4	3.6	2.6	1.7	3.5

Source: Jha and Kumar (2006)

Data shows that skill level of system is high. A master's degree is the entry level qualification in the public system and more than two-thirds of the scientists are Ph.D. degree holders. In the ICAR-SAU system, it varies from 70 to 76 per cent. The average research experience is also high. The data do reveal a gender bias ─ only about 12 per cent of the agricultural scientists are women.

Data indicate that the public system has invested heavily on human resource development by simultaneously promoting academic upgrdation and experience. The private sector, which is relatively young, lags behind. 'Other' public institutions also show relatively lower indicators, primarily because these include a large number of grass root level institutions (KVKs, NGOs) which do not deal with hardcore and long-term research.

Recruitment Process of Scientists of Research Institutes

The recruitment of scientist/ faculty member in ICAR institutions and SAUs takes place through an open system purely on merit on all-India basis. There is an Agricultural Scientists Recruitment Board (ASRB) which recruits scientists in case of ICAR. The ASRB is an independent body for recruiting scientists and research management positions (RMPs) like Deputy Director-Generals, Assistant Director-Generals, National Director (NATP/NAIP), Directors, Project Coordinators, Head of Divisions, etc.

In ICAR, scientists are recruited through all-India open competition. The selection procedure varies according to the level of post. At entry level, scientists for Agricultural Research Service (ARS) are selected through all-India written test, followed by an interview. The ASRB collects the requirement for entry-level scientist for various disciplines, and posts the advertisement in National Dailies and Employment News (a weekly Newspaper) for seeking applications from the eligible candidates. The sort-listed candidates are allowed to appear in the written examination, and successful candidates are called for interviews. The candidates securing/ scoring aggregate high percentage are offered both ARS and National Eligibility Test (NET), while others are given the NET certificate and are eligible for appearing for the post of Assistant Professor/ Lecturer in SAUs and General Universities and Agricultural Colleges.

The Research Management Positions (RMPs) at the ICAR headquarters and the institutes are filled through advertisement and selection for the tenure of five years. Under the new service rules, every scientist may have to work for sometime during his/ her carrier to solve problems of neglected and tribal areas.

Selection of faculty member at the entry level (i.e. Assistant Professor/ Lecturer) and for higher post in SAUs, faculties/ colleges of agriculture and allied field in general universities is done through advertisement and open interview. Every SAU advertises the requisite number of posts in different disciplines in national dailies and Employment News. Candidates eligible for the post(s) and having requisite qualifications submit their application and appear before the selection committee for interview and the successful candidates are offered the post. Selection for faculty posts in agricultural institutes / colleges affiliated to general universities is also done though open interview. The selection for faculty posts in agricultural colleges affiliated to general universities is done through interview conducted by the Higher Education Commission of respective states.

Linkage with State/ Provincial Research Installations

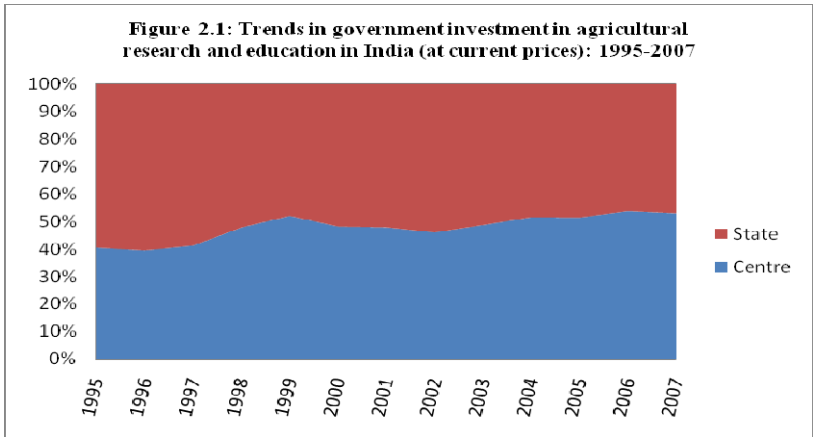
The responsibilities of agricultural research, education and extension rest with states in India. Despite this, ICAR coordinates the research work of national importance through its institutes, network projects, agricultural universities, scholarships/ fellowships and other means. As a promoting agency, the ICAR has clearly spelt out the terms and conditions governing the grants to institutions for conducting agricultural research. In the case of schemes implemented by the state governments directly, the ICAR normally provides a matching recurring grant. In project of all-India importance, the ICAR bears the major share of expenditure, in some cases even the full expenditure, though the schemes are implemented through state agencies. The ICAR allocates funds for the schemes implemented by the general universities and non-governmental organizations (NGOs).

Investment Trends in Research

The Indian NARS is largely under public domain. Research and education (R&E) are highly complementary activities and both are pursued jointly. Also, the distinction between expenditure on R&E is not distinctly maintained in the government accounts, making delineation of 'research' expenditure difficult.

The government investment on agricultural R&E includes the expenditure made by the central and all state governments, and union territories of India. The R&E expenditures were compiled from accounts of the Union and State governments (GOI), which contains all Plan and Non-Plan expenditures on revenue and on capital accounts.

The ICAR receives all financial resources from the Government of India. The ICAR, besides supporting a network of its own institutions, allocate a part of funds to SAUs in the form of research schemes and annual grants. The state governments support the SAUs which are entrusted with the responsibility of imparting education and conducting state or location-specific research. Some government funds are also used to support research in public organizations like Agro Economic Research Centres and commodity research stations outside the ICAR and SAU system. Some funding by respective commodity boards like tea, coffee, etc. are also provided for research. However, such funding is not included here.



There has been a quantum jump in total government investment in agricultural R&E in India during the period 1981-2007 (at current prices). The investment in agricultural R&E was Rs. 1875 million in 1981, which increased to Rs 7704 million in 1991, Rs. 25446 million in 2001, and further to Rs. 43200 million in 2007. Thus, during 1981-2007, investment has increased by 23 times. The trends in disaggregated investment in R&E, shown in Figure 2, reveal that total expenditure increased at a rate of 11.08%, while centre and state expenditures have grown at a rate of 13.74% and 8.84%, respectively, during 1995 -2007.

The changing emphasis on the structure of NARS over time has changed the shares of Central and state governments in the national investment on agricultural R&E. During 1980s and 1990s, the state governments contributed about 54% to the total investment (Table 4), but a reversed trend is noticed after 2000. The increasing centralization in R&E expenditure is not a welcome sign as agriculture is a state subject.

Table 4. Share of central and state governments in agricultural R&E expenditure in India

Period (TE)	Share (per cent)	
	Central government	State governments
1980-81 to 1982-83	46.9	53.1
1991-92 to 1993-94	44.6	55.4
2005-06 to 2007-08	54.0	46.0

Trends in public expenditure on R&E in terms of R&E intensity (investment as percentage of agricultural gross domestic product) have shown that R&E intensity increased from 0.45 per cent in 1995 to 0.59 per cent in 2000 and further to 0.64 per cent in 2007. These intensity ratios indicate that investment in R&E is growing over time.

Institutional Governance (Research Advisory Body, Management Body)

(a) Reforms for Enhancing Efficiency

Functioning of the ICAR is reviewed periodically to enhance its capacity to respond to highly dynamic needs of the agricultural development in the country. A joint Indo-American Team was appointed by the Government of India in 1954 and another in 1959. The first team made a large number of recommendations on research, higher education including administration and personnel management. These recommendations inter alia laid emphasis on the methodology for utilization of research funds of the ICAR, administration and control of grant funds, development of adequate research facilities by states and their participation in schemes of regional or national significance, and development of national or regional centres in areas wherein centrally supported institutions could function more effectively.

The Second Indo-American Team stressed on the overall development of agricultural research programs through (i) identification of research priorities, (ii) formation of an

Agricultural Research Policy Council of the high-level technical officers to serve as Standing Advisory Committee to the Governing Body of ICAR, (iii) strengthening of co-ordination of all agricultural research programs, and (iv) effecting necessary organizational changes, such as taking over of the central research institutes as well as the commodity commodities under the administrative control of ICAR. The Team also recommended that projects of regional or national significance and cross-commodity projects should alone be implemented by the ICAR, and the responsibility for local research be left to the states.

In October 1963, the Government of India appointed an Agricultural Research Review Team with a specific object of improving the agricultural research set-up in the country and for suggesting necessary changes. This team made important recommendations: (i) replacement of existing Council by a new council for Agricultural and Food Research, with powers to develop and administer national research programs, (ii) authorization of new Council to assume full technical and administrative controls of all the Central Agricultural Research Institutes and Commodity Committees and certain other research organizations then financed by the Government of India, (iii) taking over by the ICAR of other related institutions like the Central Food Technological Research Institute (CFTRI), and (iv) taking up of responsibility of all the extension activities by the ICAR in the country. This team also suggested that IARI, IVRI, NDRI should be designated as the National institutes by providing greater autonomy in their functioning.

Based on the recommendations of the Research Review Team, the Government of India decided in March 1965, to reorganize ICAR by way of (i) bringing under the ICAR all the Central Research Institutions, (ii) reconstituting the Governing body by making it pro-eminently a body of scientists, (iii) giving financial assistance for research to ICAR in the form of a block grant on the model of the Atomic Energy Commission, (iv) agreeing in principle to designate the IARI, IVRI and NDRI as National Institutes and taking up of necessary legislation therefore, (v) adoption of a personnel policy on the lines suggested, and (vi) formation of a Cabinet Committee on the Agricultural Research.

The ICAR took over the administrative control of 9 research institutes on 1 April 1966, other Research Institutes were taken over in subsequent years. The ICAR also assumed the research functions of the Central Commodities Committees dealing with tobacco, cotton, oilseeds, coconut, lac, jute, sugarcane, arecanut, cashewnut, and spices together with the control of research stations and laboratories maintained by these Commodity Committees.

The Parliament of India, in June 1970, approved the introduction of legislation for (a) declaring ICAR as an institution of national importance; (b) converting ICAR into a statutory body and (c) conferring upon ICAR certain functions performed by the University Grants Commission (UGC) in the field of agricultural education.

On the basis of recommendations of the Dr Gajendragadkar Committee (1972), the Department of Agricultural Research and Education (DARE) was set up in 1973 in the Ministry of Agriculture to link ICAR with central and state governments on the one hand and international organizations on the other. The ICAR was retained as an autonomous Society so as to confer necessary operational and functional autonomies in the

organization of agricultural research and education. The Agricultural Scientists' Recruitment Board (ASRB), an independent recruiting agency, was created for the selection and career advancement of the scientists on the pattern of the Union Public Service Commission (UPSC), and a separate Agricultural Research Service (ARS) was constituted in the ICAR. The ICAR was also delegated powers to formulate policies, develop programs and ensure their implementation. The constitution of Governing Body and General Body of ICAR was changed, and Accreditation Committee and Scientific Panels were also set up.

In 1987, a high powered ICAR Review Committee was set up under the Chairmanship of Dr G.V.K. Rao was set up to review organizational infrastructure, personnel policies and functional role of ICAR to meet new challenges of agricultural production and raising agricultural productivity. The Committee made several recommendations that aimed at making 'ICAR tall, slim and healthy'. The Committee recommended that it should become a body with vision and vigour ─vision to analyze problems of Indian agriculture, particularly issues like ecological sustainability of Indian agriculture, economic viability of agricultural production, equity in agricultural growth, and particularly developing a system of education and training which could handle all problems of the future. The Committee recommended that ICAR should primarily concentrate on planning, aiding, promoting and coordinating agricultural research in the country, and should directly involve itself in research activities that are basic and strategic in nature, and it should intervene in regional problems only where SAUs lack infrastructure or capacity to do so. The ICAR institutes as a matter of fact should become 'Centre of Excellence', and develop their national character in real spirit. The Committee also emphasized on the need for greater functional autonomy and decentralization to make the system work efficiently. Many of the recommendations have been implemented.

In August 2004, another Committee was constituted under the Chairmanship of Dr R. A. Mashelkar, Secretary, Department of Scientific and Industrial Research (CSIR), Ministry of Science and Technology, to examine structural framework of the ICAR and suggest measures for according autonomy to the organization, functional flexibility to its scientists and suitable models to actively pursue identified areas of research and other research-related activities on commercial lines. Based on the recommendations of the Committee, the Council has taken steps to rationalize number of research management positions at the headquarters for strengthening of ICAR-industry interface to promote commercialization of technologies, and for institutionalizing a system of IPR protection.

The Planning Commission of the Government of India also constituted a Task Force on Revamping and Refocusing of the National Agricultural Research System in October 2004 under the Chairmanship of Dr M.S. Swaminathan. The Task Force recommended, among other things, promotion of basic and strategic research in agricultural sciences. In response, Government of India has created a National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA). The Fund was initiated during the X Five Year Plan (for the year 2006-2007 only) with an outlay of Rs.50 crore. Twenty one projects were approved during the X Plan. In view of its strategic importance, the fund is continuing during the XI Five Year Plan (2007-2012) with an

outlay of Rs.100 crore. It is highly likely to continue and expand beyond the XI Five Year Plan. In addition, the Council has set up an empowered committee of eminent scientists to determine policy and priorities for fund allocation and approval of the research projects on competitive basis to attain and sustain advantages through cutting-edge of science S&T research.

As part of reform process to improve efficiency of agriculture system, improve equity and reduce poverty, making agriculture a business enterprise, India has been operating a Word Bank aided project called national Agricultural Innovation Project (NAIP) to accelerate and transform Indian agriculture on sustainable basis and make agriculture a business unit involving private sector and other stakeholders. The project is operating from 2006 onward to date and likely continue even beyond 2012.

b) Management of Outreach Program/ Infrastructure

Outreach program of ICAR/ SAUs is mainly managed by Krishi Vigyan Kendras (KVKs) or Farm Science Centres (FSCs). The ICAR has created a vast network of KVKs aiming at assessment, refinement and dissemination of technologies/ products. At present, there are 589 KVKs covering 398 under SAUs, 47 under ICAR Institutes, 94 under NGOs, 33 under State Governments and the remaining 17 under other organizations.

The Directorate of Information and Publications of Agriculture (DIPA) a unit of ICAR is also involved in outreach program of ICAR. Through publications and ICT-driven technology, the Directorate delivers agricultural information to stakeholders in time and cost effective way. DIPA also facilitates strengthening of e-connectivity among ICAR institutes, SAUs and KVKs.

Besides, KVKs facilitate backstopping for dissemination of contingent plan for drought and flood situations which play a vital role in the mitigation of situations in the various districts of the country. To show the potentiality of technologies, KVKs organize 'Technology Week' across the country involving SAUs, line departments, private agencies, NGOs and farmers' organizations. In addition to field demonstrations of improved technologies, KVKs organize training programs for farmers, and rural youths. The programs for rural youths include vocational training on orchard management; production of inputs at site; economic empowerment of women; livestock production & management; value addition; entrepreneurial development, commercial horticulture; capacity building and group dynamics; fisheries; farm machinery, tools and implements, etc. KVKs also impart training to extension personnel of government departments and NGOs and upgrade their knowledge and skills in frontier areas of agricultural technologies. KVKs back up technology products like seeds, planting materials, bio-products, livestock strains and fingerlings, etc.

State Department of Extension and related line department of government department also help in managing outreach programs of the Council and SAUs. Private sectors have come in a big way in selected areas of seeds, pesticides, milk and poultry production etc. to disseminate, refine and provide need-based technology to the farming community.

c) Private Sector Involvement / Partnership

Research system can be strengthened by diversifying funding and institutional arrangements, and increasing overall efficiency of the system. Increasing dependence on public funds may not be sufficient to attain the desired level of research results. Therefore, alternate sources of research funding / participation should supplement the public funds. These funds should be utilized through appropriate institutional arrangements. In this regard, private sector can play an important role. Public and private sectors can interact in several ways for providing research services, depending upon their comparative advantage and national research needs. For increasing research efficiency, public and private sectors can join together to articulate research needs and design a strategy to address them. The sharing of prioritized demand-driven research agenda by public and private research institutions on the principle of comparative advantage in conducting research, can improve overall research efficiency manifold.

Private sector has come in a big way in agricultural research after opening of seed sector and introducing of reforms at the beginning of 1990s. Private sector research is mostly done by large commercial companies and is confined to areas where profits are quick. In crop, private sector is concentrating on production of hybrid seeds, tissue culture and recently on genetically modified (GMs) food and fibre crops. They are also concentrating on livestock (development of poultry breeds and nutrition) and agricultural machinery (tractors, implements, and pumps). In the livestock sector, the National Dairy Development Board (NDDB) does research on nutritional package as well as management of diseases. In addition to profit-oriented research, a few institutes undertake upstream research of wider applicability. For instance, The Energy Research Institute (TERI), Delhi, and the Indo-American Hybrid, Bangalore, are working on in-vitro culture and biotechnology. Southern Petro-Chemical Industries Corporation has established a research foundation which is working on Bt toxin gene. The Maharashtra Hybrid Seed Company, Jhalana (Maharashtra), has established a Research Foundation conducting its own plant breeding and in-vitro culture including biotech research, and also sponsor research on hybrids in various crops.

Private sector involvement in agriculture is on a rising path. Several agribusiness companies have developed new models to reach farmers. Some of these include models like e-choupal, Tata Kisan Kendra, Mahindra Krishi Vihar, Haryali Kisan Bazaars, PepsiCo Contract Farming, Private media, etc. have been discussed here:

d) e-choupal

To improve the farmers share in consumer rupee and providing required services at farmer's door steps, ITC in June 2000 launched the concept of e-choupal. This model came into picture to solve farmers' problems like fragmented small size farms, weak infrastructure and involvement of large number of intermediaries. This model deleted small (*kachcha*) and large (*pucca*) traders from the traditional value chain and involved them in its value chain called as *Sanchalaks* who now supervise and coordinate the activities in e-choupal. ITC targets to cover 0.1 milion villages, 25 million farmers and

establish 25,000 e-choupals in 15 states by 2010. It utilizes basically the information and communication technologies to deliver the farmers needs related to cropping information and commodity pricing.

e) Tata Kisan Kendra

Under the supervision of Tata Chemicals, Tata Kisan Kendras (TKKs) aim to change the rural India from bullock-cart age into the era of satellites and IT. It has a wide network in the states of Punjab, Haryana, and Uttar Pradesh. A TKK provides services like agri-inputs, farm equipment leasing, agronomy services, training and information. It also provides seeds, pesticides, and fertilizers at affordable prices. The TKK provides contemporary information through magazines and journals. These kendras have also established crop clinics to provide information on which crop to grow, when to grow and specific amount of nutrients required.

f) Mahindra Krishi Vihar: One Stop Shop

Mahindra Subhlabh Services Ltd. (MSSL), a subsidiary of Mahindra Company, has been operating in 11 states of India through its dealer network and tractor customer database. It sells quality seeds, fertilizers and pesticides and buys the agricultural produce on contract. In addition, it leases tractors and harvesters. It encourages farmers to take up contract farming.

g) Hariyali Kisan Bazar

The hariyali Kisan Bazar (HKB), the chain of agri-input retail stores, has been promoted by DCM Shriram Consolidated Ltd. (DSCL). It offers a complete range of agricultural inputs like seeds, fertilizers, pesticides, agricultural machinery, etc. at fair prices. HKB provides irrigation equipment, easy crop financing and technical guidance related to crop production.

h) PepsiCo

PepsiCo provides machines and other inputs to the growers of tomato, chilli and basmati rice in contract farming framework. The practice was started in 1998 in the Hoshiarpur district of Punjab state and now covers other districts of Punjab. Its services deal with the system for production and supply of agricultural and horticultural produce under forward contracts between producers/ suppliers and buyers. To win confidence of local farmers, PepsiCo partnered with Punjab Agricultural University at Ludhiana. Because of contract farming in Punjab, the yield of tomato and chilli has increased by three-and two-folds, respectively. Contract farming in this case can be regarded as a rural development solution to improve agricultural productivity along with the promises to provide the assured price. However, factors like high transport costs, inadequate cold storage facilities, unreliable suppliers of raw materials, etc. are certain bottlenecks in the success of contract farming.

Government Initiatives

Both the central and state governments have taken many steps to encourage private sector participation in agriculture. A few of them are noted here. In 2000, the Madhya Pradesh Government had decided to privatize state-owned farms to make the agriculture sector efficient. The Uttarakhand Government has initiated organic farming involving NGOs under the World Bank Assistance Agriculture Development Project. The concept of Agri-Clinic by NABARD is praiseworthy as NABARD helps in providing bank loans once the feasibility study of the project is approved. The New Agricultural Policy (NAP) of India focuses on the greater private sector participation through contract farming. In the Policy, it is stated 'private sector investment in agriculture will be encouraged more particularly in areas like agricultural research, human resource development, post-harvest management and marketing'. Besides, Government of India has launched two schemes viz., *Grammen Bhandaran Yojana*, and *Development of Marketing Infrastructure, Grading and Standardization of Agriculture Scheme*. These two schemes aim to attract private investment. The Grammen Bhandaran Yojana aims to create facilities in the rural areas and in this case, the subsidy varies from 25% to 33.3% of the capital cost of the projects based on the states and SC/STs entrepreneurs.

i) Accountability Hierarchy

A number of monitoring and evaluation mechanisms have been initiated at the national, organization, institute and project levels to ensure relevance of research and accountability in the use of public funds. At the national level, the Planning Commission and government committees monitor the progress and achievements during the preparation of Annual and Five-Year Plans. At the regional level, there are 8 Regional Committees comprising the representatives of ICAR, SAUs and government departments to assess the status of agricultural research in the region (covering several states) and make recommendations of research priorities. At the Institute level, there is Management and Research Advisory Committees to guide in administrative and functional matters, advise on research programs, and monitor their progress. In each ICAR Institute, Institute Research Council with representation of external experts evaluates research projects.

A more substantive external review of each ICAR Institute and SAU is done by an external review team, called QRT, every five years. The review progress covers organizational, management, scientific and other matters relating to effectiveness, efficiency and relevance of the Institute. In addition, for the SAUs, there is a committee to determine the norms for accreditation and financial assistance from ICAR to periodically assess performance of SAUs against these norms.

At the organizational level, Director-General in the case of ICAR and Vice-Chancellor in the case of SAU are accountable for all matters. In ICAR headquarters at Division levels, Deputy Director-Generals and program levels Assistant Director-Generals are accountable. At Institute/NRC/PD level, Director is responsible for all

matters related to Institute. Like ICAR, Director Research, Director Extension and Head of Departments are held responsible for activities related to research, education and extension.

j) Performance Evaluation (Individual)

The performance of an individual scientist is judged based on the professional achievements and general performance (including heath status and integrity) on yearly basis. Every scientist reports his/ her professional activities during the reporting year (April to March) in the prescribed format called Annual Assessment Report (AAR). The AAR contains two parts: Part I: General particulars (to be filled by the administrative office) which include personal details of individual scientist, while part II contains self assessment (to be filled by the scientist being reported upon) or information related to professional activities undertaken by individual scientist during the year which include research, programs conducted (training/teaching/workshop/seminar, etc.) technology development & transfer, administrative and management responsibilities discharged, publications and presentations, membership of professional societies, awards and recognitions, etc.

The annual performance of a scientist is assessed using a grading system by the Reporting Officer by objectively taking professional activities and due note of the shortfalls/ constraints mentioned by the scientist. Based on the performance, scientist during the year is graded into five grades (i) Outstanding 61-65, (ii) Very Good 49-60, (iii) Good 37-48, (iv) Average 25-36, and (v) Below average 13-24. The Reporting Officer also comments on the health status and integrity of the scientist. Finally, the overall grading is awarded based on academic grading and general performance by the Reviewing Officer.

k) Leadership Development

The NARS of India encourages develop expertise in frontier areas of science to become leader in respective areas. This is promoted through deputation of a scientist to attend programs in domestic/ foreign institutions. The Council also provides fellowships and scholarships to undertake research in frontier areas of science to develop the capacity. ICAR also sends scientists on deputation to foreign countries through memorandum of understanding (MOU) for acquiring expertise and gaining experience and guide the future activities.

l) Human Resource Development

The ICAR provides opportunity to acquire higher training by its scientists in both India and abroad. Training/ capacity building within the country is under the purview of the Director of the ICAR Institute. The total cost of training is borne by the Institute. A scientist may also get permitted on demand to acquire higher qualification/ training with

full salary for three years. ICAR also encourages scientists to acquire higher training in foreign countries in a limited number, depending on the importance of area and need of the Institute providing full cost. Faculty may also get training abroad through externally-funded project, if provisions are made.

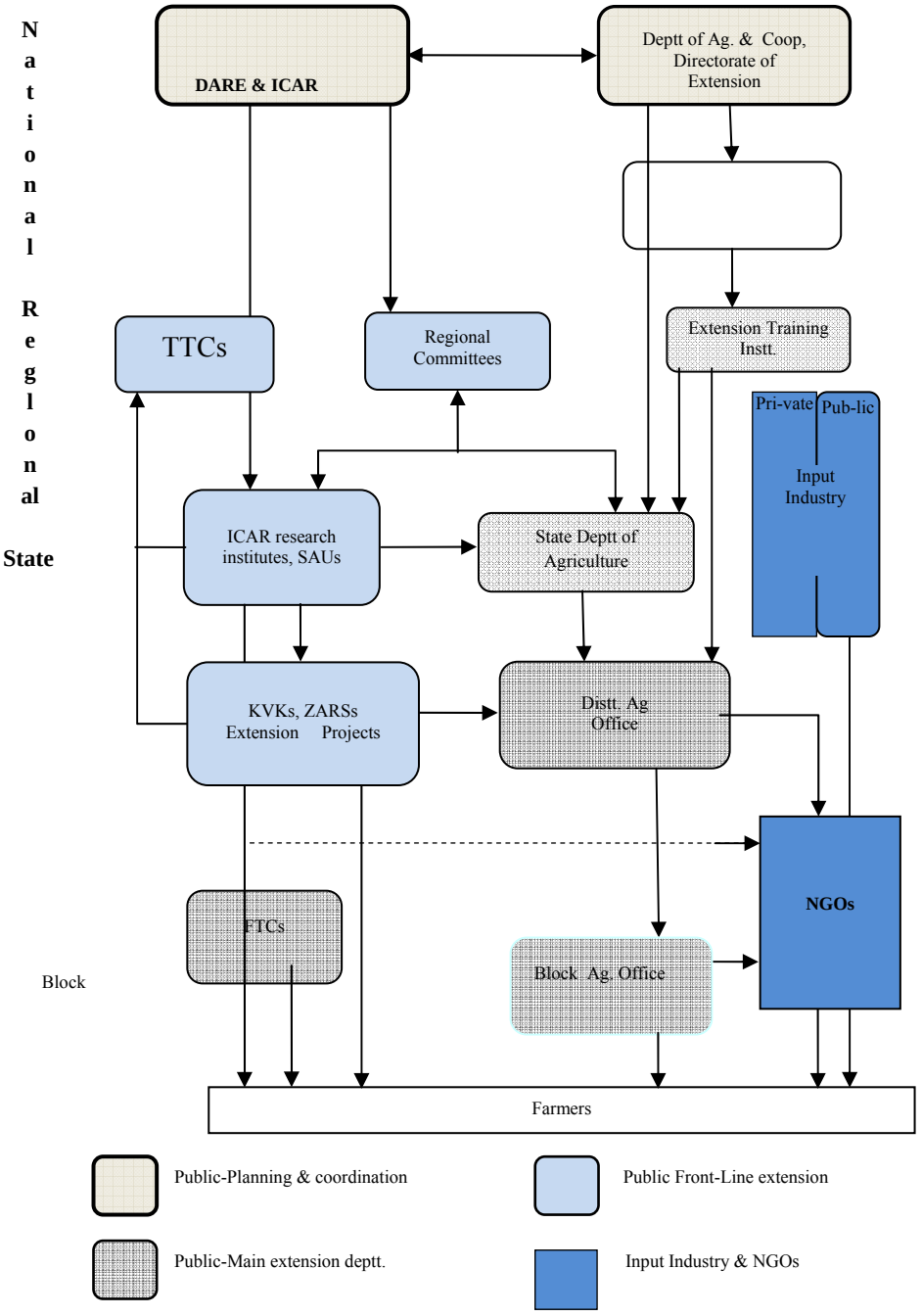
m) Research Extension Linkage

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 of ICAR and SAU system, (iii) extension program of input industries in the public and private sectors and NGOs, and (iv) special rural development programs of the central and state governments. However, the main responsibility of transfer of technology rests with the State Governments being agriculture 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 3.

In India, research-extension linkages have been institutionalized at the 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 & Cooperation (DAC) are organized twice a year to discuss critical agricultural R&D issues. At the regional level, 8 Regional Committees were constituted to review R&D status in the ICAR institutes and SAUs located in the region. These committees are represented by the senior research and extension officers, farmers' representatives and NGOs and meet once in two years. The meetings and seasonal workshop of Zonal Agricultural Research and Extension Advisory Committee facilitate close interaction between researchers, extension workers and farmers.

Today intensive agriculture involves key concepts like sustainability, diversification, commercialization, environment safety, etc. Therefore, there is a need to reorient the philosophy of extension from technology transfer mode to technology application mode. This emphasizes for policy reforms in extension-service system. The policy reforms in agricultural extension envisage the replacement of the old single discipline based commodity oriented approach of Training & Visit (T&V) by multi-disciplinary Farming System (FS) approach. The FS approach emphasizes that research and extension agenda should be determined by explicitly defined farmers' needs rather than perception of research scientists or extension functionaries. In the changing scenario, there is a growing recognition that public extension cannot meet wide range of complex demands of agricultural technology of various regions and different classes of farmers. This recognizes the role of multi-agency approach to work with public extension. Further three major arms of agricultural extension network are:

Figure 3. Institutional structure of the Indian agricultural extension system



Public Extension Services

- State government line departments operated extension system (departments of agriculture, horticulture, and livestock development)
- State agricultural universities based extension (Directorates of Extension, Krishi Vigyan Kendras (KVKs) and Krishi Gyan Kendras (KGKs)
- ICAR extension (Zonal Research Stations, KVKs, Agricultural Technology Information Centres (ATICs), Institute Village Linkage Program (IVLP), etc.

Private Extension Services

- Community Based Organizations (Farmers' Organizations, Farmers Cooperatives, Self-Help Group, etc)
- Para Extension workers (contact farmers, link farmers, gopal, mitra kisans, mahila mitra kisans, etc.)
- Agri-Clinics and Agribusiness
- Input suppliers/ dealers (pesticides, seeds, nutrients, farm implements, etc.)
- Corporate sector (commercial crops– tobacco, tea, coffee, oilseeds), seeds, vegetables, farm implements-tractors, threshers, sprinklers, drip irrigations, etc).

Mass Media and Information Technology

- Print media-Vernacular Press
- Radio, Television, Private Cable Channels, etc.
- Electronic connectivity through computers, NICNET, Internet, V-SAT, etc.
- Farm Information and Advisory Centres (FIAC)
- Private Portals
- Public and Private Information Shops

Despite efforts made to institutionalize research-extension-service system to meet the needs of framers many constraints remain. These include no effective and structured interaction between research and extension agencies resulting into non-workable convergence of decisions taken, inherent institutional capability of extension agencies, inadequate funding, lack of trained extension personnel in states, breaking of institutional mechanism, no direct interface between scientists and farmers, etc. However, improving the research–extension linkage is the key to effective utilization of the extension system. This can be done through direct interface between farmers and scientists, activating existing interface mechanism and research priority setting based on Strategic Research Extension Program (SREP). Though direct interface between farmers and scientists minimize losses, it involves high costs and outreach of scientists is limited. This method of extension is limited for large states like Uttar Pradesh, Madhya Pradesh, though it is working well in Punjab which is initiated by Punjab Agricultural University.

n) Education

The task of coordinating and supporting the present agricultural education system in India has been assigned to the ICAR by the Government of India. Having the statutory power vested in it, ICAR coordinates and supports higher agricultural education in the country at par with that of University Grants Commission (UGC). The Council partly

provides funds to agricultural universities and monitors the course curriculum. To undertake new course/ degree program, the SAU needs to take permission from the Council. To maintain the quality of higher education in agricultural universities, accreditation of the agricultural university is done by the Committee constituted by the ICAR. Fulfilling the eligibility, the university is granted accreditation for five years. Besides SAUs, agricultural education in India is also provided in few Central Universities having strong agricultural institute and faculty. The ICAR partly supports them in the form of funds. Apart from this agricultural colleges affiliated to general universities also provide education in agriculture. ICAR keeps watch on these institutions to maintain quality and updation of course curriculum.

Apart from these, the ICAR impart higher education through its four major institutions viz., Indian Agricultural Research Institute (IARI) New Delhi, Indian Veterinary Research Institute IVRI), National Dairy Research Institute (NDRI), and Central Institute of Fisheries Education (CIFE).

o) Management Information System

As a part of Organization & Management (O&M) reforms process started during NATP, an exercise was initiated called Management Information System (MIS) using information technology. The broad aim of MIS is to strengthen the information management within the Indian NARS by developing electronic linkages between and amongst ICAR Institutes, National Research Centres (NRCs), Project Directorates (PDs), All-India Coordinated Research Projects (AICRPs), State Agricultural Universities (SAUs), Zonal Research stations (ZRSs), Krishi Vigyan Kendras (KVKs), Directorate of Extension (DoE), National Institute for Management of Agricultural Extension (MANAGE) and extension units at the state and district levels. This information network provides access to internet, national and international scientific literatures, database and CD-ROM libraries. MIS includes two main components, viz., Agricultural Research Information System (ARIS) and Library Improvement and Networking (LIN). In fact, strengthening of Agricultural Research Information System (ARIS) was initiated under the NARP II.

The ARIS brings the information management culture in NARS so that agricultural scientists can carry out research more effectively by having systematic access to research information available in India as well as in other countries, better project management of agricultural research, and modernization of logistics. The basic infrastructure required for linking all ICAR institutes has been created. The e-mails and Internet connectivity have been established in almost all ICAR institutes, Sate Agricultural Universities and Krishi Vigyan Kendras, which are main entities of NARS.

ARIS has four information modules namely Agricultural Research Personnel Information System (ARPIS); Agricultural Research Financial Information System (ARFIS); Agricultural Research Library Information System (ARLIS) and Agricultural Research Management Information System (ARMIS).

Efforts have been made to develop MIS to cater needs of agricultural research system management. The major initiatives are described below:

1. Agricultural Field Experiments Information System aims at systematic maintenance of data on field experiments conducted on various aspects of agricultural technology at a central place and retrieval of information on selective basis as per requirements. It was evolved over years as an outcome of National Index of Agricultural Field Experiments Scheme. The main information included in this system are study objectives, details about treatments, experimental design, cultural practices followed, general crop conditions, summary results and plot-wise observations. Similarly, National Information System on Animal Experiments (NISAE) has been developed wherein the information relating to the experiments conducted in the country in various fields of animal sciences can be stored at a central place in a compatible form. Another information system to manage long term fertilizer experiments conducted or in progress at various organizations under horticulture, crop sciences and NRM is also at place.
2. A network of social scientists including Agricultural Economists and Agricultural Statisticians has been developed to facilitates cost effective and timely exchange of research-related information
3. Expert System on Wheat Crop Management is an effort to vitalize the extension services in order to reach the farmers effectively. The developed expert system will be available on the Internet. This expert system has potential to help the farmers in getting instant solution to their problems. It can provide solutions and suggestions to the farmers and research workers in the absence of experts and scientists and in this way could be a boon to the NARS in the process of obtaining sustainability in agriculture.
4. The IASRI has taken up lead to develop a web based on-line information system for National Information System on Agricultural Education Network in India with the usual facilities of updating, retrieval and dissemination of information at the national level (NISAGENET). The system will be capable of maintaining up-to-date agricultural education data bank and providing answers to assessment of agricultural education related queries covering all important aspects like characteristics of agricultural universities / institutions, colleges under different universities, teaching programs offered, infrastructural facilities available in different universities, manpower in agricultural universities like cadre-wise manpower, function-wise manpower distribution, sex-wise and grade-wise distribution of faculty and R&D information like university research funding, university-wise distribution of projects, technologies developed, SAUs achievements, SAUs publications, etc. The NISAGENET will be useful to academicians, planners, policy makers, scientists, technologists, and students for undergoing higher education in agriculture, and other related individuals and institutions.
5. Personnel Management Information System Network (PERMIS*net*) has been developed for ICAR setup for providing information for systematic planning and development of human resources in the ICAR. It will maintain up-to-date information on ICAR personnel under various services on personal and professional attributes. The system provides information on Scientists, Technical

Staff, Administrative and Supporting staff on the above mentioned parameters, besides information on cadre strength and institutional structure to help the management in taking appropriate timely decisions. Similarly, PIMSNET, the centralized on-line project monitoring system has been implemented to help in increasing working efficiency and work culture in the system. The reporting through PIMSNET will help in measuring the overall impact of the research and extension technologies developed through various projects. The monitoring through PIMSNET would also usher in electronic governance and office automation.

The ICAR has an Agricultural Research Information System (ARIS) as the central source of information on all research projects and schemes financed by the ICAR. The research projects of the institute funded have been computerized and updating of the databases is being done. The ARIC is the national input centre for the AGRIS and CARIS agricultural databases of the FAO, which is the largest information system of its kind in the world. The ARIC is also the national focal point for the SAARC Agricultural Information Centre (SAIC). It has published several directories in addition to a half-yearly directory of conferences, seminars, symposia and workshops in agriculture. It is regularly upgraded to provide on-line uplinking and downlinking facilities to the ICAR system, and to the agricultural information system of the entire world.

Under the NAIP, emphasis is being given on (i) strengthening of the ICAR-Net, (ii) digitized content creation and knowledge management, (iii) strengthening 44 libraries of SAUs and the 98 ICAR institutes into fully electronic libraries connected over ICAR net, (iv) formation of an 'ICAR e-Journal consortium' for centralized subscription of e-resources and information sharing in the agricultural domain at national level on the pattern of the 'UGC Consortium' of 100 plus universities under UGC, 'CSIR Consortium' of 40 R&D labs, etc.

In addition, the Directorate of Information and Publications of Agriculture (DIPA) is committed to promote ICT-driven technology and information dissemination system for quick, effectual, and cost-effective delivery of messages to all the stakeholders in agriculture. Keeping pace with the current knowledge diffusion trends, the Directorate delivers and showcases ICAR technologies, policies and other activities through print, electronic and web mode. Directorate is the nodal centre for designing, maintenance and updation of ICAR website along with facilitating of network connectivity across ICAR institutes and KVKs. Besides, Directorate provides public relation and publicity support to the ICAR and its institutes across the country. The Directorate brings out various kinds of publications. (i) Handbook series ─ *Handbook of Agriculture*, *Handbook of Horticulture*, *Handbook of Animal Husbandry*, and *Handbook of Fisheries* which provide authoritative and benchmark information, (ii) Research journals viz., '*Indian Journal of Agricultural Sciences'* and '*Indian Journal of Animal Sciences'*, (iii) Semi-technical magazines / newsletters viz., Indian *Farming, Indian Horticulture, ICAR Reporter, ICAR News, ARIS News*, etc. DIPA facilitates online access to 2000 journals from a single

subscription in more than 123 libraries under the NAIP project on consortium for e-resources in agriculture (*CERA*). Directorate plays an active role in the outreach program through developing video films depicting successful technologies and telecast over the TV channels, and All India Radio (AIR). The recent initiatives under NAIP undertaken by DIPA on digitization and e-resources include Digital Dissemination System for Indian Agricultural Research (ADDSIAR), E-Publishing and Knowledge System in Agricultural Research (E-PKSAR), and Mobilizing Mass Media Support for sharing agro-Information.

Review / Evaluation / Monitoring

a) Program Review & Institutional Review

A review process is adopted for the evaluation of activities performed based on the funding sources. The review of activities (research, education and extension) performed using ICAR funding at the Divisional level by the concerned DDG (ICAR). Each institute submits its work plan for five-year period to respective Division based on the directions of the Division to undertake most important subject areas/ issues, suggestions of the working group formed by the ICAR in consultation with Planning Commission, and scientists own assessment while working with the farmers. Respective Assistant Director-General (ADG) helps in refining the Research Program and advises the DDG. Research Advisory Committee (RAC) reviews the on-going research programs of the respective institute and suggests modifications and also helps in deciding to undertake contemporary researchable areas/ issues. Based on the approved work plan, research programs / projects are prepared by the Division(s) of individual institute and are presented by the Head of Divisions before the Institute Research Council (IRC) and thoroughly discussed. Usually, the IRC meeting is held once in a year at the institute and external experts in respective fields are invited for making suggestions and approval. The ICAR has now advised to its institutes to conduct IRC every month.

Once the project is approved, it is converted into Research Program File (RPF) for monitoring and evaluation. RPFs are of three types, viz. RPF1 used to convert approved research project in workable mode from administrative point of view, and submitted to Technical Cell of the Institute. RPF 2 is used to report the annual progress made in the project and RPF3 is to report completion of research project. Project funding agencies from outside sources reviews program in their own way.

Reviewing of educational programs is done by DDG (Education) of ICAR in ICAR Deemed Universities, State Agricultural Universities and affiliated Agricultural Colleges. Review of outreach program performed by the KVKs is done by DDG (Extension) ICAR at regional level. The whole country has been divided into 8 regions for administrative convenience and Zonal Coordination Units (ZCUs) are the main link for intra-regional coordination.

Every institute of ICAR has a Management Committee (MC), which also reviews program of Institute twice a year for smooth functioning of activities. Director of the

Institute is the Chairperson of the MC. Secretary of MC briefs the past proceedings, and presents the current demand before the MC. Chairperson seeks the approval of MC members for further action.

Institutional reviews are usually done at the end of Five-Year Plan period by a Quinquennial Review Team (QRT) of individual ICAR institute / SAU by the experts group mainly from the outside system. The QRT assesses the activities (research/education/ extension) and makes suggestions for improvement.

b) Composition of Review Panel (Internal and External)

There are three main bodies, viz. Research Advisory Committee, Management Committee, and Institute Research Council for each Institute to review the programs/ project once/ twice / thrice in a year at the institute level. A QRT is constituted by the ICAR for reviewing the progress of each institute made during five-year period. The RAC, MC and IRC functions at the institute level and their constitutions have been described below.

(A) Research Advisory Committee (RAC)

The constitution of RAC is as follows:

1.	An eminent scientist from outside the ICAR system nominated by the Director-General of ICAR	Chairman
2.	4-5 external experts (including retired scientists of ICAR) representing the major areas of research and development programs of the Institute nominated by the Director-General of ICAR	Members
3	Director of the Institute	Member
4	Deputy Director-General concerned with the Institute in the case of IARI, IVRI, NDRI, CIFE and NAARM. In the case of other institutes, Assistant Director-General concerned with the Institute	Member
5	Two persons representing agricultural/ rural interests on the Management Committee of the Institute in terms of Rule 66 (a) (5) for the period of their membership of the Management Committee	Members
6	One senior level scientist of the concerned Institute nominated by the Director	Member Secretary

The tenure of nominated members, including Member-Secretary and Chairman is three years, except in the case of members at serial no. 5 noted above. There is no bar on the re-nomination of any member.

The RAC suggests research programs based on national and global context of research in the thrust areas. The RAC reviews the research achievements of the Institute and to see their relevance with the mandate of the institute. It also undertakes any other function that may be specifically assigned by the Director-General of ICAR.

(B) Management Committee

The constitution of MC is as follows:

1.	Director of the Institute	Chairman
2.	A representative of the state government in which the Institute is located nominated by the President of ICAR	Member
3	A representative of any other state government concerned with the research in the Institute, nominated by the President of ICAR	Member
4	A representative of the agricultural university having jurisdiction over the area , nominated by the President of ICAR	Member
5	Two non-official persons representing agricultural/ rural interests, to be nominated by the President of ICAR	Member
6	Four scientists of Council's Institutes to be nominated by the Director-General	Members
7	A representative from the Council nominated by the Director-General of ICAR	Member
8	The Financial Advisor of the ICAR or DARE or Accounts Officer of the same or another institute, nominated by the President of ICAR	Member
9	Administrative Officer of the Institute	Member Secretary

In the case of the IARI, IVRI, NDRI, and CIFE, which are a deemed University under the University Grants Commission Act of 1956 and such other Institutes of the ICAR, the appropriate academic and management bodies are approved by the President of ICAR.

(C) Institute Research Council

The Institute Research Council (IRC) is an advisory body for approving the research programs of the Institute. The constitution of IRC is as follows:

1.	Director of the Institute	Chairman
2.	Joint Director (Research)/ In charge (Research Coordination and Management Unit)	Member
3	Head of Divisions/ Sections	Members
4	All Principal Investigators of the Projects. This shall include the Leaders of the major programs at the Institute, Head of Divisions (HODs) and the Project Coordinators. The number of program leaders is to be decided at the Institute level in consultation with the Research Advisory Committee by adopting the following criteria: (i) For National Research Centre (NRC) all the Scientists working in the NRC may be the members of IRC (ii) For the National Institutes the membership from this category may be limited to 50.	Members
5	DDG concerned with the Institute in case of IARI, IVRI, NDRI, CIFE and NAARM and in the case of other Institutes ADG concerned with the Institute	Member
6	Scientist-in-Charge of the Research Coordination Management Unit at the Institute	Member Secretary

Frequency of Review

The RAC normally meets once in a calendar year at the Headquarters of the Institute. Only in exceptional cases, the RAC may be convened twice in a year. The duration of RAC meeting may be of 1 to 3 days depending upon the agenda of the meeting. The MC meeting may be held 2-3 times in a year depending on the actual need of the Institute. The IRC meets twice in a year at the Headquarters of the Institute. But, recently ICAR authorities in a meeting suggested holding IRC meetings on monthly basis.

Follow-up of Review

The proceedings of the RAC are forwarded to the Director-General, ICAR by the Member-Secretary, after getting the same approved from the Chairman and the Director of the Institute ensures that the proceedings are submitted to the Secretary, ICAR within a week of the meeting. The Director-General has the power to review / cause to be reviewed any decision of the RAC where he/she considers the same is not in consonance with the rules, general policy, practice or the priorities of the Council. If the proceedings are not received at the Headquarters, these may be reviewed by the Director-General any time *suo moto*. The proceedings of MC follow similar pattern to RAC.

The action on the proceedings of the Institute Research Council (IRC) is intimated immediately after their approval by the Chairman. The Member-Secretary of IRC monitors the follow-up action, which is reported at the next meeting of IRC.

Monitoring of Research Program

Research programs of the Institute are monitored by bodies like RAC, MC and IRC. RAC reviews the research programs in its meeting held once or twice in a year and suggests modifications based on national and global context of research in the thrust areas. IRC evaluates research through maintaining Research Project Files. Based on the Annual Research Progress Report, reviewed by expert, IRC makes specific suggestions about achievements and shortcomings of the project.

Follow-up of monitoring

Research projects monitoring are tracked through annual progress report and action on recommendations of QRT. Director of the institute also monitors the projects regularly.

Incentive Structure

a) Salary Structure (Break-up: basic, house rent allowances, etc.)

An entry level Scientist/ Assistant Professor in ICAR Institute/ SAU is offered the Pay Band (Rs 15600 -39100+RGP (Research Grade Pay) of Rs. 6000 (as per the 6th Pay Commission, with effect from 1 January 2006). The entry level Scientist after completing 8 years of service is placed in next Pay Band (Rs. 37400 - 67000+ RGP 8000), and after completion of 3 years service, he/she will be given RGP of Rs. 9000 and designated as Senior Scientist. After completing another 3 years of service in the Pay Band (Rs. 37400-67000/- + RGP 9000/-), a Senior Scientist will be placed in Pay Band 4 (Rs. 37400-67000/- + RGP 10000, subject to completing other formalities laid to promoted to Principal Scientist. Almost similar pay package is given to faculty serving in SAU, and faculties are designated as Assistant Professor (Scientist in case of ICAR), Associate Professor (Senior Scientist) and Professor (Principal Scientist).

House Rent Allowance

No.	Classification of cities/ towns	Rates of HRA (from 1 September 2008)
1	'X'	30%
2	'Y'	20%
3	'Z'	10%

House Rent Allowance (HRA) is payable with reference to Pay Band *plus* RGP *plus* NPA, if any (Special Pay/ Personal Pay, etc. not to be included). HRA is given based on the place of duty / city. For the purpose of paying HRA, Indian cities have been classified into three types, and accordingly HRA is admissible to employee. The following rates are being paid as per city:

A place where Composite Hill Compensatory allowance and Special Compensatory Allowance are admissible, an employee can draw only one of these allowances more beneficial to him/ her.

b) Retirement Benefits and Age of Retirement

The retirement age of a Scientist in ICAR/ SAU is 62 years, while a Faculty member working in Central University retires after completion of 65 years on performance (or case to case basis). The retirement benefits like gratuity leave encashment, etc. are described here.

Gratuity

Gratuity is a statutory benefit paid to the employees under the Payment of Gratuity Act, 1972 who have rendered continuous service for at least five years. The employee is eligible for 15 days (15/26) of pay for each completed year of service. The employer can also structure a gratuity benefit that is higher than statutory requirements. The gratuity benefit is payable on cessation of employment (either by resignation, death, retirement or termination, etc) by taking the last drawn salary as the basis for the calculation.

Gratuity benefit is mainly of three types: service gratuity, retirement gratuity, and death gratuity. These are explained one by one.

Service gratuity

Service gratuity is given to an employee who retires before 10 years of qualifying service. Such employee is not admissible to get pension facility. Service gratuity is paid at the rate of half-month's emoluments for every completed six-monthly period of qualifying service. 'Emoluments' means basic pay, non-practicing allowance, if any and includes dearness allowance (DA) admissible on the date of retirement. This gratuity is in addition to retirement gratuity admissible to those who have completed 5 years' qualifying service.

Retirement gratuity

This is admissible to all employees who retire after completion of 5 years of qualifying service at the rate of 'one fourth' emoluments for each completed six monthly period of qualifying service subject to a maximum of 16 ½ times the 'emoluments' or Rs. 1 million (from 1 January 2006). Emoluments include DA on the date of cessation of service.

Death gratuity

Death gratuity is admissible in case of death in service to an employee at the following rate:

S. No.	Length of Service	Death Gratuity payable to family
i.	Less than one year	2 times of 'emoluments'
ii.	One year or more, but less than 5 years	6 times of 'emoluments'
iii.	5 years or more, but less than 20 years	12 times of 'emoluments'
iv.	20 years or more	Half of emoluments for every completed six monthly period of qualifying service subject to a maximum of 33 times 'emoluments' or Rs. 1 million

Leave Encashment

Normally, ICAR Scientists are allowed 30 days leave (called Earned Leave) in a year, besides 8 days Casual leaves. If earned leave is not availed, these leaves get accumulated (subject to maximum limit of 300 days; rules varies from organization to organization) and at the time of retirement/otherwise or on leaving the employer, the employee is paid for the leaves remaining unutilized in his/her account. The amount received in lieu of this unutilized leaves is called leave salary / leave encashment.

Scientists/ Faculties working in ICAR and SAUs are given incentives for acquiring higher qualifications, maintaining small family, in case of eventuality (i.e. employee death), insurance cover, etc. These incentives are described here.

c) Incentives for Higher Qualification

(i) A Scientist/ Assistant Professor paid five non-compounded advance increments at the time of joining on or after 1 September 2008 having a Ph.D. degree in the relevant discipline by a University following the process of registration, course-work and external evaluation as prescribed by the ICAR.

(ii) Candidates who hold M. Phil / M. Tech /M. Sc. (Ag.) / M. V .Sc./ M. F. Sc. degree (with 4 years bachelor and 2 years Master's program) at the time of recruitment on or after 1 September 2008 as Scientist shall be given two non-compounded advance increments.

(i) A Scientist/ Assistant Professor paid three non-compounded advance increments as and when he/she acquires Ph.D. degree during service carrier on or after 1 September 2008 from a University following the process of registration, course-work and external evaluation, as prescribed by the ICAR.

(ii) A Scientist/ Assistant Professor paid one non-compounded advance increment as and when he acquires M. Phil or a post-graduate degree in a professional course as notified by the ICAR in his/her service carrier on or after 1 September 2008, provided such post-graduate qualification is not a mandatory requirement at the entry level of recruitment.

d) Incentives for Small Family Norms

A Scientist paid special allowance in the form of 'Family Planning Allowance' for undergoing sterilization operation. At the time of operation, the employee should have one surviving child and not more than two children. A male employee age should not be over 50 and his wife should be between 20 and 45 years. A female employee's age should not be over 45 and her husband's not over 50. Admissible even if twins are born after the first surviving child. The employee or spouse may have the operation. The allowance will be related to Grade Pay corresponding to the post against which the employee concern will earn the family planning allowance. This allowance will remain fixed in the entire service. If both husband and wife are employees, the allowance may, at their choice, be drawn by any one of them. Besides family planning allowance, the half-per cent rebate on House Building Advance interest will be admissible only if the sterilization has been done after 1 September 1979 but before drawal of the final installment of the House Building Allowance. The incentive is payable from the first of the month following the date of operation.

e) Immediate Relief to the Family of an Employee who Dies while in a Service

If an employee dies while in service, his/her family will be eligible for immediate monetary relief (in the form of advance) equal to two months' Basic Pay of the deceased Government servant subject to maximum of Rs. 8000/ (*the amount to be revised as per 6th Pay Commission pay scales became effective from 1 January 2006*). The advance is adjusted within six months against the arrears of pay and allowances, leave salary, death gratuity, balance in Contributory / General Provident Fund or any other payment due in respect of the deceased.

(f) Group Insurance Scheme

The scheme covers all central government employees (including departmental canteen employees) provides at a low cost and on contributory and self-financing basis, the twin benefits of an insurance cover to help their families in the event of death in service and a lumpsum payment to augment their resources on retirement. A portion of the subscription is credited to the Insurance Fund and the other portion to the Savings Fund which earns interest at the prescribed rate compounded quarterly. The apportionment is at 30% to Insurance Fund and 70% to Savings Fund with effect from 1 January 1988 at the assumed mortality rate of 3.60 per thousand per annum.

HR Management (Recruitment and Promotion Process)

To recruit persons for scientific and other management positions of ICAR, ASRB has been constituted. Entry level Scientist in ICAR is recruited through Agricultural Research Service (ARS) and other positions are filled through interview method. The recruitment to other cadre positions like technical, administration and supporting staff is done at

Institute level. Administrative posts in DARE are filled through Government of India services.

Besides recruitment, ASRB helps in promotion of scientific staff from one cadre to another. It is done through formal procedures laid for the promotion of individual cadre. Promotion policies of Technical, Administrative and Other Staff are undertaken at the Council level.

Career Advancement Scheme/ Process

Career Advancement Scheme (CAS) is one of the processes which help employees to move into next higher grade. The existing CAS of Scientists under ICAR is described below.

a) Career Advancement

(i)The minimum length of service for eligibility to move into the grade of Scientist (Senior Scale) is 4 years for those with Ph.D. degree, 5 years for those with M. Phil, and 6 years for others at the level of Scientist, and for eligibility to move into the Grade of Scientist (Selection Grade)/ Senior Scientist, the minimum length of service for Scientist (Senior Scale) is uniformly five years.

(ii)The movement into grades of Senior Scientist and above, the minimum eligibility criterion is Ph.D. degree. Those without Ph.D. can go up to the level of Scientist (Selection Grade).

(iii)A Senior Scientist with a minimum of six years of service in that grade will be eligible to be considered for appointment as a Principal Scientist.

b) Eligibility Criteria

Scientist (Senior Scale)

A Scientist becomes eligible for placement in a senior scale through a procedure of selection, if he/she has completed:

- Six years of service after regular appointment with relaxation of one year and two years respectively for those with M. Phil. and Ph. D. degree (i.e. for M.Sc. 6 years, M. Phil. 5 years and Ph.D. 4 years).
- Submitted performance of work with reference to the targets set.
- Consistently satisfactory performance appraisal reports.
- Participated in one Refresher Course/ Summer Institute with is either organized/ sponsored by the Education Division of ICAR or UGC.

Scientist (Selection Grade)

Scientists in the senior scale who do not have Ph.D. degree or equivalent published work and who do not meet scholarship and research standards but fulfill the other criterion given for the post Senior Scientist and have good record to research/ teaching/ extension and contributed in various ways in above activities and to the corporate life of

the institution, extension activities, etc. will be placed in a selection grade, subject to the recommendations of the selection committee which will be same as for promotion to the post of Senior Scientists. They will be designated as Scientists (Selection Grade) till the period they acquire Ph.D. degree and /or fulfill other requirements for promotion as Senior Scientists and if found suitable by a duly constituted Committee would be designated as Senior Scientist.

Senior Scientist (Promotion)

A Scientist in the Senior Scale will be eligible for promotion to the post of Senior Scientist if he/she has:

- Completed five years of service in the Senior Scale.
- Obtained a Ph.D. degree or equivalent published work.
- Made some mark in the areas of scholarship and research/ training/ extension as evidenced through self-assessment appraisal reports, reports of experts, evidenced by publications/ patents/ designs of new courses/ innovations/ extension activities.
- After placement in the Senior Scale participated in one Refresher Course/ Summer Institute which is either organized / sponsored by the Education Division of ICAR or UGC.
- Participated in a workshop/ seminar/ symposium/ conference, etc.
- Possessed consistently good performance appraisal report.

Principal Scientist (Promotion)

In addition to the posts of Principal scientists as pr cadre strength already fixed, which is to be filled through direct recruitment through all-India advertisement, promotions will be made from Senior Scientists to Principal Scientists after 6 years of service as Senior Scientist, as per 6^{th} Pay Commission guidelines (earlier 8 years as specified in 5^{th} Pay Commission).

A Senior Scientist will be promoted to the post of Principal Scientist if he/she has:

i. Completed six years of service as Senior Scientist, and

ii.He/she presents himself/ herself before the selection Committee constituted by ASRB with some of the following:

(a) Self appraisal reports (required)

(b)Research contribution/ books/ articles/ research papers published.

(c) Any other academic contributions. The best three written contributions of the Senior Scientist (as defined by him/her) may be sent in advance to the experts to review before coming for selection. The candidate should be asked to submit these in three sets with the application

(d) Seminars/ conferences attended

(e) Contribution to teaching/ academic environment/ institutional corporate life

(f) Extension and field outreach activities

Sabbatical Leave

There is a provision for grant of sabbatical leave to scientists for academic, scientific, technological and other related activities, at any relevant institution or organization in India or abroad, to enable them to strengthen their professional competence are made. The ICAR Scientists / Faculty Members / Professors in the grade of Rs 37,400 – 67,000 and above who have rendered not less than 6 years of service in the ICAR/ State Agricultural Universities are entitled for sabbatical leave, limited to a maximum period of one year, twice during the entire carrier of a Scientist / Faculty Member (ICAR 1998b). This leave would be granted once in 10 years. This facility again would help in development of excellence and institutional building.

Pension Facilities

Pension facilities are available to all government employees including scientists of NARS of India. Prior to 1 January 2004, the government employees including NARS Scientists were getting defined benefit pension. The Government has moved from defined benefit pension to a defined contribution based pension system as a part of the pension policy reforms and has launched a New Pension Scheme (NPS) from 1 January 2004. The scheme is expected to help the Government to reduce its pension liabilities. It is mandatory for a government employee to contribute a minimum of 10% of emoluments and not more than his emoluments as a contributory provident fund. The government/ employer will contribute (10%) to the employee account on 31 March of each year. For any period the employee does not contribute there will be no contribution from the employer also. Unlike existing pension scheme that offered assured benefits, NPS has defined contribution and individuals can decide where to invest their money. NPS is designed to leverage existing network of bank branches and post offices to collect contributions and ensure that there is seamless transfer of accumulations in case of change of employment and/or location of the subscriber.

Technology Marketing

The Intellectual Property and Technology Management (IP&TM) Unit in ICAR is headed by a Assistant Director General (IP&TM). It oversees all matters related to intellectual properties and technology transfer/commercialization. ICAR recognizes that a systematic management of its technology products and services while bringing commercial ethos in their transfer and realization at the user end would result in much-needed dividends for the nation. Therefore, the Council is slowly and steadily but comprehensively moving towards intellectual property management and technology transfer in an organized manner. A decentralized three-tier IP (intellectual property) management mechanism has been institutionalized in ICAR with effect from 2nd October 2006.

- Individual institutes of ICAR are empowered to enter into licensing contracts or agreements for commercial transfer of ICAR technologies to the interested parties.
- A middle-tier consisting of five Zonal Technology Management & Business Planning and Development (ZTM&BPD) Units at IARI, New Delhi, IVRI, Izatnagar, CIRCOT, Mumbai, NIRJAFT, Kolkata and CIFT, Kochi has been developed to

facilitate business and strengthen public-private partnerships. These zonal units also project the ICAR technology profiles available at various ICAR institutes located in the respective zones.

- The central IP and technology management mechanism at ICAR headquarters facilitates techno-legal and policy matters/concerns that may arise on case-to-case basis in the course of developing win-win relationships and also catalyzes public-private affairs at the central level.

Thrust Areas

- Streamlining transfer of ICAR knowledge and technology products through commercial, cooperative and open public routes.
- Joint intellectual property management support in collaborative projects.
- Facilitation and advisories in techno-regulatory and policy matters related to intellectual property and technology management.
- Public-private partnerships in technology/know-how transfer and R&D.

The more details about intellectual property and technology management and marketing can be referred from ICAR website (http://www.icar.org.in).

Prize and Reward System

An appropriate incentive and reward system is a powerful tool in an organization to enhance the performance and job satisfaction of its employees as well as to help organization achieve its potential. By giving awards, the system recognizes proficiency, sincerity and efficiency of researchers, extension workers and innovative farmers. The Indian Council of Agricultural Research had recognized this fact way back in 1956 when it instituted a number of awards. To date ICAR has instituted 19 awards are given in different categories. Out if this, seventeen awards are given annually, one is given biannually and one is given as often (challenge is solved) to accord recognition to the scientists and institutions who make outstanding contributions for the growth and development of agricultural science and technology and to promote excellence in the broad fields of agricultural research, education and training.

a) ICAR Norman Borlaug Award

This award is meant for all Indian scientists, and not restricted to NARS alone, who have provided breakthrough for agriculture through a new insight that has created high potential value for the future. The award is given of Rs 10 lakh (1 million) in cash. Apart from this, Rs 30 lakh (3 million) as a research contingency grant for carrying out research in an area identified mutually by the scientist and the ICAR, which have specified objectives and goals. Nomination to be invited every year, and award will be given if a rare and exceptionally gifted person or genius can be identified.

b) ICAR Challenge Award

This award is instituted to find a solution for either a long-standing problem (identified by the ICAR), which has defied solution over years, or any emerging/immediate problem which has potential of widespread damage and adverse impact on productivity or long-standing problem (identified by the ICAR), or limitation in agriculture, which is coming in the way of agricultural development, enhancing

productivity in any major agricultural, horticultural or animal/ fish project. Any scientist or group of scientist can be awarded subject to claim for solving any challenge(s). The award will be given as and when challenge is solved. The award consist Rs 10 lakh in cash, a citation and a share in the income to ICAR from the commercialization as per ICAR guidelines. All agricultural scientists of any age are eligible.

c) Sardar Patel Outstanding ICAR Institution Award

Three awards of Rs. 10 lakh (1.0 million) each to two ICAR Institutes and one State Agricultural University (SAU) are awarded annually in cash, a citation and a plaque for the best performance in agricultural research, extension and education.

d) Choudhary Devi Lal Outstanding All-India Coordinated Research Project Award

To recognize the outstanding performance of an All-India Coordinated Research Project (AICRP) and its cooperating centres in terms of linkages, research output and its impact, and to promote a sense of partnership, pride and belongingness in the minds of the co-operators, the ICAR has instituted this annual award of Rs. 3 lakh (0.3 million), Rs. 2 lakh for the main coordinating unit and Rs. 1 lakh (0.1 million) for the best Centre. The award is given in cash, a citation and a plaque for partnership research for most significant contribution to agricultural productivity.

e) Rafi Ahmed Kidwai Award

It is being awarded since 1956 for outstanding research work in agriculture, animal husbandry and allied sciences. A total of four awards of Rs. 5 lakh (0.5 million) each are given annually to individuals in areas of crop & horticultural sciences, natural resource management and agricultural engineering, animal and fishery sciences and social sciences.

f) Fakhruddin Ali Ahmed Award for Outstanding Research in Tribal Farming Systems

Established in 1977, it encourages 'Agricultural Research in Tribal Farming Systems'. Two awards of Rs. 1 lakh (0.1 million) each is being given annually for applied research and its application in tribal areas of the country aimed at improving the biological resources and livelihood. Apart from award money, an equal amount is given for study on related subject in geographical area. The approved research work would have to be completed in one year and the report is to be submitted to Agricultural Extension Division.

g) Hari Om Ashram Trust Award

Instituted in 1972, it recognizes individual scientist published original research, fundamental or applied, in four defined subject areas of crop & horticultural sciences, natural resource management & agricultural engineering, animal and fishery sciences and social sciences. The award carries 4 prizes of Rs. 1 lakh (0.1 million) each to be awarded biennially.

h) Jawaharlal Nehru Award for Outstanding Doctoral Thesis Research in Agriculture and Allied Sciences

This award is given since 1969 to young scientists for excellence in postgraduate agricultural research submitted for the doctorate degree. The award is given as an

incentive for high-quality fundamental or applied research among the post-graduate students in India. There are eighteen awards with a cash prize of Rs. 50,000 each with a citation and silver medal (Gold polished) given annually. Not more than two awards will be given in subject areas of crop sciences, biotechnology (plant/animal/fishery), crop protection, natural resource management, horticulture, agricultural engineering, animal sciences, fishery sciences, and social sciences.

i) Vasantrao Naik Award for Outstanding Research and Application in Dry farming Systems

Started in 1994, this award is given based on the published work of a scientist or an extension worker who has made outstanding contribution in the areas of Water Conservation and Dryland Farming. This is an annual award of Rs one lakh (0.1 million).

j)Lal Bahadur Shastri Young Scientist Award

This award has been instituted to promote high-quality research efforts in the selected areas of agriculture and allied sciences and to provide recognition and incentives to promising young scientists for original research work. A total of four individual awarded annually across disciplines in agriculture and allied sciences; limited to only one award in any discipline. Each award consists of Rs. 1 lakh (0.1 million) in cash and a citation, a challenge project for three years with a budgetary provision of Rs. 10 lakh (1 million) + Rs 5 lakh (0.5 million) for foreign training (3 months).

k) Bharat Ratna Dr. C Subramaniam Award for Outstanding Teachers

To provide incentive and encouragement to promote innovation in teaching across country and to recognize outstanding teachers in the field of agriculture, four national awards of Rs. 1 lakh (0.1 million) each is given annually in four disciplines of crop and horticulture sciences, natural resource management and agricultural engineering, animal and fishery sciences and social sciences. This award was instituted in 1994-95.

l) Punjabrao Deshmukh Outstanding Woman Scientist Award

This annual award was instituted in 1995, to encourage the woman scientists of the country. Women-scientists working at the Institutions under the ICAR system, including State Agricultural Universities are eligible for this award. Two annual awards of Rs. 1 lakh (0.1 million) in cash and citation alongwith provision of equal amount of Rs. 1 lakh each for motivating Women scientists and female student across the country including travel within a year of receiving the award.

m) Chaudhary Charan Singh Award for Excellence in Journalism in Agricultural Research and Development

To recognize outstanding contributions in Journalism in Agricultural Research and Development in the Country, the ICAR instituted an annual award of Rs. 1 lakh (0.1 million) in the year 2000. Two awards are given –one each for print and electronic media for his/ her significant contribution in writing/ analyzing/ reporting for promotion of Indian agriculture.

n) N.G. Ranga Farmer Award for Diversified Agriculture

To recognize outstanding contributions in diversified agricultural activities, this annual award was instituted in the name of Prof. N. G. Ranga in the year 2001. The

award is given to an individual farmer practicing new entrepreneurship/ enterprise/ management strategies for additional information to the existing one in the field of diversified agriculture in India which will result in generating additional income to individual farmer/ farming community. This award carries Rs. 1 lakh (0.1 million).

o) Jagjivan Ram Abhinav Kisan Puruskar / Jagjivan Ram Innovative Farmer Award (National/ Zonal)

ICAR has instituted this annual award (two awards at national level of Rs 1 lakh each; and eight awards at zonal level of Rs. 0.50 lakh each) is given to recognize the outstanding contribution of innovative farmer for initiatives in development, adoption, modification and dissemination of improved technology and practices for increased income with sustainability.

p) Swamy Sahajanand Saraswati Outstanding Extension Scientist Award

Instituted in 1995, it is given to the outstanding Extension Scientists/ Workers from the ICAR-SAU-NGO/ State Government Research Extension Network for their innovative research in developing extension education programs, adopting extension methodologies and creating impact of the program on the farming community, especially to the downtrodden. Two awards of Rs. 1 lakh each in cash and a citation are given annually across disciplines in agriculture and allied sciences.

q) ICAR Award for Outstanding Interdisciplinary Team Research in Agriculture and Allied Sciences

To provide recognition to outstanding interdisciplinary team research in agriculture and allied sciences to promote the culture of interdisciplinary team effort in the solution of inherently interdisciplinary problem. Four awards of Rs. 5 lakh (0.5 million) each are given to a team of scientists (normally at least five members) once in two years. The award is given to a team of scientists jointly planning and implementing integrated program/ research project dealing with at least two of four disciplines of crop and horticultural sciences, natural resource management and agricultural engineering, animal and fishery sciences, and social sciences.

r) Krishi Vigyan Kendra Award (National /Zonal)

To recognize outstanding institutional performance by Krishi Vigyan Kendras and promote a sense of pride in KVK for developing models of Extension Education and Technology application, which have run for a minimum period of five years. The award is given both at national and zonal levels. At national level one ward comprising of Rs. 3 lakh (0.3 million) + Rs 3 lakh for infrastructural development + Rs. 1 lakh for sharing among staff + Rs 5 lakh for overseas training of Program Coordinator. At zonal level, eight awards, one each for each zone is given. The award consists of Rs 1 lakh + Rs 2 lakh for infrastructural development + Rs 1 lakh for sharing among staff + Rs 1 lakh for training in Indian Institute for Program Coordinators.

s) Dr. Rajendra Prasad Puruskar for Technical Books in Hindi in Agriculture and Allied Sciences

To provide incentive and recognition to the Indian writers/authors to write original standard works in agriculture and allied sciences in Hindi, four awards of Rs. 1 lakh (0.1

million) each once in two years are given to an individual as well as team of authors annually across disciplines in agricultural and allied sciences; but not more than one in any discipline.

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ANNEXURE 1. RESEARCH INSTITUTIONS OPERATING UNDER ICAR IN INDIA

Sl. No.	Name of Institute	Sl. No.	Name of Institute
National Institutes			
1	Indian Agricultural Research Institute, Pusa (New Delhi) 110 012	2	Indian Veterinary Research Institute, Izatnagar (Uttar Pradesh) 243 122
3	National Dairy Research Institute Karnal (Haryana) 132 001	4	Central Institute of Fisheries Education, Mumbai (Maharashtra) 400 061
5	National Academy of Agricultural Research Management , Hyderabad (Andhra Pradesh) 500 030		
Central Institutes			
	Agricultural Sciences		
6	Central Agricultural Research Institute, Andaman and Nicobar Group of Islands, Port Blair 744 101	7	Central Arid Zone Research Institute, Jodhpur (Rajasthan) 342 003
8	Central Institute of Agricultural Engineering, Bhopal (Madhya Pradesh) 462 038	9	Central Institute of Arid Horticulture, Bikaner (Rajasthan) 334 006
10	Central Institute for Cotton Research Nagpur (Maharashtra) 440 010	11	Central Institute for Subtropical Horticulture, Lucknow (Uttar Pradesh) 227 107
12	Central Institute of Temperate Horticulture, (Jammu & Kashmir) 190 007	13	Central Institute of Post-Harvest Engineering and Technology, Ludhiana (Punjab) 141 004
14	Central Institute for Research on Cotton Technology , Mumbai (Maharashtra) 400 019	15	Central Plantation Crops Research Institute, Kasargod (Kerala) 671 124
16	Central Potato Research Institute Shimla (Himachal Pradesh) 171 001	17	Central Research Institute for Dryland Agriculture Hyderabad (Andhra Pradesh) 500 059
18	Central Research Institute for Jute and Allied Fibres, Barrackpore (West Bengal) 700 120	19	Central Rice Research Institute Cuttack (Orissa) 753 006
20	Central Soil Salinity Research Institute, Karnal (Haryana) 132 001	21	Central Soil and water Conservation and Training Institute, Dehradun (Uttarakhand) 248 195

Sl. No.	Name of Institute	Sl. No.	Name of Institute
22	Central Tobacco Research Institute, Rajahmundry (Andhra Pradesh)	23	Central Tuber Crops Research Institute, Thiruvananthapuram (Kerala)
24	ICAR Research Complex for Goa, Ela Old Goa (Goa) 403 402	25	ICAR Research Complex for Eastern Region , Patna (Bihar) 800 004
26	ICAR Research Complex for North-Eastern Region , Umiam (Meghalaya) 793 103	27	Indian Agricultural Statistics Research Institute New Delhi -110 012
28	Indian Grassland and Fodder Research Institute , Jhanshi (Uttar Pradesh) 284 003	29	Indian Institute of Horticultural Research Bangalore (Karnataka) 560 089
30	Indian Institute of Pulses Research, Kanpur (Uttar Pradesh) 208 024	31	Indian Institute of Soil Science, Bhopal (Madhya Pradesh) 460 038
32	Indian Institute of Spices Research, Kozhikode (Kerala) 673 012	33	Indian Institute of Sugarcane Research, Lucknow (Uttar Pradesh) 226 002
34	Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand) 834 010	35	Indian Institute of Vegetable Research, Varanasi (Uttar Pradesh) 221 305
36	National Institute of Research on Jute and Allied Fibre Technology, Calcutta (West Bengal) 226 002	37	National Institute of Abiotic Stress Management, Pune (Maharashtra) 413 115
38	Sugarcane Breeding Institute Coimbatore (Tamil Nadu) 641 007	39	Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (Uttarakhand) 263 601
	Animal Sciences and Fisheries		
40	Central Avian Research Institute Izatnagar (Uttar Pradesh) 243 122	41	Central Institute for Research on Buffaloes Hisar (Haryana) 125 001
42	Central Institute for Research on Goats, Mathura (Uttar Pradesh) 281 122	43	Central Inland Fisheries Research Institute, Barrackpore (West Bengal), 743 101
44	Central Institute for Brackishwater Aquaculture, Chennai (Tamil Nadu), 600 028	45	Central Institute of Fisheries Technology, Cochin (Kerala) 682 029
46	Central Institute of Freshwater Aquaculture, Bhubaneshwar (Orissa) 751 002	47	Central Marine Fisheries Research Institute, Kochi (Kerala) 682 018
48	Central sheep and Wool Research Institute Avikanagar (Rajasthan) 304 501	49	National Institute of Animal Nutrition and Physiology, Bangalore (Karnataka), 560 030
National Bureaux			
	Agricultural Sciences		
50	National Bureau of Agriculturally Important Insects, Bangalore	51	National Bureau of Agriculturally Important Microorganisms, Mau

Sl. No.	Name of Institute	Sl. No.	Name of Institute
	(Karnataka) 560 024		Nath Bhanjan (Uttar Pradesh) 275 101
52	National Bureau of Plant Genetic Resources, Pusa (New Delhi) 110 012	53	National Bureau of Soil Survey and Land Use Planning, Nagpur (Maharashtra) 440 010
	Animal Sciences		
54	National Bureau of Animal Genetic Resources Karnal (Haryana) 132 001	55	National Bureau of Fish Genetic Resources, Lucknow (Uttar Pradesh) 226 002
Project Directorate			
	Agricultural Sciences		
56	Project Directorate of Farming Systems Research Meerut (Uttar Pradesh) 250 110	57	Project Directorate of Farming Systems Research , Meerut (Uttar Pradesh) 250 110
58	Directorate of Groundnut Research, Junagarh (Gujarat) 362 001	59	Directorate of Information and Publications in Agriculture , Pusa (New Delhi) 110 012
60	Project Directorate of Maize Research, Pusa (New Delhi) 110 012	61	Directorate of Oilpalm Research, Pedavegi (Andhra Pradesh) 534 450
62	Directorate of Oilseeds Research, Hyderabad (Andhra Pradesh) 500 030	63	Directorate of rapeseed-Mustard Research, Bharatpur (Rajasthan) 321 303
64	Directorate of Rice Research Hyderabad (Andhra Pradesh) 500 030	65	Directorate of Sorghum Research, Hyderabad (Andhra Pradesh), 500 030
66	Directorate of Seed Research Mau Nath Bhanjan (Uttar Pradesh), 275 101	67	Directorate of Soybean Research Indore (Madhya Pradesh) 452 017
68	Directorate of Wheat Research Karnal (Haryana) 132 001	69	Directorate of Weed Science Research, Jabalpur (Madhya Pradesh) 482 004
70	Directorate of Water Management Bhubaneshwar (Orissa) 751 023	71	Directorate of Research on Women in Agriculture, Bhubaneshwar (Orissa) 751 030
72	Directorate of Cashew Research Puttur (Karnataka) 574 202	73	Directorate of Rice Research Hyderabad (Andhra Pradesh) 500 030
74	Directorate of Medicinal and Aromatic Plants Research , Anand (Gujarat) 387 310	75	Project Directorate of Mushroom Research, Solan (Himachal Pradesh) 173 213
76	Project Directorate on Onion and	77	Project Directorate on Animal

Sl. No.	Name of Institute	Sl. No.	Name of Institute
	Garlic Research , Pune (Maharashtra) 410 505		Disease Monitoring and Surveillance Bangalore (Karnataka) 560 024
78	Project Directorate on Cattle Meerut (Uttar Pradesh) 250 001		
	Animal Sciences		
79	Project Directorate on Foot and Mouth Diseases Kumaon (Uttarakhand) 253 138	80	Project Directorate on Poultry Hyderabad (Andhra Pradesh) 500 030
81	Directorate on Cold Water Fisheries Research Bhind, Nainital (Uttarakhand) 263 136	82	Project on Soybean Processing and Utilization, CIAE Campus, Bhopal-263 136
National Research Centres			
	Agricultural Sciences		
83	National Research Centre for Agro-forestry, Jhansi (Uttar Pradesh) 284 003	84	National Research Centre for Banana Thiruchirapalli (Tamil Nadu) 620 102
85	National Research Centre for Citrus Nagpur (Maharashtra) 440 010	86	National Research Centre for Grapes Pune (Maharashtra) 412 307
87	National Research Centre for Integrated Pest Management, Pusa (New Delhi) 110 012	88	National Research Centre for Litchi Muzaffarpur (Bihar) 842 002
89	National Research Centre for Orchids Pakyang (Sikkam) 737 106	90	National Research Centre for Plant Biotechnology, Pusa (New Delhi) 110 012
91	National Research Centre on Pomegranate, Solapur (Maharashtra) 413 006	92	National Research Centre for Seed Spices, Ajmer (Rajasthan) 305 206
	Animal Sciences		
93	National Research Centre on Camel Bikaner (Rajasthan) 334 001	94	National Research Centre for Equines Hisar (Haryana) 125 001
95	National Research Centre for Meat and Meat Products Hyderabad (Andhra Pradesh) 500 059	96	National Research Centre for Mithun Medziphema (Nagaland) 797 106
97	National Research Centre for Pigs Guwahati (Assam) 785 037	98	National Research Centre on Yak Dirang (Aruanchal Pradesh) 790 101
	General		
99	National Centre for Agricultural Economics and Policy Research Pusa (New Delhi) 110 012		

ANNEXURE 2. LIST OF ALL INDIA COORDINATED RESEARCH PROJECTS IN INDIA

Sl. No.	Name of AICRP	Sl. No.	Name of AICRP
	Crop sciences		
1	Network Coordinator (Acarology) UAS, GKVK, Bangalore (Karnataka)	2	Network Coordinator (Arid Legumes) CAZARI, Jodhpur (Rajasthan)
3	Project Coordinator (Bio-control) NBAII, Bangalore (Karnataka)	4	Project Coordinator (castor, Safflower and Sunflower) ,DOR, Hyderabad (Andhra Pradesh)
5	Project Coordinator (Cotton Improvement), CICR Research Station, Coimbatore, (Tamil Nadu)	6	Project Coordinator (Chickpea) IIPR, Kalyanpur, Kanpur (Uttar Pradesh)
7	Project Coordinator (Forage Crops) IGFRI, Jhansi (Uttar Pradesh)	8	Project Coordinator (Groundnut), DOGR, Junagarh (Gujarat0
9	Project Coordinator (Honeybees & Pollinators) CCS HAU, Hisar (Haryana)	10	Project Coordinator (Jute and Allied Fibres), CRIJAF, Barrackpore (West Bengal)
11	Project Coordinator (Linseed) CSAUA&T, Kanpur (Uttar Pradesh)	12	Project Coordinator (Maize) DMR, Pusa (New Delhi)
13	Project Coordinator (MULLARP), IIPR, Kalyanpur, Kanpur (Uttar Pradesh)	14	Project Coordinator (National Seed Project), DOSR, mau (uttar Pradesh)
15	Project Coordinator (Nematodes), IARI, Pusa (New Delhi)	16	Network Coordinator (Ornithology), ANGRAU, Hyderabad (Andhra Pradesh)
17	Project Coordinator (Pearl millet), RAU, Jodhpur (Rajasthan)	18	Project Coordinator (Pesticide Residues), IARI, Pusa (New Delhi)
19	Project Coordinator (Pigeonpea) IIPR, Kanpur (Uttar Pradesh)	20	Project Coordinator (Sesame and Niger), JNKVV, Jabalpur (Madhya Pradesh)
21	Project Coordinator (Sorghum) DOSR, Hyderabad (Andhra Pradesh)	22	Project Coordinator (Small Millets), UAS, Bangalore (Karnataka)
23	Project Coordinator (Soybean) DOSR, Indore (Madhya Pradesh)	24	Project Coordinator (Sugarcane), IISR, Lucknow (Uttar Pradesh)

Sl. No.	Name of AICRP	Sl. No.	Name of AICRP
25	Project Coordinator (Rice) DRR, Hyderabad (Andhra Pradesh)	26	Project Coordinator (Rapeseed Mustard), DORMR, Bharatpur (Rajasthan)
27	Network Coordinator (Rodent Control), CAZRI, Jodhpur (Rajasthan)	28	Network Coordinator (Tobacco), CTRI, Rajamundry (Andhra Pradesh)
29	Network Coordinator (Under-utilized Crops), NBPGR (New Delhi)	30	Project Coordinator (Wheat and Barley), DWR, Karnal (Haryana)
31	Network Coordinator (White Grubs and other soil anthropods), RAU, Jaipur (Rajasthan)		
	Horticulture		
32	Project Coordinator (Arid Zone Fruits) CIAH, Bikaner (Rajasthan)	33	Project Coordinator (Medicinal Aromatic Plants and Betelvine) DOMAP, Anand (Gujarat)
34	Project Coordinator (Cashew) DOCR, Puttur (Karnataka)	35	Project Coordinator (Floiculture) IARI (New Delhi)
36	Project Coordinator (Mushroom), DOMR, Solan (Himachal Pradesh)	37	Project Coordinator (Onion and Garlic), PDO&G, Pune (Maharashtra)
38	Project Coordinator (Palms) CPCRI, Kasargod (Kerala)	39	Project Coordinator (Potato Improvement), CPRI, Shimla (Himachal Pradesh)
40	Project Coordinator (Subtropical fruits), CISH, Lucknow (Uttar Pradesh)	41	Project Coordinator (Spices) IISR, Calicut (Kerala)
42	Project Coordinator (Tropical Fruits), IIHR, Bangalore (Karnataka)	43	Project Coordinator (Tuber Crops), CTCRI , Thiruvananthapuram (Kerala)
44	Project Coordinator (Vegetables), IIVR, Varanasi (Uttar Pradesh)		
	Natural Resource Management		
45	Project Coordinator (Agricultural Meteorology) CRIDA, Hyderabad (Andhra Pradesh)	46	Network Coordinator (Soil Biodiversity and Biofertilizer) IIS, Bhopal (Madhya Pradesh)
47	Project Coordinator (Agroforestry), NRCA, Jhansi (Uttar Pradesh)	48	Project Coordinator (Integrated Farming System) PDFSR, Meerut (Uttar Pradesh)

Sl. No.	Name of AICRP	Sl. No.	Name of AICRP
49	Project Coordinator (Dryland Agriculture), CRIDA, Hyderabad (Andhra Pradesh)	50	Project Coordinator (Harvesting, processing and value addition of natural resins and gums) IINRG, Ranchi (Jharkhand)
51	Project Coordinator (Long-term Fertilizer Experiments) IISS, Bhopal (Madhya Pradesh)	52	Project Coordinator (Management of Salt affected Soils and Saline Water in Agriculture) CSSRI, Karnal (Haryana)
53	Project Coordinator (Micro-nutrients and secondary Nutrients and Pollutants elements in Soils and Plants) IISS, Bhopal (Madhya Pradesh)	54	Project Coordinator (Optimization of Ground water Utilization) DOWM, Bubaneshwar (Orissa)
55	Project Coordinator (Soil Test and Crop Response) IISS, Bhopal (Madhya Pradesh)	56	Project Coordinator (Water Management) DOWM, Bubaneshwar (Orissa)
57	Project Coordinator (Weed Control), DOWSR, Jabalpur (Madhya Pradesh)		
	Engineering and Technology		
58	Project Coordinator (Application of Plastic in Agriculture), CIPHET, Ludhiana (Punjab)	59	Project Coordinator (Ergonomics and Safety in Agriculture) CIAE, Bhopal (Madhya Pradesh)
60	Project Coordinator (Farm Implements and Machinery) CIAE, Bhopal (Madhya Pradesh)	61	Project Coordinator (Post--harvest Technology) CIPHET, Ludhiana (Punjab)
62	Project Coordinator (Renewable Sources of Energy for and Agriculture and Agro-based Industries) , CIAE, Bhopal (Madhya Pradesh)	63	Network Project on Processing and Value-addition of Natural Resins and Gums, Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand)
64	Project Coordinator (Utilization of Animal Energy with Enhanced System Efficiency), CIAE, Bhopal (Madhya Pradesh)		
	Animal Sciences		
65	Project Coordinator (Animal Genetic Resources) NBAGR, Karnal (Haryana)	66	Project Coordinator (ADMAS) PDADMAD, Bangalore (Karnataka)
67	Network Coordinator (Blue Tongue) IVRI, Izatnagar (Uttar Pradesh)	68	Network Coordinator (Buffalo Improvement) PDC, Meerut (Uttar Pradesh)

Sl. No.	Name of AICRP	Sl. No.	Name of AICRP
69	Project Coordinator (Cattle) PDC, Meerut (Uttar Pradesh)	70	Project Coordinator (Improvement of feed Resources and Nutrient Utilization in raising animal Production and Outreach Programme on Methane Emission), NIANP, Bangalore (Karnataka)
71	Project Coordinator (FMD) IVRI Campus, Mukteshwar (Uttar Pradesh)	72	Project Coordinator (Goats) CIRG, Mathura (Uttar Pradesh)
73	Project Coordinator (Haemmrhagic Septicaemia) IVRI, Izatnagar (Uttar Pradesh)	74	Project Coordinator (gastro-intestinal parasitism) IVRI, Izatnagar (Uttar Pradesh)
75	Project Coordinator (Pigs) NRC on Pigs, Guwahati (Assam)	76	Project Coordinator (Poultry Breeding), DP, Hyderabad (Andhra Pradesh)
77	Project Coordinator (Process Upgradation of indigenous milk for industrial application) NDRI, Karnal (Haryana)	78	Project Coordinator (Sheep breeding) CSWRI, Avikanagar (Rajasthan)
	General		
79	Project Coordinator (Home Science) DRWA, Bhubaneshwar (Orissa)		

ANNEXURE 3. LIST OF STATE AGRICULTURAL UNIVERSITIES IN INDIA

Sl. No.	Name of State Agriculture University	Sl. No.	Name of State Agriculture University
1	Acharya N G Ranga Agricultural University, Hyderabad (Andhra Pradesh)	2	Andhra Pradesh Horticultural University, Tadepalligudam (Andhra Pradesh)
3	Anand Agricultural University Anand (Gujarat)	4	Assam Agricultural University Jorhat (Assam)
5	Bidhan Chandra Krishi Vishwa Vidyalaya, Nadia (West Bengal)	6	Bihar Agricultural University Sabour (Bihar)
7	BirsaAgricultural University Ranchi (Jharkhand)	8	Chandra Shekhar Azad University of Agriculture and Technology , Kanpur (Uttar Pradesh)
9	Ch Charan Singh Haryana Agricultural University, Hisar (Haryana)	10	Ch Sarwan Kumar Krishi Vishwa Vidyalaya Palampur (Himachal Pradesh)
11	Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (Maharashtra)	12	Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra)
13	Dr Yashwant Singh Parmar University of Horticulture and Forestry, Solan (H.P)	14	Govind ballabh pant University of Agriculture and Technology , Pantnagar (Uttarkhand)
15	Guru Angad dev Veterinary and Animal Science University, Ludhiana (Punjab)	16	Indira Gandhi Krishi Vishwa Vidyalaya, Raipur (Chhattisgarh)
17	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya Pradesh)	18	Junagarh Agricultural University Junagarh (Gujarat)
19	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar (Karnataka)	20	Kerala Agricultural University Trichur (Kerala)
21	Kerala Veterinary University Pookode (Kerala)	22	Madhya Pradesh Pashu Chikitsa Vigyan Vishwa Vidyalaya, Jabalpur (Madhya Pradesh)
23	Maharashtra Animal Sciences and Fisheries University, Nagpur (Maharashtra)	24	Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan)
25	Mahatma Phule krishi Vidyapeeth Rahuri (Maharashtra)	26	Marathwada Agricultural University, Parbhani (Maharashtra)
27	Narendra Dev University of Agriculture and Technology, Faizabad (Uttar Pradesh)	28	Navsari Agricultural University Navsari (Gujarat)

Sl. No.	Name of State Agriculture University	Sl. No.	Name of State Agriculture University
29	Orissa University of Agriculture and Technology, Bhubaneshwar (Orissa)	30	Punjab Agricultural University Ludhiana (Punjab)
31	Swami Keshvanand Rajasthan Agricultural University, Bikaner (Rajasthan)	32	R V S Krishi Vishwa Vidyalaya Gwalior (Madhya Pradesh)
33	Rajasthan University of veterinary & Animal Sciences, Bikaner (Rajasthan)	34	Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya , Gwalior (Madhya Pradesh)
35	Rajendra Agricultural University, Samastipur (Bihar)	36	SD Agricultural University Dantiwada (Gujarat)
37	Sardar Ballabh Bhai patel University of Agriculture and Technology, Meerut (U.P)	38	Sher-E-Kashmir University of Agriculture and Technology, Srinagar (Jammu and Kashmir)
39	Sher-E-Kashmir University of Agriculture and Technology, Jammu (Jammu and Kashmir)	40	Sri Venkateswara Veterinary University Tirupati (Andhra Pradesh)
41	Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)	42	Tamil Nadu Veterinary and Animal Sciences University, Chennai (Tamil Nadu)
43	University of Agricultural Sciences, Bangalore (Karnataka)	44	University of Agricultural Sciences, Dharwad (Karnataka)
45	University of Agricultural Sciences, Raichur (Karnataka)	46	University of Horticultural Sciences, Bagalkot (Karnataka)
47	UP DDU Veterinary and Animal Science University, Mathura (Uttar Pradesh)	48	Uttar Banga Krishi Vishwa Vidyalaya, Cooch Behar (West Bengal)
49	West Bengal University of Animal and Fishery Sciences, Kolkata (West Bengal)	50	Central Agricultural University Imphal (Manipur)

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN NEPAL

Appendix D

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM IN NEPAL

B. Mishra
Nepal Agricultural Research Council

December, 2010

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1. GOVERNANCE SYSTEM OF AGRICULTURAL RESEARCH AND DEVELOPMENT

i) Historical background

History of organized agricultural development in Nepal started in 1932 AD when first agriculture office was established and few Nepalese students were sent to India to study modern agriculture (Joshi, 1977). Before that, some fruit saplings and breeds of cattle and horses were introduced by then rulers as a hobby in their homestead. In Singh Durbar Complex (secretariat of Government of Nepal), there was a small garden called *Putali Bagaincha*, which was probably the first agricultural farm. In 1937 AD, agriculture council and first technical school were established in Kathmandu. Same year, nurseries and orchards in Chhauni, Balaju, and Godawari were established (Joshi and Khatiwada, 1986). In 1948 AD, central research farm were established in Parwanipur. Similarly, in 1952 AD, Ministry of Agriculture and Department of Agriculture were established in the country. In 1954 AD, disciplinary divisions such as agronomy, entomology, and agricultural engineering under Department of Agriculture were established at Khumaltar complex and other disciplines kept on emerging on the basis of felt need under Department of Agriculture in Kathmandu (ORD, 2007).

ii) Establishment of institutions (Acts, ordinance)

There are various public and private institutions and organization under National Agricultural Research System established in different years under different acts and ordinance. Among them, Nepal Agricultural Research Council (NARC), an apex body for agricultural research in the country was established in 1991 as an autonomous organization under "Nepal Agricultural Research Council Act - 1991". The following institutions were established either under act and ordinance or government decision (Table 1).

Table 1. Institutions and the year of establishment

S. N.	Institutions	Year of establishment	Acts/ordinance
1.	Department of Agriculture (DoA)	1952	Government Decision
2.	Department of Livestock (DLS)	1969	Government Decision
3.	Nepal Academy of Science and Technology (NAST)	1982	Royal Ordinance
4.	Institute of Agriculture and Animal Science (IAAS)	1972	Under TU Act
5.	National Agriculture Research and Development Fund (NARDF)	2001	Council of Ministers
6.	Forum for Rural Welfare and Agricultural Reform for Development (FoRWARD)	1996	Social Welfare Act
7.	Local Initiatives for Biodiversity, Research and Development (LI-BIRD)	1995	Social Welfare Act
8.	Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED)	1991	Social Welfare Act

iii) Organizational structure (government department, autonomous body, governing body etc.)

A) Nepal Agricultural Research Council

Nepal Agricultural Research Council, an autonomous institution, has a two-tier body: The Council and the Executive Board. The sixteen-member Council (Table 2), the apex body for policy level works on agricultural research and natural resource management, is chaired by the Minister for Agriculture and Cooperatives. Executive Director acts as the member secretary of the council. The eight-member Executive Board (Table 3), chaired by Executive Director of NARC, implements and executes research programmes approved by the Council. One of the programme directors acts as member secretary of

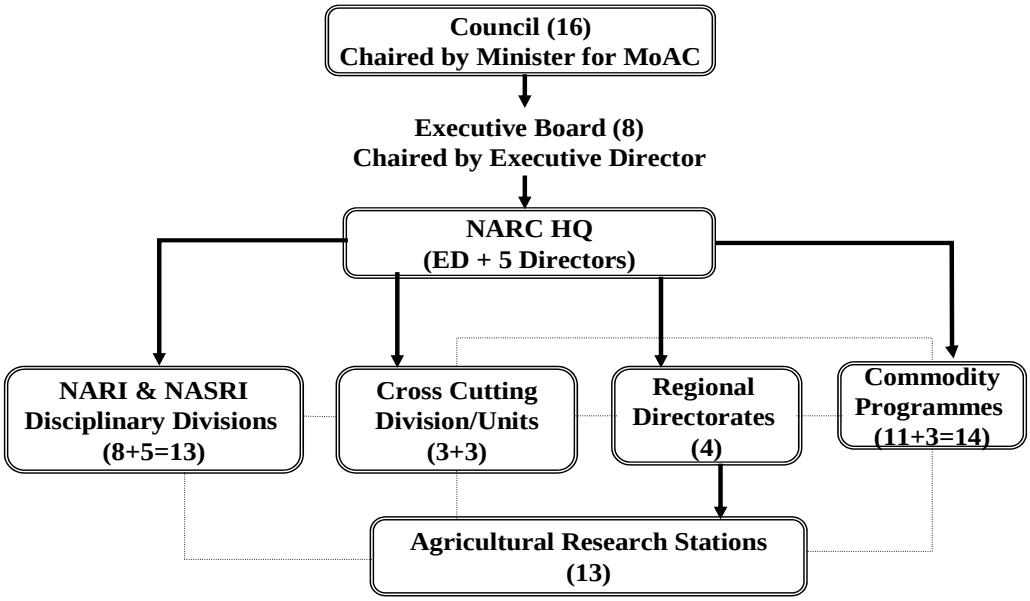

Figure 1. Organogram of Nepal Agricultural Research Council

the board. The organogram of NARC is given in Figure 1. NARC head quarter is headed by Executive Director along with five directors viz Crop and Horticulture Research, Livestock and Fisheries Research, Planning and Coordination, Personal Administration and Financial Administration (Annexure 1). There are two institutes under NARC namely National Agricultural Research Institute and National Animal Science Research Institute headed by directors.

Table 2. The members of Council of Nepal Agricultural Research Council

S. N.	Representatives	Position
1.	Minister or State Minister for Agriculture and Cooperatives	**Chairman**
2.	Member (agriculture sector), National Planning Commission	**Member**
3.	Secretary, Ministry of Agriculture and Cooperatives	**Member**
4.	Secretary, Ministry of Finance	**Member**
5.	Secretary, Ministry of Forest and Soil Conservation	**Member**
6.	Secretary, Ministry of Science and Technology	**Member**
7.	Secretary, Nepal Academy of Science and Technology	**Member**
8.	Dean, Institute of Agriculture and Animal Science	**Member**
9.	An experienced agriculture scientist working in NARC (nominated by Government of Nepal)	**Member**
10.	Scientist having made contribution to agriculture research and working in related organization (nominated by Government of Nepal)	**Member**
11.	Scientist having made contribution to agriculture research and working in related organization (nominated by Government of Nepal)	**Member**
12.	Scientist retired from NARC or reputed commercial farmers (nominated by Government of Nepal)	**Member**
13.	Scientist retired from NARC or reputed commercial farmers (nominated by Government of Nepal)	**Member**
14.	One person nominated by Government of Nepal from agriculture entrepreneurs	**Member**
15.	One person nominated by Government of Nepal from agriculture research related non-government organization	**Member**
16.	Executive Director of NARC	**Member Secretary**

Note: Government of Nepal may change number of Council Members by publishing a notification in the Nepal Gazette. (Source: NARC, 2006)

Table 3. The members of Executive Board of Nepal Agricultural Research Council

S. N.	Representatives	Position
1.	Executive Director, NARC	**Chairman**
2.	Joint Secretary, Ministry of Finance	**Member**
3.	Joint Secretary, Ministry of Agriculture and Cooperatives	**Member**
4.	Joint Secretary, National Planning Commission (agriculture sector)	**Member**
5.	Director General, Department of Agriculture	**Member**
6.	Director General, Department of Livestock Services	**Member**
7.	One from the Chiefs of NARC Regional Research Stations (nominated by Government of Nepal)	**Member**
8.	One from the NARC Program Directors (nominated by Executive Director	**Member Secretary**

Source: *NARC, 2006*

B) Department of Agriculture

Department of Agriculture is the government organization under the Ministry of Agriculture and Cooperatives and is headed by the Director General. Under Director General, there are three Deputy Director Generals as Planning and Human Resource, Monitoring and Evaluation and Technology Transfer. The department is main governing organization for the agricultural development in the country. There are fourteen Program Directorates who looks after the National Programs. At the regional level, there are five Agricultural Directorates, five Regional Training Centers, six Seed Testing Laboratories, five Plant Protection Laboratories and five Plant Quarantine Offices. A total of 378 Agriculture Service Centers are established in 75 districts under District Development Offices. These Agriculture Services Centers are the field level organization which act as service provider to the farmers.

C) Department of Livestock Services

Department of Livestock Services (DLS) is the government ogranization under the ministry of Agriculture and Cooperatrives and is headed by the Director General. Under Director General, there are three Deputy Directors viz Planning and human resosurces, Animal Health and Veterinary. The department is governing organization for the livestock development in the country providing the livestock services to farmers. It has fice Regional Directorates and seventy five district level livestock development offices.

D) Nepal Academy of Science and Technology

Prime Minister is the Chancellor of the Academy. Chancellor chairs the Academic Assembly, the highest body of NAST (Annexure 2). The Academic Assembly normally meets twice a year setting policy guidelines for the Academy and approving the annual program and budget. The Minister for Science and Technology is an ex-officio Pro-chancellor. Other members of the Assembly include the Academicians of NAST, Vice Chairman of National Planning Commission, Vice Chancellors among the universities, three representatives of the Science and Technology professional societies and two staff members of the Academy. The Vice Chancellor, appointed by the Chancellor in recommendation of a special committee, is the Chief Executive, who heads a management council, composed of up to five Members of the Academic Assembly and a Member Secretary. NAST's programs are conceived and executed by the Faculties and the Divisions led by senior staff of the Academy.

E) Institute of Agriculture and Animal Science (IAAS)

This institute is one of the five technical institutes under Tribhuvan University, Nepal. Its mission is to produce competent manpower i.e. middle (Junior Technicians/Junior Technician Assistants) and higher (undergraduate and postgraduate) levels in agriculture and allied disciplines and to promote research, development and technology dissemination in agriculture. The institute is governed by Management and Development Council (Annexure 3). The Dean is head of the institute with all administrative responsibility. The Faculty Board executes the programs of the institute approved by the council. Implementation, Examination, Research, Subject matter, Postgraduate and Extension Committee under Dean has been given the responsibility to suggest the board and council for program and planning.

F) National Agricultural Research and Development Fund (NARDF)

NARDF is an autonomous independent body under MoAC. It provides grants to innovative agricultural research and development projects that support national objectives and priorities and deliver measurable outputs within a three-year period. Its structure, responsibilities and summary of the functions is given in Annexure 4. The Fund Management Committee has responsibility for managing the fund and is accountable to funding sources and other stakeholders. It decides on overall policy and strategy, and allocation of funding for priority areas. The NARDF Secretariat is headed by the Member Secretary of the FMC. The secretariat acts as the executive body of the NARDF, handling all matters of the day to day management of the fund.

G) Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED)

CEAPRD is an autonomous non-government organization (NGO) governed by an Executive Board of nine members elected every four years by the General Assembly (Annexure 5). The Executive Board designs policy and set out broad goals. Executive Chairperson leads the Board as the chief Executive of Center. An Executive Director is responsible for planning, executing and monitoring regular activities of the center and assisting the Chairperson. The executive Director is assisted by a number of professional and support staff. The organizational structure of CEAPRED is given in Annexure 5.

H) Local Initiatives for Biodiversity, Research and Development (LI-BIRD)

Local Initiatives for Biodiversity, Research and Development (LI-BIRD) is a nongovernmental organization (NGO) established in 1995. It is governed by eleven members Executive Board headed by a Chairperson. Executive Director is the Board Secretary who is responsible for planning and executing the regular activities of the organization and assisting the chairperson. ED is assisted by a panel of professional and support staffs.

I) Forum for Rural Welfare and Agricultural Reform for Development (FoRWARD)

FORWARD is an autonomous, non-profit making, service-oriented non-governmental organization which has been established to improve the livelihoods of under-privileged rural communities using the principles of self help. Initiated by a team of community development professionals in 1996, the Executive Committee elected by the General Assembly provides overall policy direction and guidance to the organization (Annexure 6). The Executive Committee delegates its authority to an Executive Director who is responsibility for implementing policy decisions and day-to-day management of the organization. Programme Coordinator leads the team of multidisciplinary specialists for overall execution of the programmes run by the organization. Additionally, a Core Management Team comprising the founder members of the organization provides support in strategic programme planning and policy management. At the operational level, the organization ensures delivery of its services through district-based teams of staff led by district/field coordinators.

iv) Reformation and development

Institutional development of agriculture started in Nepal with the establishment of Krishi Addaa (Agriculture Office) in 1942. Addressing the need of agriculture development in the country, Department of Agriculture (DoA) was established in 1952. The agricultural research and development works were carried out under the umbrella of DoA along with the creation of research stations, disciplinary divisions and district development offices. DoA was renamed Department of Agriculture Education and Research in 1967. Restructuring of DoA was done to strengthen the research and development. Nepal Agricultural Research and Service Centre (NARSC) established in 1984 under DoA with the objective to strengthen the research system. Restructuring of NARSC was done in 1991 by the establishment of an autonomous organization Nepal Agricultural Research Council under "Nepal Agricultural Research Council Act 1991'' with the realization of need of efficient, dynamic and cost effective agricultural research system in the country. Since then some restructuring of NARC have been done. At present, it is under the restructuring process as outlined in the Three Years' Interim Plan, 2008 of Nepal. For this, amendments are to be made in the act and by-laws. NARC wants its Executive Director of NARC to function as the separate Secretary of Research in the Ministry of Agriculture and Cooperatives. It will help to strengthen policy making and implementation, research planning and resource mobilization for better agricultural research system in the country. Further, NARI and NASRI, the two institutes under NARC, are in the process being reorganized them to act as to be Deemed University.

The institutions under DoA were restructured many times. DoA established in 1952 was divided in 1967 into five departments, namely agriculture extension, fisheries, horticulture, animal health and agricultural education and research with the aim to implement agriculture development programs effectively. Highlighting on lower level of coordination these five departments were unified into DoA in 1973 with the establishment of Department of Food and Market service. Restructuring was again done to form DoA and Department of Livestock Services (DoLS) in 1980 and a separate Department of Horticulture (DoH) was established in 1989. Then in 1993, a government policy of one umbrella system was endorsed. As a consequence all the departments were brought under one department - Department of Agricultural Development (DAD). Further, restructuring of DAD took place in 1996 by creating DoA, DoLS and Department of Food Technology and Quality Control (DFTQC). Finally, in 2005, process of restructuring in DoA continued by creating technical divisions, program directorate and national programs to deliver their services.

Department of Livestock Services (DLS) was first established in 1939 as veterinary dispensary, which was transformed into Veterinary Hospital in 1940. Till 1964, 33 veterinary Hospitals, 21 dispensaries and 18 check-posts were established. Five farms

were also established during this period. In 1966, Department of Livestock Development and Animal Health was established and various livestock development programs like animal health, nutrition, breeding management etc. were implemented. It was amalgamated with Department of Agriculture (DOA) in 1972 and separated from DOA in 1979 and named as its earlier name, Department of Livestock Development and Animal Health. During this period, 75 district livestock development offices, service centers in field levels, regional labs and some new farms were established. Divisions and sections were also established in the central level to support the livestock development programs. It was again amalgamated with DOA with the name Department of Agricultural Development (DOAD) in 1992 with the objective to provide all the agricultural services under one umbrella. Due to some managerial complexities and problems in program implementation, it was again separated from DOAD and named as Department of Livestock Services (DLS) in 1995.

School of Agriculture under the Ministry of Agriculture was established in 1957. It was upgraded in College of Agriculture in 1968 and handed over to TU in 1972. The college was restructured according to the need of agricultural education in the country and renamed as Institute of Agriculture and Animal Science in 1975 under the governance of Tribhuwan University. With the need to strengthen the agricultural education system and to develop high quality qualified agricultural human resources, the institute is in the process of evolving itself into agricultural university.

v) Establishment of present NARS

It is the presumption that the organizations involved in agricultural research are under NARS. In Nepal, major partners involved in agricultural research are NARS, university, International Agricultural Research System (IARS), donors, NGOs/INGOs and community based organizations (CBOs). After the establishment of NARC, it is the most important lead institute in NARS which has extensive network of research institutes across the country (Paudel *et. al*., 2006). Within NARC, there are two institutes (NARI and NASRI), 13 disciplinary divisions, 3 cross cutting divisions, 3 cross cutting units, 14 national commodity research program, 4 regional agricultural research stations and 13 research stations along with 50 agro-ecological out-reach sites (Figure 2). Asides these institutions, some government and non-government organizations are also directly or indirectly involved in agricultural research. NARDF provide funds for both research and development in agriculture. IAAS under TU involved in agricultural research work related to academic requirement for higher level degree program. NAST performs agricultural research mainly focusing on natural resources, bio-technology and environment. Non-government organizations namely CEAPRED, LIBIRD and FORWARD are involved mainly in the development of agriculture.

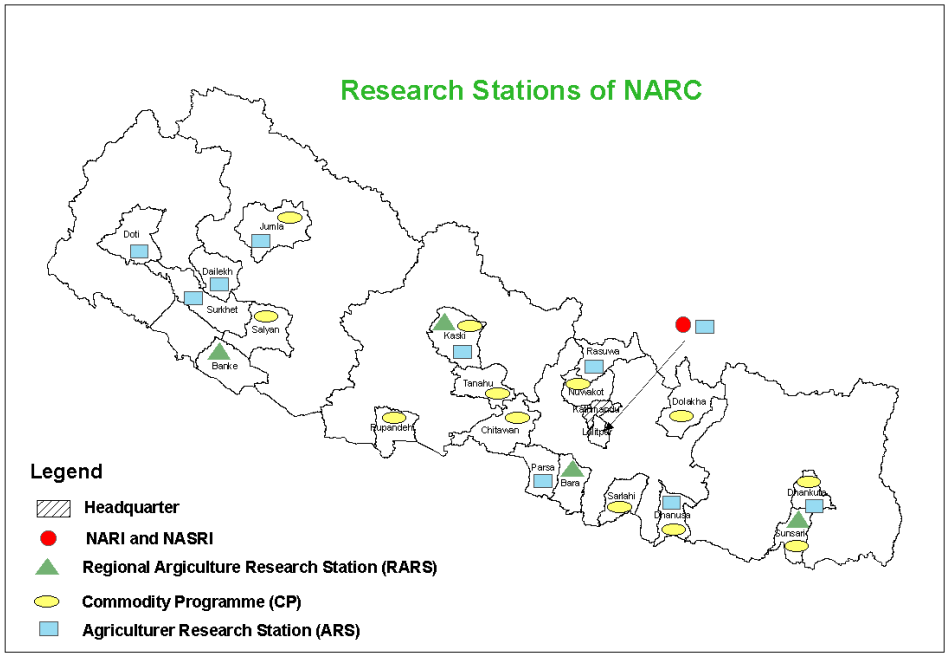

Figure 2. Different institutions under NARC and their allocation

2. ORGANIZATION OF NARS

i) Institutes involved in the NARS

Nepal Agricultural Research Council (NARC) is the main organization involved in the agricultural research in the country. As stated in the preamble of NARC Act 1991, the mission of NARC is to conduct high level studies and research on the agriculture sector and to find out measures of solutions of the problems ushering to uplifting livelihood of general public. So the main mission of NARC is to provide appropriate technologies to the farmers and agro-entrepreneurs and other clients in order to transfer the agriculture into a dynamic system and thereby to improve living standard of Nepalese population. It has different units located across the country which conduct research and study in different aspects of agriculture to increase agricultural productivity and production by generating appropriate agro-technologies suitable to various agro-ecological zones. There are two national institutes (NARI and NASRI), 14 National Commodity Research Programmes, 4 Regional Agricultural Research Stations (RARSs), 20 technical Disciplinary Divisions and units and 14 Agricultural Research Stations (ARSs).

National Agricultural Research Institute (NARI) under NARC, headed by a Director, deals mainly with the research on agronomical and horticultural crops. It has eight disciplinary divisions. National Animal Science Research Institute (NASRI) deals with the livestock and fisheries research activities in the country. It has five disciplinary divisions. Its overall activities are administered by director.

The Nepal Academy of Science and Technology (NAST) under the Ministry of Science and Technology is an independent body to promote science and technology in the country. It is mandated to advance science and technology for the development of the nation, to preserve and modernize indigenous technologies, to promote research in science and technology and to identify and facilitate appropriate technology transfer.

National Agriculture Research and Development Fund (NARDF), established in 2001, is an autonomous organization to promote the participation of government, private, non-government and educational institutes and civil society for agricultural research and development for over all development of agricultural sector in the country. It aims to provide full or partial grant to priority area of agricultural research and development on the basis of competitive grant system.

Two educational institutes are directly involved in agricultural research and development activities. Institute of Agriculture and Animal Science (IAAS) under Tribhuvan University (TU) promote interdisciplinary research by developing and conducting both basic and applied biological and social science research related to agriculture and livestock sectors. Similarly, Himalayan College of Agricultural Sciences and Technology (HICAST), a private institute, provide academic degree in the field of agriculture and livestock.

Department of Agriculture (DoA) and Department of Livestock Services (DoLS) under the Ministry of Agriculture and Co-operatives (MoAC) are the two main government organization responsible for agricultural and livestock development in the country. They are mandated for the promotion of agricultural and livestock technologies to the end-users by employing public-private-partnership with the strategies of strengthening the co-operation and coordination between research and extension.

There are a number of non-government organizations (NGOs) involved in the agricultural research and development activities. Center for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED), the largest NGO, was established in 1991 AD with the objective to reduce poverty, enhance food security and empower women, deprived and disadvantaged communities of Nepal. It's on of the specific objective is to promote commercial high-value agricultural, livestock and agro-processing activities based on local comparative advantages (CEAPRED, 2008).

Local Initiatives for Bio-diversity Research and Development (LI-BIRD) in another independent NGO, which aims to create and increase opportunities for the sustainable management of natural resources and bio-diversity and to improve the livelihood of the poor through participatory approach.

Forum for Rural Welfare and Agricultural Reform for Development (FORWARD) is another independent non-government organization which goal is to raise the living standard of rural communities with special emphasis on socially marginalized disadvantaged groups including Dalits, tribal groups, women and children, through integrated, sustainable development interventions. Its major program areas are knowledge management, natural resources management, livestock development, environment and climate change, food security, action research, market management, capacity building employment generation and agro-biodiversity conservation (FORWARD, 2007).

ii) Decentralization of authority

Council of NARC is the main authority which decides policy and approves budget. Executive Board executes and implements the programs approved by the council. Executive Director has all administrative and financial authority. However, these authorities have been delegated to the directors of administration and finance, respectively. Director of planning and monitoring has been authorized in whole planning and monitoring process. Directors of Crop and Horticulture Research and Livestock and Fisheries Research have the responsibility to assists the function of Executive Director as well as looking after the research programs. The administrative authority within NARI and NASRI is decentralized to the directors of these two institutes.

The power of Executive Director of NARC has been decentralized to the directors of Regional Agricultural Research Station (RARS) and chiefs of Agricultural Research Stations and Commodity Programs to implement the research programs as well as daily administrative and financial work.

Director Generals of Department of Agriculture (DoA) and Department of Livestock Services (DoLS) has delegated their administrative, technical and financial authority to Deputy Director Generals, Regional Directors, Program Directors and chiefs of District Level Development Offices.

In National Academy of Science and Technology (NAST), Vice Chancellor has been given all the authority which has been delegates to the member secretary. The Dean of Institute of Agriculture and Animal Science (IAAS) has decentralized its authorities to different directors within the organization on personal administration, financial, research and management of institutes. Executive or governing Board of different non-government organization involved in agricultural research and development has authorized the power to executive directors to execute and implement policy, plan and programs of the organization accordingly.

NARDF has only the central secretariat headed by member secretary of fund management committee. All the authorities go to the member secretary which has given the responsibility of all matter of the day to day management of the fund along with soliciting project concept notes and proposal from potential researchers and development supports, processing of proposals received from applicants, management of peer reviews and tje proposal review process, financial management of the grants awarded to the project and arranging and administering meetings of the Technical Sub-committee (TSC) and Fund Management Committee (FMC).

iii) Status of autonomous and governance of the institutions

NARC is an autonomous apex body under the Ministry of Agriculture and Co-operatives for agricultural research in the country with the ultimate goal of poverty alleviation with sustainable growth of agriculture production through the development of appropriate technologies in different aspects of agriculture. Council of NARC is the main governing body for decision making whereas Executive Board executes the decision of Council. The Executive Director act as an administration chief of NARC and implements the decisions made by Executive Board and govern to run the approved programs. Directors of NARC assist the executive director in implementing the programs.

NAST is also an autonomous organization under the Ministry of Science and Technology. Academic Assembly governs setting of the policy guidelines and approving the annual program and budget. Vice-chancellor of management Council is the Chief Executive who governs and executes the assembly's decision. Its programs are implemented by the faculties and divisions led by the chiefs.

IAAS is an autonomous educational institute under Tribhuwan University and Himalayan College of Agricultural Science and Technology (HICAST) is another autonomous private agricultural educational institute. IAAS is governed by Tribhuwan University.

Department of Agriculture and Department of Livestock Services are the two government organization under the Ministry of Agriculture and Co-operatives. They are governed by MoAC. They have biggest institutional network in the country for the development of agriculture and livestock.

National Agricultural Research and Development Fund is an autonomous agency under the MoAC. It is governed by Fund Management Committee (FMC) chaired by the Secretary of the Ministry of Agriculture and Co-operatives and administered and operated by the NARDF Secretariat. The head of the Secretariat is the Member Secretary of the FMC.

LI-BIRD, CEPRED and FORWARD, the private sector non-government autonomous organizations, are governed by their own either General Assembly or by Executive Board or Executive Committee. The Executive Director of each organization is the administrative chief of their organization.

iv) Role of Council in terms of research management

The Council of NARC is mandated to make decision at policy level. It gives guideline on the research agenda and to the Executive Board to execute the program and plan. It has the authority to approve the research projects, programs and budget for different projects and programs.

v) Co-ordination mechanism

At ministry level, the Secretary of the Ministry of Agriculture and Co-operative coordinate with the help of Executive Director of NARC. In Executive Board, the Chairman Executive Director of NARC makes the co-ordination with different ministries, Government Departments and National Planning Commission as the Joint Secretaries of the ministries and Director General of DoA and DoLS are the members of Executive Board. Heads of most of the NARS institutes are the member of Council of NARC. Similarly, the Executive Director of NARC is one of the members in Executive Board or Executive Committee or Governing Board of different NARS institutes. The participation of heads of in different forum helps to co-ordinate among the NARS institutes. At national level, there is National Agricultural Technical Working Group chaired by Executive Director of NARC (NARC, 2008). Its meeting is organized by NARC and headed by Executive Director, where most of the NARS institute representatives meet once in a year. This is another forum for developing co-ordination among them.

However, NARC is working in collaboration with various organizations in the field of technology development and sharing, technology transfer and scaling-up, support in human resource development and financial support (Fig 2.1)

There are three modes of financial resources available to NARC namely, grants from Government of Nepal, grants from national and international donor agencies and governments and fund obtained from research production, consultancy services and others. Government of Nepal (GoN) allocates a lump sum amount of budget for Nepal Agricultural Research Council through the Ministry of Agricultural and Co-operatives. This budget is divided under staff cost, operational cost, administrative cost and capital cost by planning division within NARC. Staff costs are allocated based on total number of staff working in NARC. The operational, administrative and capital costs are allocated according to the approved project proposal and requirement of different agricultural stations, divisions and programs. The Council of NARC approves the allocated budget for different expenditure headings. It has right to guide and reallocate the budget, if any.

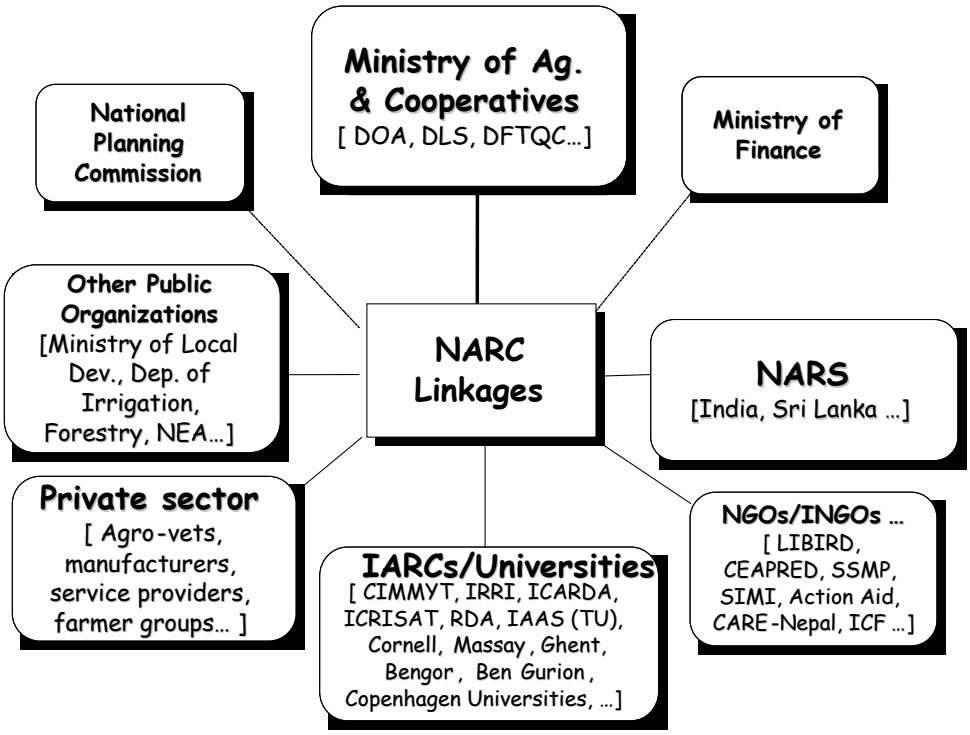

Figure 3. Linkage of NARC with different organizations

vi) Mode of resource allocation (financial, HR, logistics, equipments, infrastructure and facilities etc) and involvement of Council in resource allocation

For government organization like DoA and DoLS, Government of Nepal allocate the budget through Ministry of Finance and the Ministry of Agriculture and Co-operatives.

Expenditure is done according to the rules and regulation of GoN. In NARDF, funds are made available by MoAC. Where as in NAST and IAAS the funds are given by the GoN and Tribhuban University, respectively.

vii) Priority fixation of research (method followed)

Agricultural research has been given priority in "Agricultural Perspective Plan (APP) 1995 prepared for National Planning Commission of Government of Nepal. The plan has rightly emphasized to increase the size and quality of the agricultural research system. The APP recognizes high value commodities and given priority for the seed multiplication of different crops (APROSC and JMA, 1995). Under this ground, priority for agriculture sector is fixed by National Planning Commission (NPC) at national level and also by MoAC. Consequently, priority in agriculture research at national level is dependent of NPC priority which is Top-down. On the other hand, bottom-up approach is also followed based in the feed back from extension department to the research institutes according to the stakeholders demand. NARC follows the guidelines given by the government as well as feed back from the extension departments. Finally Executive Board and Council approve the priority brought through the bottom-up process. Priority is given to a system based research approach which multi-disciplinary and multi-commodity with the involvement of multi actor teams and being participatory in nature. The priority of research projects is given to those generated from village level workshops participated by researchers, extension workers, development agencies and farmers groups, and supported by the Regional Agricultural Technical Working Group and National Agricultural Technical Group.

NAST fixes its research priority according to the government policy in science and technology. The agricultural development priority is fixed by national planning commission and accordingly by MoAC. DoA and DoLS develop their programs accordingly.

In NARDF, research and development priority is fixed by the technical committee within its thematic areas according to the demand of stakeholders and priority given by national planning commission. While fixing the priority, there is obligation to address the specific needs of the deprived and marginalized sections of the population, duly consideration of appropriate indigenous technical knowledge, traditional practices and locally available resources. Finally, Fund Management Committee gives the approval and has the authority to amend, if any.

In Institute of Agriculture and Animal Sciences, research priority is fixed by the Directorate of Research in co-ordination with the head of different department.

viii) Research planning process

NARC has adopted an approach to planning that utilizes the logical frameworks a management tool and nests the institute's own goal and objectives with those of GoN (Ministry of Agriculture and cooperatives. NARC is increasingly focusing its research programmes and activities in pluralistic and partnership mode to make them more relevant, dynamic and efficient (Figure 4). It envisaged in multi-disciplinary, multi-sectoral and multi-stakeholder research with defined roles, responsibilities and resources for each partner. In the initial stage, the planning division of NARC sends project

proposal formats with the recommendations made from Regional Agriculture Technical Working Group (RATWG) and National Agriculture Technical Working Group (NATWG) meetings along with guidelines from MoAC, NARC and National Planning Commission to all the institutions of NARC. The format covers all the requirements of budgetary provisions (administrative, staff, operational and capital budgets) to develop the research proposal and to conduct annual research program.

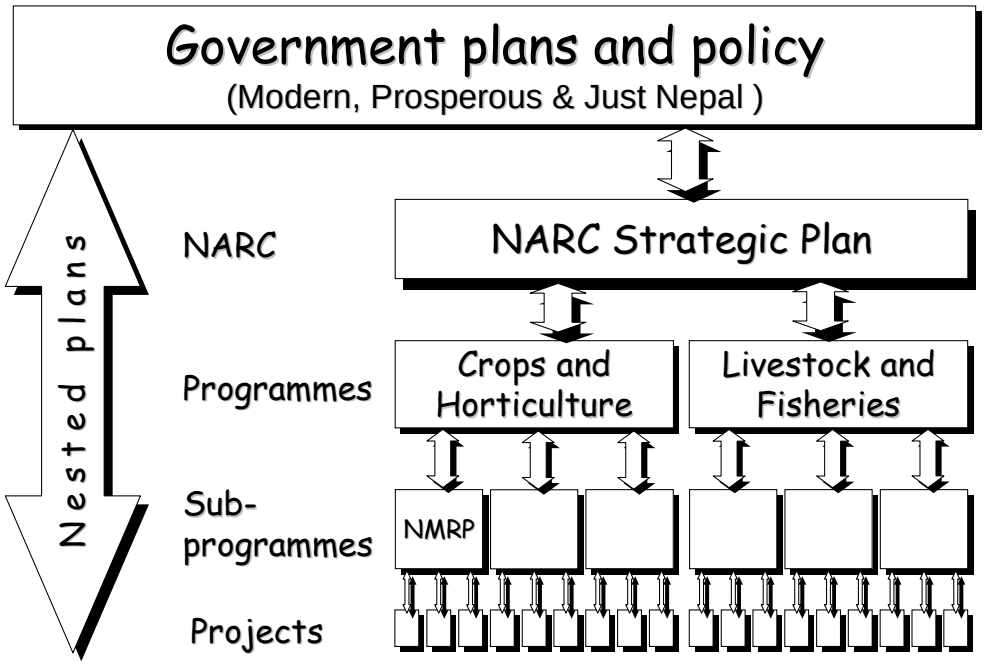

Figure 4. Nesting of NARC plans and projects

Then the technical panels and sectoral panels examine the research project proposal from technical point of view and allocate operational budget for the project activities. The finance division examines proposed budget and allocation for staff and administrative expenses. Again planning division deals with the budget not covered by either by technical panels or by finance division. The complete set of proposed research projects of all institutions are forwarded to program sub-committee for technical verification and modifications including budgetary provisions. The program sub-committee selects the project proposal for implementation in conformity with the NARC's policy and guidelines, priority setting by NPC and MoAC guideline. The technical panel and program sub-committee has the authority to accept or reject or merge the activities and project itself of the proposed project.

After review, research proposal and program budget are submitted to NARC Board, NARC Council, MoAC, MoF and NPC for necessary action. Final approval of project proposals and budget are decided with the consultation of MoAC, MoF and NPC by NARC Board and Council upon the availability of fund from GoN and donors.

Under NARDF funding research proposal, first of all it calls for Project Concept Note (PCN) each year under its funding envelops of already fixed six thematic areas. The PCN is then reviewed by the Peer Reviewers. The selected PCN by Technical sub-committee (TSC) is then sending back to the proponents for full proposal. The received full project proposal is then reviewed by the team of Peer Reviewers and submitted to TSC for further review and approval. The proposal then submitted to Fund Management Committee who finalizes the funding and approval of the project (NARDF, 2007).

ix) Research scientists (institute-wise)

In Nepal Agricultural Research Council, out of 406 approved scientific staff 177 posts are fulfilled. The research scientists are categorized from Scientist (S 1) to Principal Scientist (S 8). The ratios of scientist to technical officer, scientist to technical assistants, scientists to other administrative, account and office helpers and scientists to all staffs are 1.72, 1.77 and 3.5, respectively. The details of the human resources of NARC are given in Annexure 7. The scientific staffs are not sufficient to address all the researchable issues in agriculture. However, vacant scientific posts are being fulfilled in near future.

In NARDF, there are 3 agricultural officers and 2 planning officers in the secretariat along with few support staffs. In NAST, nearly 140 staff members are employed and out of which 50 percent are researchers. There are 26 academicians in different subject areas (NAST, 2009).

The Department of Agriculture has the highest human resource from central to district levels. There are a total of 722 senior agricultural officers and agricultural officers working in the field of agronomy, soil, plant projection, extension, horticulture and fisheries sectors. A total of 4,248 are supportive staffs that includes senior and junior technicians, administrative and other supportive staffs. Most of them are based in the district and regional level offices (DoA, 2008).

CEAPRED has 48, 72 and 82 senior agricultural professionals, medium level agriculturists and junior level supportive staffs. Out of them 90 per cents are field based. In LIBIRD out of 98 employees, 39 per cent are agricultural professionals and 61 per cent are supportive junior level staffs. Similarly, FORWARD have 9 specialists and 6 support staffs at the central level. More than 100 staffs are working in the different project districts. The organization has also affiliated specialists members covering a range of expertise in agriculture natural resource management, rural development and related areas.

x) Recruitment process of scientists of research institutes

NARC has its own autonomous Recruitment Committee headed by Executive Director, which has five members. The members of the committee are one Joint Secretary from MoAC, one Council Member, one professional Expert and the Director of Administration of NARC as Member Secretary. The committee is assisted by administrative staffs of NARC. The entry point of scientist is at Scientist Level 1and Level 3 on competitive basis with the minimum qualification of Master degree, PhD degree and Master Degree with five years of experience. Above Level 4, there are the provision of vertical promotion, internal self competition and internal open competition. The Scientific Levels are from Level 1 to Level 8. In the process of recruitment of vacant positions, the committee advertises the post for any type of competition. There are both

written and oral examinations except for the post to be fulfilled under vertical promotion scheme.

Under government organizations i.e. Department of Agriculture and Department of Livestock Services, Civil Service Commission (CSC), an autonomous organization of Government of Nepal has been given the responsibility of recruiting the agricultural staffs. CSC advertises the posts as requested by the MoAC. Then all the processes are followed under the rules and regulations of Government of Nepal. The Service Commission of Tribhuwan University has the authority to recruit the different level staff in Institute of Agriculture and Animal Science. NGOs fulfill their staff according to their rules and regulation in competitive basis.

xi) Linkage with state/provincial research installations

There is no province or states in the country at present, therefore not applicable.

xii) Investment trend in research (Capital and operational, Donor support trend)

The expenditure in agricultural research and development has increased during 1995 to 2000 mainly due to the support from World Bank during Agricultural Research and Extension Project. USAID was the principal supporter of agricultural research in Nepal for several decades in past. During the support period of donors, the investment in agricultural research mainly through Nepal Agricultural Research Council was comparatively better than present. The various sub-sectors within agriculture have received differential emphasis in government resource allocation over time and their performance has also varied. The absolute amounts of budget to different sub-sector shown an increasing trend over time, but there are wide fluctuation from year to year (Thapa, 1996). In the recent years, the annual budget for NARC has been increasing year by year (Table 4). But the trend shows that its share in the National budget and MoAC budget is decreasing year by year since 2003/2004 (Figure 4). Similarly, the funding from the donors is not encouraging. During the past five to six years, some funds have been provided as operational budget by Swiss Development Cooperation under Hill Maize Research Project and Japan Government under KR2-Fish project (Table 5).

Table 4. Budget allocation for different fiscal years (Rs in '000) of NARC

Description	2060/61 (2003/04)	2061/62 (2004/05)	2062/63 (2005/06)	2063/64 (2006/07)	2064/65 (2007/08)	2065/66 (2008/09)
Annual Budget of Nation (NRs)	102,400,000	111,689,900	126,885,100	143,912,300	168,995,600	236,015,897
Annual Budget of MoAC (NRs)	2,472,945	2,692,284	3,364,780	3,516,279	4,176,853	5,759,500
Approved Annual Budget of NARC (NRs)	300,575	311,249	295,055	355,000	415,000	510,000
Percent from Nation Budget	0.29	0.28	0.23	0.25	0.24	0.22
Percent from Budget of MoAC	12.15	11.56	8.77	10.10	9.94	8.55

High percent of the allocated budget to NARC goes to staff expenses. The trend shows that the expenditure in operational budget in decreasing trend (Table 6 and Figure 5). The support from the donors is absolutely low since last three to four years, which have lead to lower in the operational budget. There is the need for more investment in agricultural research from the government and it has to be increased 2-3 folds. The government has also to invest more in the development sector of the agriculture.

Table 5. Source wise funding budget (NRs' 000) of NARC

Description	2060/61 (2003/04)	2061/62 (2004/05)	2062/63 (2005/06)	2063/64 (2006/07)	2064/65 (2007/08)	2065/66 (2008/09)
NARC/GON	48,300	48,300	47,650	66,200	0	510,000
ARP/GON	201,960	210,500	200,496	232,700	347,700	0
KR2 Fish	28,050	30,000	28,500	37,100	46,300	0
HMRP/SDC	22,265	22,449	18,407	19,000	21,000	0
Total	300,575	311,249	295,055	355,000	415,000	510,000

Table 6. Budget breakdown by main headings (NRs in '000) of NARC

Description	2060/61 (2003/04)	2061/62 (2004/05)	2062/63 (2005/06)	2063/64 (2006/07)	2064/65 (2007/08)	2065/66 (2008/09)
Staff	159,000 (52.9)	160,000 (51.41)	180,000 (61.01)	193,000 (54.37)	210,000 (50.60)	250,000 (49.02)
Operational	99,291 (33.0)	105,089 (33.76)	83,387 (28.26)	111,272 (31.34)	133,507 (32.17)	131,209 (25.73)
Administrative	37,604 (12.5)	36,880 (11.85)	24,468 (9.65)	40,728 (11.47)	45,593 (10.99)	38,791 (7.61)
Capita	4,680 (1.6)	9280 (2.98)	3200 (1.08)	10000 (2.82)	25900 (6.24)	90,000 (17.65)
Total	300,575	311,249	295,055	355,000	415,000	510,000

Note: Figures in parenthesis are per cent.

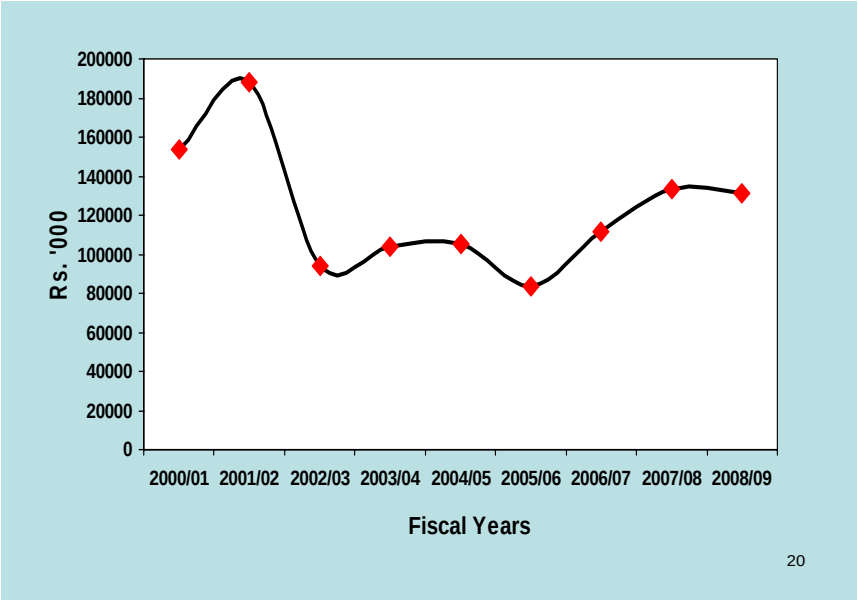

Figure 5. Trend of allocation of operational budget in NARC

3. INSTITUTIONAL GOVERNANCE (RESEARCH ADVISORY BODY, MANAGEMENT BODY)

i) Reforms for enhancing efficiency

Many institutes within NARS have been reformed in due course of time in past. NARC came into autonomous status in 1991 under the policy guidelines of agricultural Research Co-ordination Board (AREB) formally named as National Agricultural Research Coordination Committee (NARCC) (Baniya and Joshi, 1997). Before NARC, it was working as Nepal Agricultural Research and Service Centre (NARSC). With realization of the need of an efficient, dynamic and cost effective agricultural research system in the country, NARC came into existence. As envisaged in the Three Years' Interim Plan 2007/2008, NARC is in the process of structural reformation to increase its efficiency. Further, DEEMED University concept has been advocated for strengthening the agricultural research capacity and capability in the country. NARC's present two institutes NARI and NASRI are in the process of evolving into National Academy of Agriculture Science to act as Deemed University. Moreover, efforts amendments to be made in NARC Act 1991 are underway.

Among the other institutes, Institute of Agriculture and Animal Science is in the process of converting it into self an Agricultural University.

ii) Management of outreach program/infrastructure

In the context of NARC, out-reach research program is a combination of technology generation, verification and service activities conducted by researchers in collaboration with extension personnel along with the concerned stakeholders. Fined tuned approved

technologies in the out-reach sites are then disseminated and scaled-up by the concerned agencies.

Centrally located Out-reach Research Division (ORD) of NARC is responsible to plan, manage, coordinate and strengthen out-reach program at national level. It initiates central level work plan, operational strategies, strengthen, coordination and linkage among R and D partners, and various supportive activities related to participatory technology development.

Commodity programmes, disciplinary divisions, regional agricultural research stations and agricultural research stations of NARC manages their outreach research programme in their out-reach research sites through out-reach research unit. There are a total of 54 out-reach research sites nation wide within NARC. ORD supports RARS, ARS, commodity programmes, disciplinary divisions, NGOs and GOs for planning, monitoring and evaluation of outreach programmes (Paudel *et a*l., 2007).

In Nepal, major partners involved in technology generation are NARS, universities, IARS, Community Based Organization (CBOs), INGOs and NGOs. Under NARS, the important institution is NARC, which manages out-reach research programmes for agro-technology transfer through the model depicted in Figure 6 with the involvement of various stakeholders. There are guiding principles and procedures of managing and implementing research activities in the command area of R/ARS, commodity programs and disciplinary divisions within NARC (Figure 7).

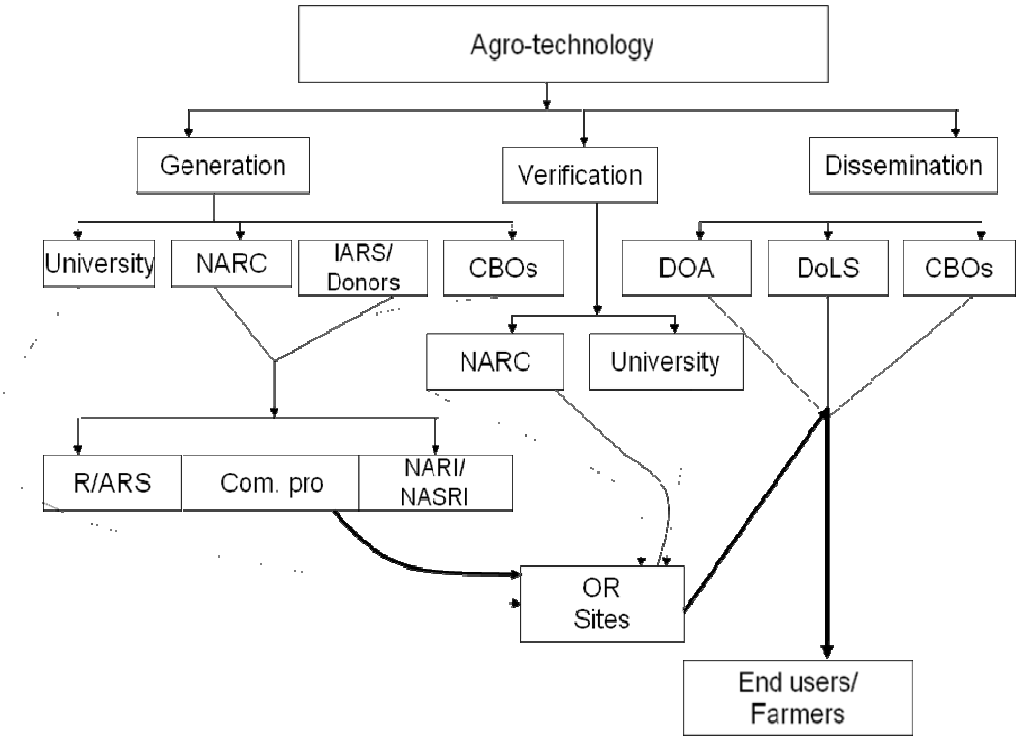

Figure 6. Agro-technology transfer model in NARC

iii) Private sector involvement/partnership

A wide range of private sector organizations namely Agro-entrepreneurs, Agro vets, Farmers' and Agro-entrepreneur's associations, commercial producers, product traders, promoters and their associations are emerging as the most important stakeholders of agricultural research and development in Nepal. They are mostly involved in technology promotion, commercialization of agriculture and delivery of services. They provide substantial back-ward linkages in term of supply of inputs, services, credit, knowledge and forward linkages in processing, value addition and marketing (Gauchan, 2000). The investment of fund from private sector in agricultural research is negligible. Despite the mutually supportive and complementary roles played by both public and private sector R and D organizations in overall agricultural development in the country, the linkages between them particularly public sector research agency such as NARC and agro-input dealers and agro-entrepreneurs is week. To strengthen the linkage between public and private sector and to strengthen the involvement of private sector in agricultural research there is need of supportive policies and regulation for mobilization of resources, skills and knowledge in available in private sector.

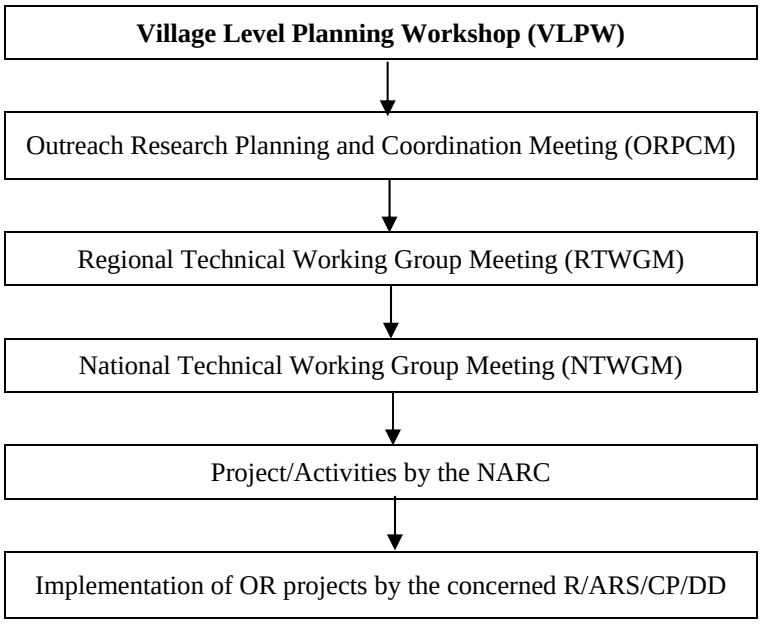

Figure 7. Procedure for implementing outreach research in Nepal

iv) Performance evaluation (Individual)

The performance evaluation of NARS institutes under MoAC (NARC, DoA, DoLS and NARDF) is done once in a year after the end of the fiscal year at MoAC in the presence of representatives from National Planning Commission and Ministry of Finance chaired by the secretary of the MoAC. The evaluation of the individual scientists and researchers are based on the work performance and is done once in a year after the end of fiscal year through personal performance appraisal. The evaluation is done by the senior scientist, directors and executive directors wherever required.

v) Leadership development

NARC always encourages the scientists to develop leadership in their field of work as well in management. It is providing the opportunity in developing the leadership by enhancing the capacity and capability through short and long term trainings. But, to lead the institute or office within the NARC, seniority is the main basis followed. Sometimes, the counting of seniority hinders over the ability, skill and merit of the scientists Same implies in other institutes under NARS except private organizations.

vi) Human Resource Development (higher training opportunities & support, % shared by the government vs. donor)

In the past, donor agencies like the World Bank, USAID and the institutes under CGIAR System provided full financial support for higher trainings (M. Sc. and Ph. D.) in agriculture sector of Nepal. In last decade, World Bank, IAR institutes under CGIAR system and government of India through ICAR are the main donors in supporting human resource development. Some of the IARS institute like IRRI is also supporting financially and technically for higher study. The financial support from the Government side is negligible in this regard. However, there is the provision of getting short or long term higher training by any scientist within NARC and by an agriculturist in government organizations through their own effort. They can get five years of study leave in their whole service period only after the completion of three years permanent job within the same organization.

vii) Research Extension Linkage

The linkage between the three partners should be strong as depicted in Figure 8. The flow of technology from research to extension and extension to farmers and other stakeholder are strong. However, the feedback from farmers to extension and extension to the research is very week as shown in the diagram. Due to the week feed back system; farmers' actual problems do not reach to the researchers. It also shows week extension system. The researches are not coming-up with problem oriented. What so ever the technologies developed by the research institutes are not properly delivered to the clients.

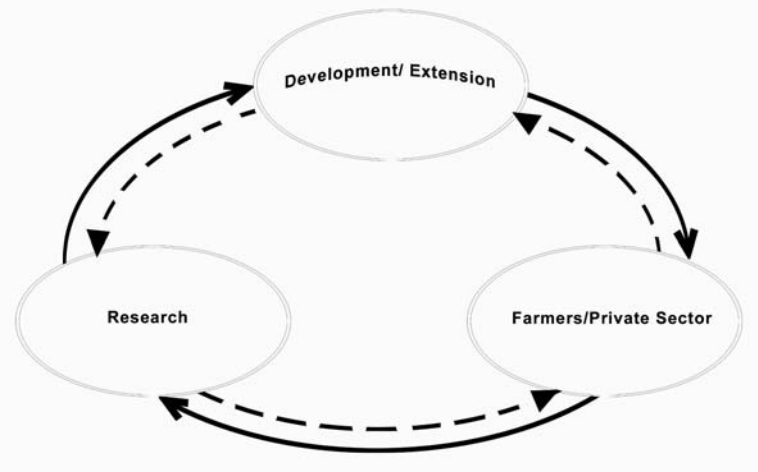

Figure 8. Status of Linkage among R and D partners

In the changing context, in order to strengthen a two way feedback among the public private partnership as depicted in Figure 9 is needed. In the figure, there is better coordination between research and extension in A, similarly, research and clients in B, extension and clients in C. However, meeting points for all stakeholders is D which is very small. Unless the area of D is increased farmers will not benefited due to the intervention of the technologies. Our target to bridge the gaps between technology development and delivery should be increased by the share of D in practice.

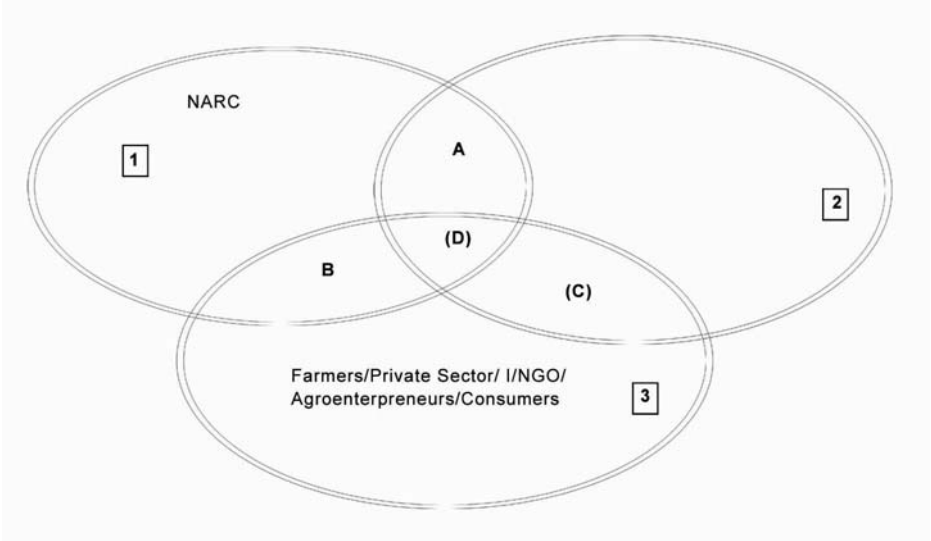

Figure 9. Diagrammatic depiction of linkages and coordination among research, extension and clients (Source: NARC, 2008)

There are many ways to bridge gaps in technologies delivery to users groups. To bridge the gaps among research, extension and other stakeholder, the Government of Nepal has approved the guidelines for Agricultural Technical Working Group Meeting (NARC, 2008). In the guideline, working model of linkage and co-ordination between research and development institutions has been developed (Figure 10). According to the model and the guideline, the linkage and coordination mechanism is targeted for different hierarchy comprising from central levels to district levels where frequent interactions among institution is mandatory so that coordination mechanism has been tied up in the annual targets of all institutions.

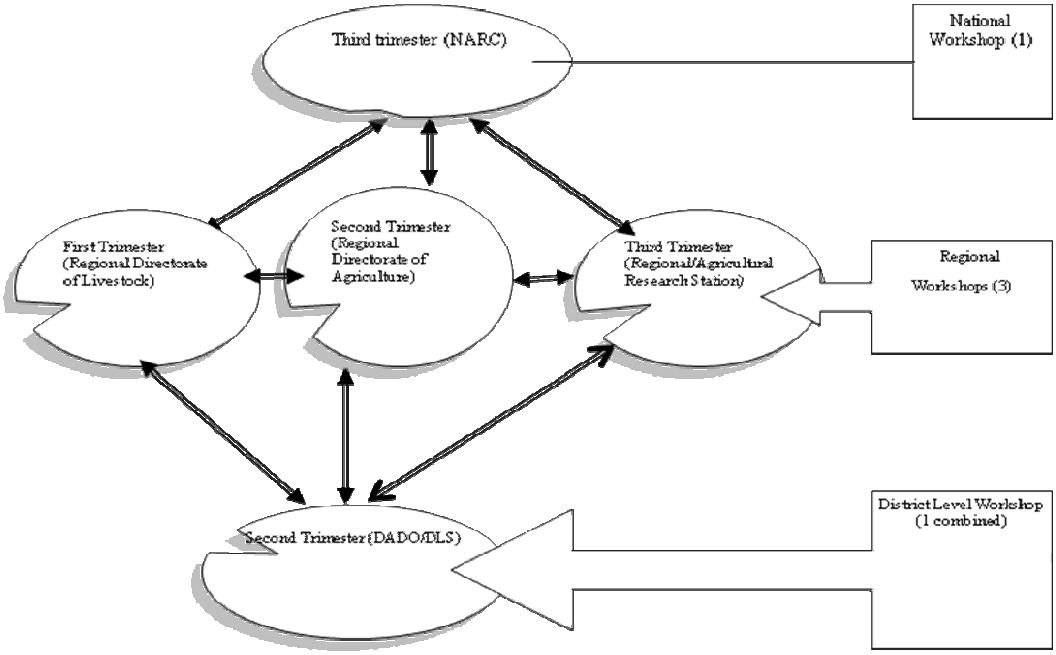

Figure 10. Cyclic diagram of Agricultural Technical Working Group (source: NARC, 2008)

ix) Education (link with the Agricultural University)

NARC has no direct link with the universities abroad in the field of education. However, it has Memorandum of Under standing (MoU) with IAAS/TU in Nepal under student exchange program. IARS is also supporting NARC by providing logistic and financial support through research institution under consultative groups of International Agricultural Research System (CGIAR) for educational purpose. Institutions like IRRI, CYMMYT, ICARDA, ICRISAT, IPGRI, APPARI, ILRI under CGIAR have direct link with NARC through MoU. It has indirect linkage with the universities of India, Srilanka, and Pakistan through ICAR, Srilankan Council of Agricultural Research and Pakistan Agricultural Research Council (PARC). Previously, NARC had link with Cornell University, USA in the field of rice-wheat research project through Rice-Wheat Consortium.

x) Management information system

The management of different institutes, disciplinary divisions and research stations within NARC is done by the respective chiefs. Reporting is done by the respective chiefs to the line directors and the management team of NARC. But, the divisions within NARI and NASRI are managed by the directors of these two institutes. The information is reported periodically in every trimester.

4. REVIEW/EVALUATION/MONITORING

i) Program review and institutional review

Programs within the NARC institutes are reviewed by the chief of the concerned institute. Scientists have to submit the report to the chief periodically. The programs of the divisions within NARI and NASRI are reviewed by the director of concerned institutes. Monitoring and evaluation division of NARC at central level performs the program and institutional review within the NARC. At national level, MoAC has the authority to perform review of the program and evaluation of the institutions within the Ministry of Agriculture and Cooperatives.

ii) Composition of review panel (Internal and External)

At national level, the performance evaluation of programs and institutes under MoAC (NARC and NARDF) is reviewed at MoAC in review meetings in the presence of representatives from National Planning Commission and the Ministry of Finance in the chairmanship of Secretary of MoAC. In NARC, review is performed at regional and central level in the chairmanship of Executive Director of NARC in the presence of the representatives from MoAC, National planning Commission and the Ministry of Finance and the Director General of Department of Agriculture and Department of Livestock Services. Institutional review of NARC institutes is evaluated by a panel of Directors of NARC headed by Executive Director. There is the provision of formation of Programme Sub-committee, Finance Sub-committee and Personal Sub-committee under the Act of NARC for reviewing the program and the institute itself and made recommendation to the Executive Board. These committees have not been materialized.

iii) Frequency of review

The program and institutional review of the organizations under MoAC is reviewed once at the end of the fiscal year. In NARC, program review is performed at the end of each trimester for trimester progress reporting at the NARC head quarter. NARC annual review meeting is also organized at central level once in a year to review the progress in programs and budget expenditure. The evaluation of institutes within NARC is performed once in a year.

iv) Follow up of review

The suggestions and comments on the program and institutional review within NARC are followed by line directors i.e. crop and horticulture research, livestock and fisheries, planning and monitoring, administration, finance and the executive director. The secretary of the ministry of agriculture and cooperatives has the authority to follow-up the review of NARC programs.

v) Monitoring of research program

Monitoring and evaluation division under the directorate of planning and monitoring has given the responsibility to monitor the research program within NARC. But the monitoring system is very week due to the lack of sufficient resources and manpower. There is urgent need to strengthen the central level M and E (Monitoring and Evaluation) Division in terms of staff, database and resources, and establish M and E unit at regional

research station level too. Research projects and activities are also monitored by directors of crops and horticulture research and director of livestock and fisheries research.

vi) Follow up of monitoring

The monitoring and evaluation division of NARC submits its monitoring reports with suggestion and recommendation to the concerned directors. The line directors follow up the monitoring periodically either by themselves or by forming a group of scientists. Some times executive director too monitors the research projects and activities at field level.

5. INCENTIVE STRUCTURE

i) Salary structure (break up, basic, house rent, allowance etc.)

The basic salary of NARC staff is according to the government rules and regulation. They are paid at the rate fixed by the Government of Nepal. In past decade, scientists were getting around NRs 1,000/= higher than the civil servants counterpart of Government of Nepal. But now a day, it is equivalent. There is no provision of any allowance except cost of living allowance which ranges from 14 to 27 percent of basic salary for lowest to scientific staffs.

ii) Comparison with other civil service and private services

NARC scientists and other staffs are receiving similar salary and incentives as the other members of government civil service. Private sector NGOs are providing more salaries to their staff as compared to NARC staffs along with additional facilities and incentives. Scientists and other staffs of NAST are getting transportation allowance but not the staff in NARC is getting transportation allowance. Similarly, doctors working in government hospitals are paid double of their salary. It is felt that NARC scientists and supporting staff should paid more salary along with other allowance like house rent, transportation expenses, overtime educational allowance to the children etc. to get the better out put from the research. Previously, the salary of the scientists was about 15% higher than the government staff. NARC can not increase the salary and provide the different allowance until the government makes the policy. Annual fixed budget allocated to NARC is not sufficient for it.

iii) Retirement benefit and age of retirement

The retirement age of the scientists of NARC is 60 and those of technical and supporting staffs is 58 years. In government organization the retirement age is 58 years. At present, NARC has limited qualified scientific human resources. Some of them have retired is last few years and more of them are going to retire within 5 years of span. It will create huge shortage of qualified and experienced researchers though recruitment of researchers is underway. But it will take a decade to be experienced in their field of work. Therefore, there is need to extend the retirement age of scientists by 2-4 more years to strengthen the agricultural research in the country by utilizing their knowledge and experience. There is no provision of deputing the retired scientists in contract basis. After retirement, scientist and other staffs of NARC and the government civic service holders get pension, medical allowance (one month salary per year of total working years) and insurance money.

iv) Incentive structure (financial and others)

There is no more extra incentive or allowance before the retirement of scientists and other supportive staffs other than according to the government rules and regulations. However, financial incentive is given in the case of accidental injuries and death. Medical allowance is given either before or after the retirement equal to the rate of one month salary per year of permanent job. Under insurance scheme some amount is deducted from salary and the same amount is added and deposited in the bank.. After retirement, financial incentives are given as pension or gratuity, left over medical allowance, left over leaves. All the above incentives are also given under government organization.

v) HR management (recruitment and promotion process)

The recruitment policy of NARC aims for achieving staffing balance according to the requirement of the programs and fulfilling the vacant positions in achieving its goal and objectives. NARC recruitment committee has all the authority to recruit and promote staffs. The committee is composed of five members chaired by the Executive Director. Scientists are recruited at two levels namely Scientist Level 1 (S1) and Scientist Level 3 (S3) through free competition. Some number of the posts under fresh recruitment is fixed for recruitment of deprived community, Mdheshi and women. There is provision of recruiting scientists and other staffs in contract or temporary basis if the position is vacant. But this provision is nonfunctional due to government policy. Most of the scientists and supporting staffs are based at central level institutions in NARC. Most of the research stations are sort of researchers to the centers. They want to be at centre due to better opportunities. The insurgency in country also caused diversion of researchers. The numbers of researchers are insufficient in ARS/RARS/ Commodity Programs especially in remote areas. There is no provision of scientific training for newly recruited scientists and supporting staffs. It is felt that they should be trained before joining their work. Due to limited resources available, it could not be materialized.

The promotion of scientist and other staffs is done periodically. Four types of promotional scheme exist in NARC i.e. Vertical, Internal Competition and Special promotion and file promotion with competition. There are different criteria fixed by recruitment committee for each type of promotion. The person is eligible for promotion only after four years of service period expect in Special promotion. It is given to those who have not been promoted by any means after along period of service. The criterion for promotion includes seniority, educational qualification, work performance appraisal, scientific papers, working experience in remote area. Promotional process in NARC needs to be reformed and reevaluated. Because, sometimes seniority often takes precedence over ability, skills, qualification and merit.

It is felt that the recruitment and promotional process should be handled by Civic Service Commission for fairness. In government organization, these two processes are handled by Civic Service Commission.

vi) Career advancement scheme / process

The scientists and other staffs within NARC are free to develop their academic career under the rules and regulation of NARC. Educational leave for a total of 5 years is given to scientists and technical staff for higher study after three years of permanent job in

NARC. They should get prior approval from NARC in case of personal enrollment in any educational institute or organization. The educational leave must be approved from NARC before joining the higher study. It is given for two and three years for Master and Ph. D, respectively in the initial stage. If one can not finish within the given timeframe, then they should take approval again if the leave period is left. There is no age limit for education leave for the scientist who wants to get their higher study with their won effort. But, under the NARC nomination, the age limit is 48 for both post graduate degrees. The scientist getting the degree through NARC nomination must work in NARC for double of time foe the period of educational leave.

vii) Sabbatical leave

Sabbatical leave is given in NARC twice for a period of one year each in whole service period. The sabbatical leave is allowed to them who don't have educational leave left and need more academic study but not the research or post-doctorate. For the sabbatical leave, the recommendation is made by line directors and the sanctioned by executive director.

viii) Pension facilities

The pension is provided after the retirement of the staffs within NARC. The pension is provided to them only after 20 years of services period who have retired due to age limit. After retirement, one can get monthly pension according to the rules and regulation of NARC. Any one can voluntarily retire depending on their own decision without any facility. But, there is a provision of voluntarily retirement with incentives, if NARC make the advertisement and the resources are available. Under it, gratuity is given. But, this scheme is not in function because of limited resources and fund in NARC. However, a proposal has been send to the government of Nepal for fund allocation.

ix) Technology marketing

There is no standard policy for technology marketing. The technology so far developed in NARC has to be made available to the stakeholder under government rules based on Right of Information Act. There is no license fee or royalty for delivering the approved agricultural technologies. However, some of the technologies on fishery, off-season vegetable production, and source seed production of cereals have been commercialized.

x) Prize and reward system

There is no established award system in NARC. But, 25 Year's Services Medal is given who have served the institution for 25 years or more. There is the provision of rewarding three best scientific papers from Summer Crops and Winter Crops Research Workshop. The papers are evaluated under the established criteria developed by the review committee formed during the workshop. Further, one best researcher and supporting staff each from technical, administration and account are also rewarded according to certain criteria. The recommendation comes from the working institute within NARC. The committee of directors of NARC, headed by Executive Director takes the decision after evaluation of each recommendation. All these prize and rewards are distributed on NARC Day which is celebrated on 25 Baisakh (Nepali calender) each year.

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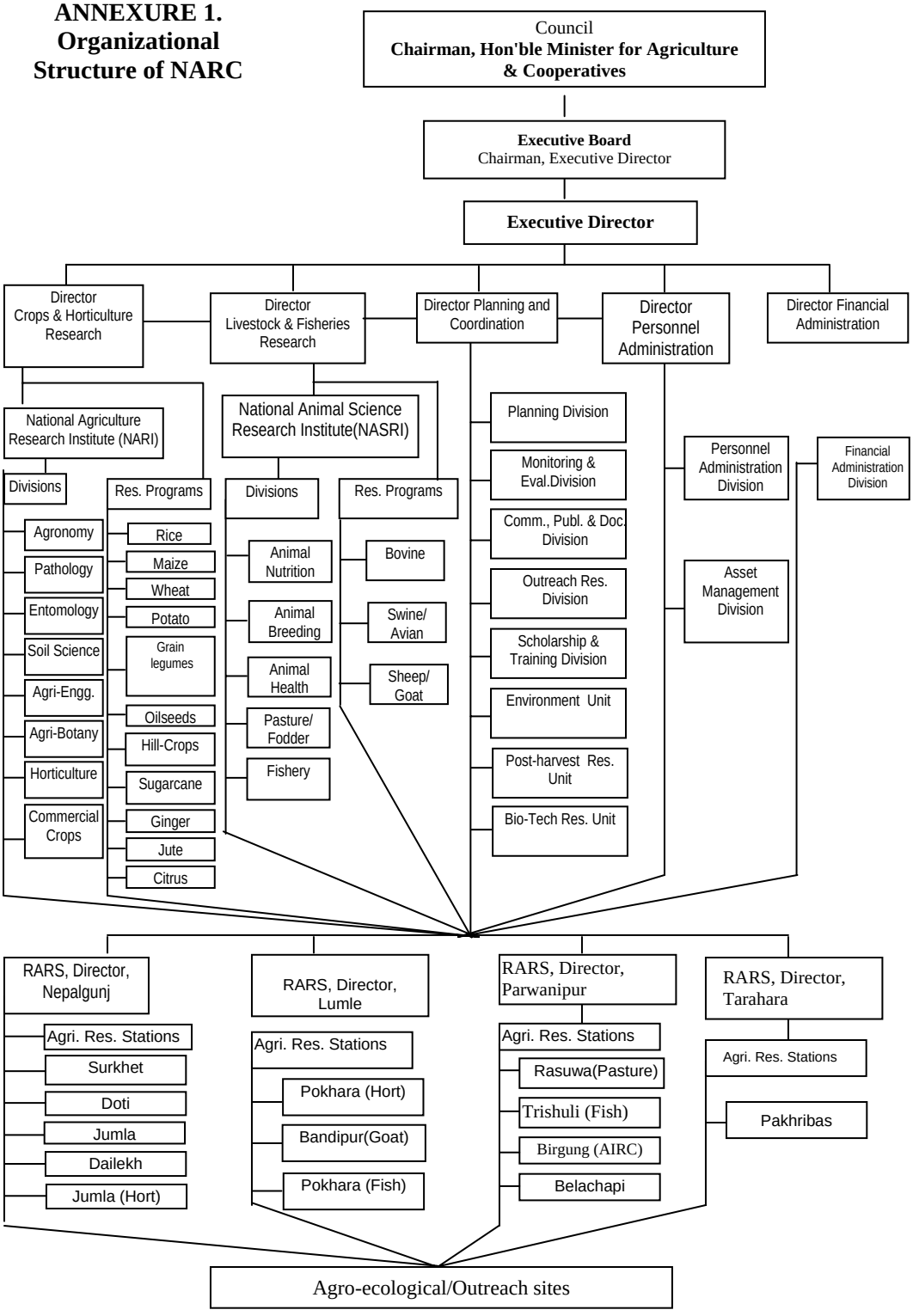
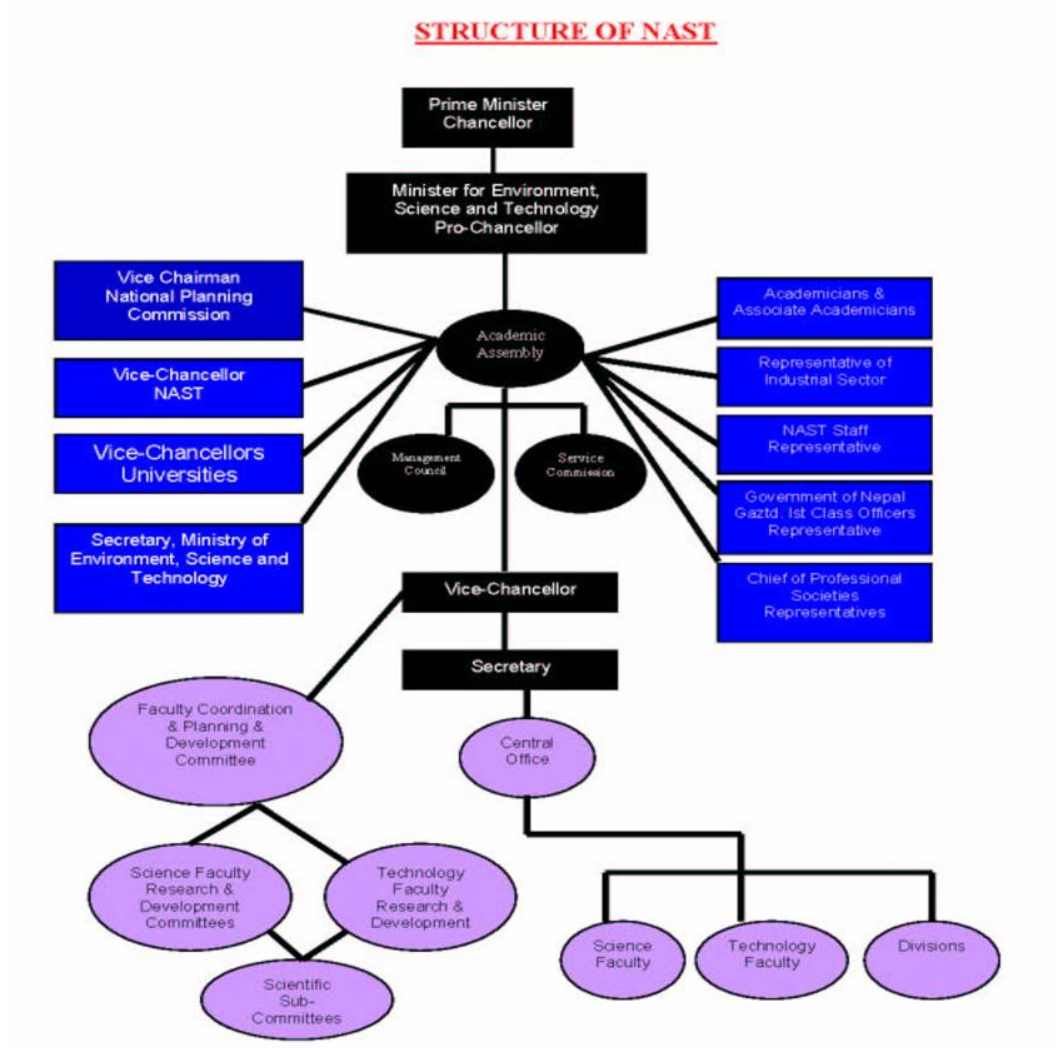
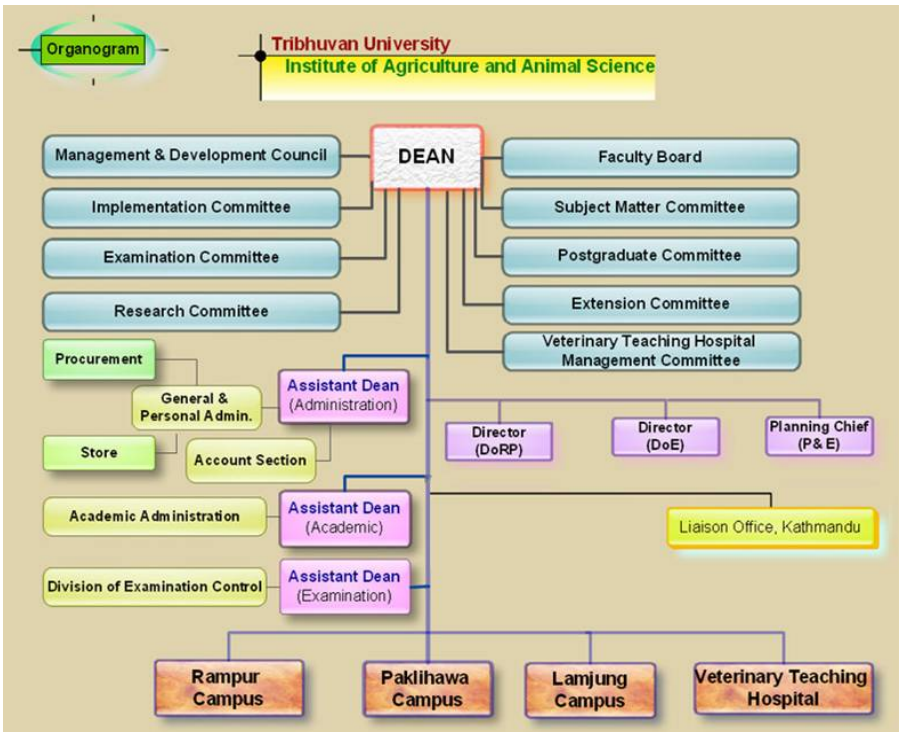
ANNEXURE 1. Organizational Structure of NARC



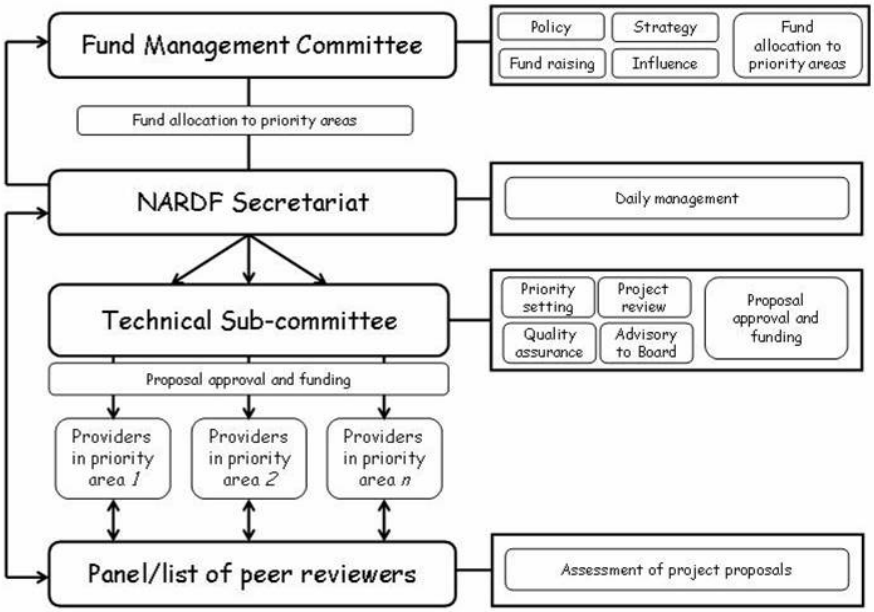
ANNEXURE 2.


STRUCTURE OF NAST
Prime Minister
Chancellor
Minister for Environment, Science and Technology
Pro-Chancellor
Vice Chairman
National Planning
Commission
Vice-Chancellor
NAST
Vice-Chancellors
Universities
Secretary, Ministry of
Environment, Science and
Technology
Academic
Assembly
Management
Council
Service
Commission
Academicians &
Associate Academicians
Representative of
Industrial Sector
NAST Staff
Representative
Government of Nepal
Gaztd. Ist Class Officers
Representative
Chief of Professional
Societies
Representatives
Vice-Chancellor
Secretary
Faculty Coordination
& Planning &
Development
Committee
Central
Office
Science Faculty
Research &
Development
Committees
Technology
Faculty
Research &
Development
Scientific
Sub-
Committees
Science
Faculty
Technology
Faculty
Divisions

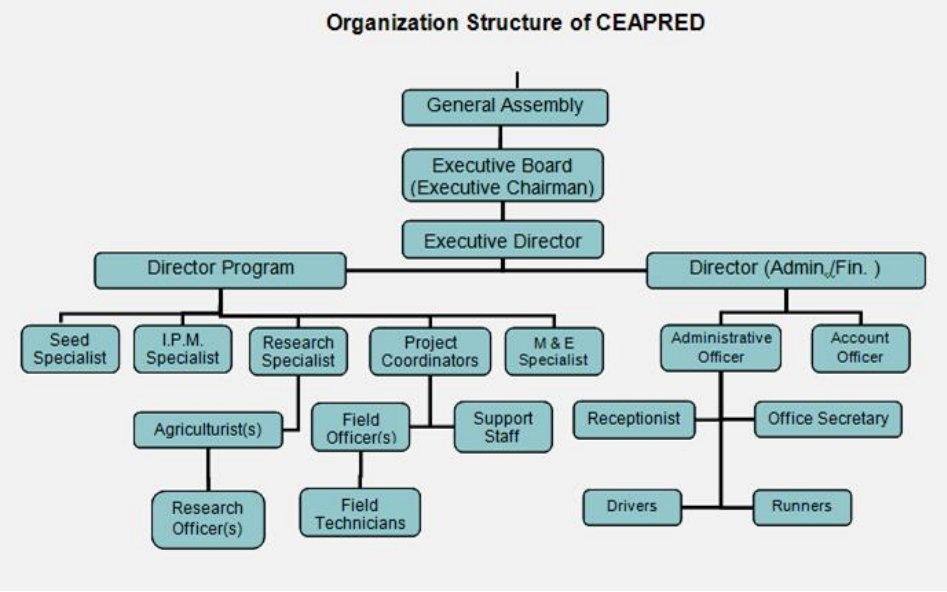
ANNEXURE 3. Organizational Structure of IAAS



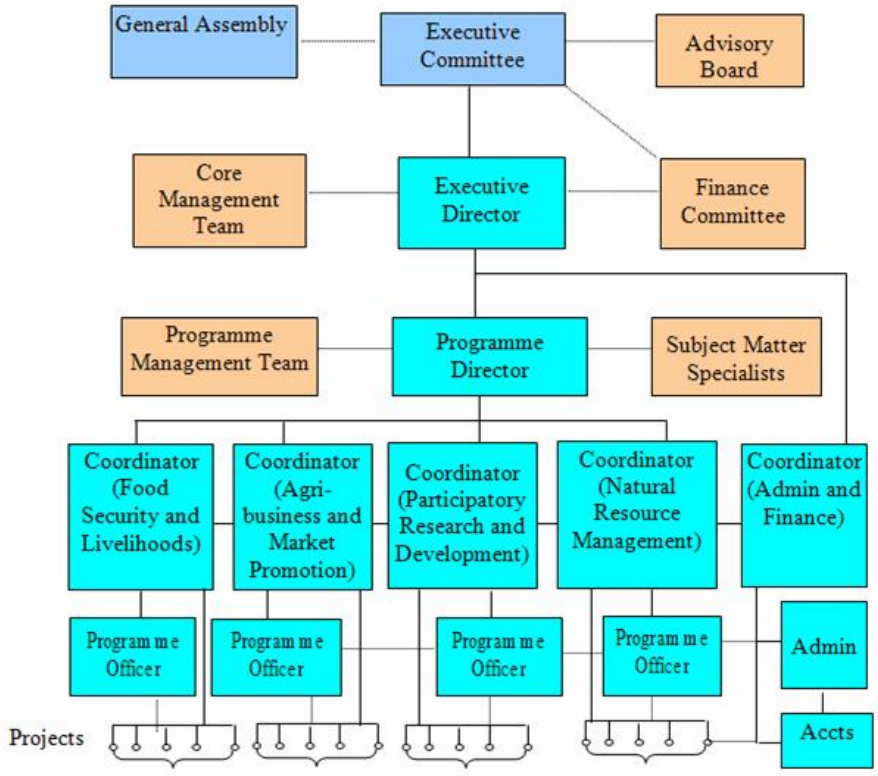
ANNEXURE 4. Organizational structure of NARDF



ANNEXURE 5. Organizational structure of CEAPRED



ANNEXURE 6. Organizational structure of FORWARD



ANNEXURE 7. Human Resource Situation of NARC

Group	Sub-group	Approved Position (No)	Fulfilled Position (No)	Vacant Position (No)
Scientist	Unspecified	7	1	6
	Agronomy, Plant Breeding and Genetics	110	51	59
	Plant Pathology	52	21	31
	Horticulture (Pomology/Olericulture)	41	27	14
	Soil	36	13	23
	Entomology	23	9	14
	Agri-eco, extension and socioeconomics	23	9	14
	Agriengineering	17	8	9
	Livestock product and product management	27	14	13
	Veterinary	19	8	11
	Fisheries	13	9	4
	Animal Nutrition and feeding	9	2	7
	Pasture and Forage	8	2	6
	Animal Breeding & Genetics	8	0	8
	Food Technology	4	1	3
	Biostatics	4	0	4
	Biotechnology	3	2	1
	Agri-metereology	1	0	1
	Library Science	1	0	1
	Sub-Total	**406**	**177**	**229**
Technical (T6 & T7)	Agronomy, Plant Breeding and Genetics	119	96	23
	Plant Pathology	18	12	6
	Horticulture (Pomology/Olericulture)	49	33	16
	Soil	29	21	8
	Entomology	24	17	7
	Agri-eco, extension and socioeconomics	17	13	4
	Agriengineering	17	10	7
	Livestock product and product management	38	23	15

Group	Sub-group	Approved Position (No)	Fulfilled Position (No)	Vacant Position (No)
	Veterinary	12	9	3
	Fisheries	32	25	7
	Animal Nutrition and feeding	4	2	2
	Pasture and Forage	11	6	5
	Animal Breeding & Genetics	6	6	0
	Food Technology	4	3	1
	Biostatics	2	2	0
	Agri-metereology	1	0	1
	Computer Operator	11	8	3
	Librarian	2	2	0
	Civil Engineer	4	4	0
	Sub-Total	**400**	**292**	**108**
Technicians	JT (T5)	132	85	47
	Computer Assistant (T5)	14	6	8
	Library Assistant (T5)	2	2	0
	Overseer (T5)	6	3	3
	Electrician (T5)	3	2	1
	Mechanics (T5)	6	3	3
	Plumber (T4)	2	2	0
	JTA (T4)	132	83	49
	Prabidhik Sahayogi	311	262	49
	Sub-Total	**608**	**448**	**160**
Account & Admin	Account -A9	1	0	1
	Account- A8	1	1	0
	Account -A7	5	5	0
	Account -A6	33	33	0
	Account -A5	30	24	6
	Admin -A9	1	0	1
	Admin - A8	3	3	0
	Admin -A7	6	5	1
	Admin -A6	54	49	5
	Admin -A5	**41**	**32**	**9**
	Aadmin- A4	**20**	**16**	**4**

Group	Sub-group	Approved Position (No)	Fulfilled Position (No)	Vacant Position (No)
Group-wise total human resources	Office Helper (Karyalay Sahayogi)	143	128	15
	Driver	67	65	2
	Sub-Total	**405**	**361**	**44**
	Scientist (S1-S6)	406	177	229
	Technical Officer (T6-T7)	400	292	108
	Technicians (T4-T5)	297	186	111
	Prabidhik Sahayogi	311	262	49
	Account -Officer level	40	39	1
	Account -assistant level	30	24	6
	Administration -Officer level	64	57	7
	Administration assistant level	65	50	15
	Office helper & Driver	210	193	17
	Total	**1823**	**1280**	**543**

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN PAKISTAN

Appendix E

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN PAKISTAN

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Pakistan Agriculture Research Council
Islamabad, Pakistan

December, 2010

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1. INTRODUCTION

The Islamic Republic of Pakistan (hereafter, "Pakistan") is highly dependent on the agricultural sector, which is the main income and employment-generating sector of the economy (Nienke, et al. 2007). In 2009, this sector accounted for 21 percent of the total gross domestic product (GDP) (GOP, 2010). It employs 45 percent of Pakistan's total labour force. About 62 percent of the country's population resides in rural areas, and is directly or indirectly linked with agriculture for their livelihood (GOP, 2010). While on the one hand, the sector is a primary supplier of raw materials to downstream industry, contributing substantially to Pakistan's exports, on the other, it is a large market for industrial products such as fertilizer, pesticides, tractors and agricultural implements (GOP, 2010).

The agriculture sector is also an important source of foreign exchange earning through exports of agricultural commodities and agriculturally-based products. However, substantial foreign exchange is required for imports of agricultural commodities and products. Pakistan's trade balance has been negative for most of its history as a nation (Nagy and Quddus, 1998). However, severe water shortages, in combination with salt-affected soils, soil erosion, low-yielding varieties, and the limited use of modern farming technologies, has resulted in relatively low crop yields (Alam and Naqvi 2003). In the meantime, Pakistan has one of the highest population growth rates in the Asia–Pacific region - 2.4 percent annually or, in absolute numbers, an additional 3 to 4 million people each year (Nienke, et al., 2007).

In order to ensure food security for this fast-growing population, food production needs to grow by at least the same rate. Growth rates of at least 6 to 7 percent are required to ensure GDP growth and a reduction of the country's poverty levels (Nienke, et al., 2007). Because land and water resources are becoming increasingly scarce in Pakistan, this agricultural production growth will need to take place through increasing yields and crop intensities (Alam and Naqvi 2003). This will require the broad dissemination of new and improved technologies, and agricultural research and development (R&D) is the channel through which this will occur (Nienke, et al., 2007). This report provides an overview of recent institutional developments and investment trends in agricultural R&D in Pakistan based on a review study.

2. MACROECONOMIC CONTEXT

Pakisan covers a large variety of agro-ecological zones ranging from coastal areas in the south to the Himalayan mountains in the north, hence it has great capacity for producing a wide range of food commodities (Nienke, et al., 2007). Most of Pakistan is classified as arid or semi-arid, so the agricultural sector is highly dependent on water supply through either irrigation or water harvesting. In 2003, 72 percent of Pakistan's agricultural area was irrigated (FAO 2006). Pakistan has the largest network of irrigation canals in the world, distributing water from the three major basins in Punjab province. Lack of water is one of the major constraints to agricultural growth in Pakistan. During the drought of 2000–01, for example, the total production of wheat and rice declined by 10 and 19 percent, respectively (FAO 2006).

The most important crops produced in Pakistan are wheat, sugarcane, cotton, and rice which accounted for more than three-quarters of total crop output in 2009. Wheat is the main staple of people's diet in Pakistan and it is by far the country's largest food crop in terms of metric tons produced. In 2009, Pakistan produced more wheat than all of Africa and nearly as much as all of South America (GOP, 2010). Cotton is not only an export crop that earns foreign exchange, but also a provider of raw material to the local textile industry. In 2009, cotton production contributed to 2 percent of Pakistan's GDP. Rice is an important food cash crop and also one of Pakistan's principal exports. Sugarcane is a major raw material for producing both white sugar and gur (jaggery) (GOP, 2010).

The performance of *Livestock* – the single largest contributor to overall agriculture (53.2 percent)

however, grew by 4.1 percent in 2009-10 as against 3.5 percent last year (GOP, 2010). Cattle is raised throughout the country and Pakistan is the world's 4th largest milk-producing country by volume. Buffaloes are kept mainly in the northern and southern irrigated plains, while more than half the country's sheep are reared in the western dry mountains, western dry plateau, and northern dry mountains. Large herds of goats are common in areas with forage and grazing.

In addition, Pakistan has a vibrant poultry sector, with more than half a billion birds produced annually. The *Fishery* sector expanded by 1.4 percent, against its previous year's growth of 2.3 percent. *Forestry* which has experienced negative growth for the last six years, exhibited positive growth of 2.2 percent this year. Nonetheless, over the past several years, the forest sector has contracted, underscoring the scale of the environment challenge facing a country that already has amongst the highest rates of deforestation in the world (GOP, 2010).

Forests cover about 4 million hectares, or less than 5 percent of the country (Ministry of Finance 2006). Most forests are in the Northern Areas and Azad Kashmir, where coniferous trees predominate. However, forest management and exploitation are held back by the geographic isolation of these two regions. In other parts of the country, most of the native forests were destroyed before independence in 1947 as a result of population pressure, overcultivation, and overgrazing. The lack of tree cover in these parts greatly contributes to many of the agricultural sector's problems, including soil erosion, the silting of streams, flooding, and a shortage of timber and firewood (Nienke, et al., 2007).

Fisheries play only a minor role in the national economy, accounting for just 0.3 percent of GDP in 2009 (GOP, 2010). Nonetheless, it is the principal source of livelihood for the communities inhabiting the coasts of Sindh and Balochistan, as well as along the major rivers and lakes. Fish exports have become increasingly important in recent years and the national government is taking important infrastructural measures to improve the sector as a whole.

3. GOVERNANCE SYSTEM OF AGRICFULTURAL RESEARCH AND DEVELOPMENT

Historical Background

Agricultural research in Pakistan (previously the northwestern regions of British India) dates back to 1929, when the Imperial (currently Indian) Council of Agricultural

Research was founded to promote agricultural research in India. At the time of partitioning of India in 1947, only one agricultural college and one research station remained, albeit with insufficient resources i.e. agricultural research was confined in the agricultural college and research institute at Lyalpur (now Faisalabad). The need to have a national agricultural research organization was acutely felt. At independence, there was a considerable loss of scientific talent from that institute, which had been the premier agricultural college and research center for undivided North India. The inflow of scientists transferred from institutions in present-day India only partially compensated for this loss. The urgent need for and importance of a strong central agricultural research organization to complement and support the work of the provinces has been recognized, and the government has taken a number of action to develop this capacity. Considering the active development of Pakistan's research system, it is not surprising that several teams have made extensive reviews of the agricultural research system and have made numerous recommendations for its strengthening and improvement, many of which have been implemented. Among the major reviews are as under:

(i) *Setting up the Food and Agricultural Committee in 1948 was the first step in that direction. It was reconstituted as the Food and Agricultural Council of Pakistan (FACP) in 1951;*

(ii) *It was renamed the Agricultural Research Council (ARC) in 1964; However, its scope remained limited as a funding agency. In the late 1950s, research and teaching institutions in the North West Frontier Province, Punjab, and Sindh provinces were founded with assistance from the United States. These institutions laid the groundwork for the current agricultural education and public research system.*

(iii) *The joint Pakistan-American agriculture research review team, 1968;*

(iv) *The second joint Pakistan-American team on agricultural research, 1973;*

(v) *ARC's effectiveness and functionality were enhanced as a result of the recommendations that emanated from the joint review of the agricultural research system in Pakistan by a combined team of Pakistani and American scientists in 1968 and in 1973 given at (iii) and (iv);*

(vi) *The agricultural research development loan, USAID, 1974;*

(vii) *The joint review team for agricultural research in Pakistan under the loan agreement between Pakistan and the United States, 1976;*

(viii) *The year 1978 went down as an important landmark in the history of agricultural research. ARC was given autonomous status in order to improve the management and effective coordination of research efforts. In 1979, the process culminated in the redesignation of ARC to PARC*

(ix) *The World Bank agricultural research subsector review, 1980;*

(x) *Agricultural Research Division (ARD) established with Chairman PARC as its Secretary.*

(xi) *PARC Ordinance was promulgated in 1981;*

(xii) *One year later, the government announced its agricultural policy, which stressed equitable growth in all aspects of agriculture.*

(xiii) World Bank staff appraisal report of the agricultural research project, 1981;

(xiv) The Minnesota reconnaissance team report on the agricultural research system of Pakistan, 1982;

(xv) ISNAR in 1983 examined the relationships between PARC and the provinces, including those within and among the institutions of the center and the provinces, and made suggestions and recommendations for their improvement. ISNAR also examined the concepts, organizations and functioning of a selected group of national coordinated research programme (NCRPs).

(xvi) The Sixth Five-Year Plan (1983–88) also emphasizes transforming agriculture from subsistence to export-oriented and making the country not only self-sufficient in agricultural commodities but also to achieve a substantial exportable surplus to improve its foreign-exchange-earning capacity.

(xvii) PARC planned its program in accordance with these exigencies and is making concerted efforts to maximize agricultural productivity, through such measures as providing effective coordination, strengthening research facilities, improving the terms and conditions of researchers, creating adequate training facilities, funding research activities, diffusing improved production technologies, and by creating National Coordinated Research Programs in the commodities and disciplines that are of national economic importance. In 1998, the Pakistani agricultural research system was reorganized at the federal and provincial level, and few changes have occurred since.

(xviii) Agricultural Research Division was abolished in 1993.

a. Establishment of Institutions (Ordinance, Acts) and their Reformation, Transformation and Development

Agricultural research in Pakistan is performed by a wide number of federal/central institutions, provincial agricultural research institutes (ARIs), Agricultural universities at provinces and private sectors/companies. The federal research establishments are involved in basic and strategic research, provincial research institutes are focusing on applied research, agricultural universities are confined to basic research and private sectors/companies (agro-industry) cover fertilizer, pesticides, seed, machinery and involved in adaptive research. The types of agencies involved in agricultural research are briefly described in the following sub-sections:

i. Federal/Central Institutions

About sixteen institutions are established at federal levels which are overseeing their respective part of National Agricultural Research System. These institutions are (i) Pakistan Agricultural Research Council (ii) Pakistan Central Cotton Committee (iii) Pakistan Atomic Energy Commission (iv) Pakistan Science Foundation (v) Pakistan National Accreditation Council (vi) Pakistan Council of Scientific and Industrial Research (vii) Pakistan Council for Research in Water Resources (viii) Pakistan Institute

of Development Economics (ix) Pakistan Forest Institute (x) Center for Applied Molecular Biology (xi) Center of Excellence in Water Resources Engineering (xii) International Water & Salinity Research Institute (xiii) Soil Survey of Pakistan (xiv) Federal Seed Certification and Registration Department (xv) Water and Power Development Authority (xvi) Agricultural Policy Institute (xvii) Higher Education Commission

1. **Pakistan Agricultural Research Council:** The Pakistan Agricultural Research Council (PARC) established in 1981 is the major federal agency responsible for agricultural research and development under the Ministry of Food and Agriculture (MINFA). Very recently PARC has been placed under newly created Federal Ministry of Food Security and Research (MINFSR). Its present charter, under the PARC ordinance of 1981, gives it the authority to head a research system composed of strong provincial and central components that jointly plan and execute priority research programs in the country (ISNAR, 1983). It is semi-autonomous organization. The main functions of PARC are to conduct, support, coordinate, and promote agricultural research throughout Pakistan. PARC also provides training for research staff and acquires and disseminates research information to improve the use of new technologies in the country (Ali and Ashraf, 2006). PARC also generates, acquires and disseminate agricultural information for expeditious utilization of research results. It also creates research establishments to fill in the provincial gaps, and trains high level scientific manpower. It develops its research agenda in accordance with the government policies thus keeps abreast with the requirements of national and international demands. Therefore, PARC has always been contributing towards a prosperous Pakistan.
2. **Pakistan Central Cotton Committee (PCCC):** The Pakistan Central Cotton Committee (PCCC) emerged as incorporated institution on the national horizon in 1948, with broad objective to concentrate its efforts on bringing an improvement in growing, marketing and manufacturing of cotton and cotton by-products through an extensive program of Research & Development (R&D) in all its conceivable aspects. The Committee is semi-autonomous body. It supports research on cotton production and genetic improvement in stations at Multan and Sakrand, and on fiber technology at a laboratory in Karachi. In addition, the committee does promotion and development work on cotton production and marketing. Punjab also has a research station devoted to cotton production and improvement at Multan, adjacent to the central station. www.ccri.org.pk/pccc.htm
3. **Pakistan Atomic Energy Commission (PAEC):** The history of Pakistan Atomic Energy Commission (PAEC) goes back to 1956, when the Atomic Energy Research Council was established. In 1964, 1965 and 1973 reorganization took place and the Atomic Energy Commission was incorporated as a statutory body under an Act, with considerable autonomy. In 1972 the commission was transferred from the Science and Technology Research Division to the President's Secretariat. http://www.paec.gov.pk/paec-hist.htm. PAEC is now the largest S & T organization of the country, both in terms of scientific/technical manpower and the scope of its activities. Starting with a nuclear power reactor at Karachi (KANUPP) and an

experimental research reactor at Nilore, Islamabad (PARR-I), the emphasis in the early years remained focused on the peaceful uses of nuclear energy. Consequently research centres in agriculture, medicine, biotechnology and other scientific disciplines were set up all over the country. As the emphasis shifted towards concerns for national security, important projects were also initiated in this area. Pakistan Atomic Energy Commission is actively working in the field of Agriculture employing Nuclear Techniques at its Agriculture Centres at Faisalabad, Peshawar and Tandojam. http://www.paec.gov.pk/paec-hist.htm

Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad: Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad, is a research and development centre functioning under the auspices of Pakistan Atomic Energy Commission. The project was approved by Government of Pakistan in 1967. Research activity was started in 1970 and the institute was formally inaugurated on April 6, 1972. From the outset, the mandate was to create and maintain new genetic material for sustained agriculture development and to conduct research on applied problems in the field of agriculture and biology using nuclear and other related techniques. NIAB is located on Jhang Road, Faisalabad at a distance of 7 km from the city centre. Its laboratories and related facilities are built on an enclosed area of 60 acres (24 hectares) with an attached experimental farm having an area of 140 acres (56 hectares). http://www.niab.org.pk/

National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad: PAEC has clear mandates on the safe use of modern sciences with an aim to improve the socio economic growth of the country. NIBGE is one of the main biotechnology institutes of the four bioscience centers of PAEC and was formally inaugurated by the President of Pakistan in 1994. It is also an affiliate center of ICGEB. The institute is a focal point of modern biotechnology and provides a technology receiving unit to help the development of country through applications of modern biotechnology and genetic engineering. The research programs at NIBGE are mainly aimed at improving agriculture, health, environment and industry and are supported by national and international financial grants. The institute's research facilities include state of the art equipments supported by technical services, IT facility and a National Library for Biological Sciences. The institute now offers several services and marketable products. The educational programs leading to MPhil and PhD degrees have also been incorporated in the institutes mandate for the development of human resources in modern sciences. http://www.nibge.org/

Nuclear Institute for Food and Agriculture (NIFA), Peshawar: Nuclear Institute for Food and Agriculture (NIFA), one of the four agricultural research institutes of Pakistan Atomic Energy Commission (PAEC), was estblished in 1982. The institute works for the enhancement of crop production and protection, soil fertility, water management and conservation and value addition of food resources, employing nuclear and other contemporary techniques. NIFA is committed to help ensure sufficient, nutritious and environment friendly food production in the country. With its dedication to excellence and continuous improvement in our processes and system, it strives to meet rather exceed the expectations of end-users. It accomplishes

this through human resource development and the use of nuclear and other contemporary advanced research techniques that are commensurate with its resources. http://www.nifa.org.pk/

Nuclear Institute of Agriculture (NIA), Tandojam, Sindh: Nuclear Institute of Agriculture (NIA) is the first agricultural institute of PAEC. It was established forty years ago and was formally inaugurated as AEARC on 22 November, 1963. the institute has been conducting goal-oriented research on agricultural and biological problems, related to improvement of major crops, physiology of plants from different aspects related to enhancement of crop productivity, entomological studies related to development of non-polluting techniques such as biological insect control of crop pests and disease and soil science studies related to chemistry, fertility of soil and efficient use of fertilizer and irrigation. A biotechnology laboratory has been established at NIA in which the efforts are mainly focused on the production of virus free plants of banana. The significant achievement of the institute is the evolution of sixteen high yielding, disease resistant and improved quality varieties of important crops such as wheat (7), rice (4), cotton (2), sugarcane (2) and mungbean (1). These varieties are very popular among the growers and are being cultivated on majority of the area in the province of Sindh. The research work of the institute is regularly published in the renowned national and international journals and in comprehensive annual reports which is a regular feature of the institute since its inception. The present souvenir is being published on the celebration of 40^{th} anniversary of this institute. Every scientist, research worker and supporting staff members deserve congratulations on all the outstanding achievements of the institute, publication of this souvenir and celebration of successful forty years of NIA.

4. **Pakistan Science Foundation (PSF):** Pakistan Science Foundation (PSF) is the apex body for promotion and funding of scientific and technological research and science popularization in the country. PSF has two subsidiary organizations i.e. Pakistan Museum of Natural History **(PMNH)** and Pakistan Scientific and Technological Information Center **(PASTIC)**. The Foundation functions as a link of PMNH/PASTIC agency for the establishment of comprehensive scientific and technological information dissemination centers, promotion of basic and fundamental research in the universities and other institutions/ centers , establishment of science centers, clubs, museums, herbaria and planetaria, promotion of scientific societies, organization of periodical science conferences, symposia and seminars, exchange of visits of scientists and technologists with other countries and grant of awards, prizes and fellowships to individuals engaged in developing processes of consequence to the economy of the country. http://www.psf.gov.pk/
5. **Pakistan National Accreditation Council (PNAC):** Pakistan National Accreditation Council (PNAC) has achieved a milestone of Mutual Recognition Arrangement (MRA) with International Laboratory Accreditation Cooperation (ILAC) and Asia Pacific Laboratory Accreditation Cooperation (APLAC). Now Pakistan is included in the list of countries having equivalent status for accreditation of testing and calibration laboratories all over the world. The Pakistan National Accreditation Council (PNAC) has been established under the administrative control of the

Ministry of Science and Technology, Government of Pakistan as the national apex agency to accredit conformity assessment bodies such as laboratories and certification bodies. The accreditation services of PNAC were launched during the year 2001. To become the most competent accreditation body of the region. PNAC strives for improvement, competence and integrity of conformity assessment bodies by providing them an internationally recognized accreditation service and also promote quality culture, which ultimately benefit the consumers, producers, regulators and other stakeholders. http://www.pnac.org.pk/

6. **Pakistan Council of Scientific and Industrial Research (PCSIR):** "Pakistan Council of Scientific and Industrial Research (PCSIR) was established in 1953 under Societies Act to promote the cause of Science and Technology in the country. Since 1973, it is functioning under the Act of Parliament, which was amended in 1984. Chief Executive of the Council is the Chairman who is appointed by the Federal Government. The 21- member Council is the policy making body of the PCSIR, which is composed of Chairman, three Members of the Governing Body, three Directors of PCSIR Laboratories, four representatives from four ministries, four Directors of Industries, one from each province and six representatives of the industry" http://www.pcsir.gov.pk/about.html.

   "There are eleven Laboratories / Units and five HRD Centres established throughout the country, headed by Director Generals / Directors who directly report to the Chairman. In Head Office 150 officers / staff including 07 Directors are working in different divisions / wings. There are 767 Scientists / Engineers / Technologists working in different Laboratories supported by 742 technicians/skilled workers/supporting staff and 1096 administrative staff". http://www.pcsir.gov.pk/about.html

7. **Pakistan Council for Research in Water Resources (PCRWR):** "The Pakistan Council of Research in Water Resources (PCRWR) was established in 1964, under a resolution and named as Irrigation, Drainage and Flood Control Research Council (IDFCRC) within the Ministry of Natural Resources. It was brought under the control of Ministry of Science and Technology in 1970. The Council was renamed as Pakistan Council of Research in Water Resources (PCRWR) in 1985. The PCRWR is an apex autonomous body established with the objective to conduct, organize, coordinate and promote research in all aspects of water resources. Since its inception, PCRWR has played its role as a national research organization by undertaking and promoting applied as well as basic research in various disciplines of water sector, more specifically, irrigation, drainage, surface and groundwater management, groundwater recharge, watershed management, desertification control, rainwater harvesting, water quality assessment and monitoring, and development of innovative water resource management, conservation and quality improvement technologies, etc". http://www.pcrwr.gov.pk

8. **Pakistan Institute of Development Economics (PIDE):** "The Pakistan Institute of Development Economics was established at Karachi in 1957 and in 1964 accorded the status of an autonomous research organization by the Government of Pakistan. It is devoted to theoretical and empirical research in Development Economics in

general and on Pakistan-related economic issues in particular. In addition to providing a firm academic basis to economic policy-making, its research also provides a window through which the outside world can view the nature and direction of economic research in Pakistan. Other social sciences, such as demography and anthropology and interdisciplinary studies increasingly define the widening scope of research that must be undertaken for proper economic policy and development to have sound underpinnings. Over the past 50 years PIDE has earned an international reputation and recognition for its research. Our faculty is rich and our advisory committee consists of world renowned economists such as Nobel Laureate Robert A. Mundell". www.pide.org.pk

"PIDE is located at the Quaid-i-Azam University Campus in Islamabad, the capital of Pakistan. The campus rests against the backdrop of the Margalla hills on the Potohar Plateau, within a short distance of the remains of Taxila, which once housed the world's oldest university. Archaeological remains discovered in this area show that it has been a center of civilization for some 5,000 years. The Institute, neighbor to several other academic outfits situated in this historic and scenic part of the green foothills of the great South Asian mountain ranges, is the hub of economic and social science research in this part of the world. In November 2006, PIDE was granted the degree awarding status and hence our top priority now is to provide quality education which is affordable but of world class standard in this region along with a truly stimulating learning environment. The advice of PIDE's International Advisory Board is also sought on various aspects of the Institute's academic activities. This Board comprises outstanding scholars (including Nobel Laureates) in the fields of Economics, Demography and Anthropology". www.pide.org.pk

9. **Pakistan Forest Institute (PFI):** "Pakistan Forest Institute (PFI) was established in 1947. It conducts research and imparts education and training in forestry sciences to the nominees of the Provincial Forest Departments and of other agencies such as the Forest Development Corporation. The Forest Products Research Division is a Directorate of Pakistan Forest institute Peshawar, Ministry of Environment Government of Pakistan. This division is providing research and training services to the Government and non-Governmental organizations in the field of Wood Anatomy (wood identification), Timber testing, Wood Seasoning and preservation, Composite Wood Products and Pulp and Paper science and technology. Our aim is to help the local forest products industry in improving the quality of their products by disseminating the recent advances in the field of wood sciences. We fully realize this fact that Pakistan is one of Forest deficient countries. Our research must be focused on the economical uses of our forest resources for the benefits of our peoples". http://ilm.com.pk/admissions/pakistan-forest-institute-peshawar/
10. **Federal Seed Certification and Registration Department (FSC&RD):** "The Seed Industry Project was launched in the country through promulgation of Seed Act, 1976. This enactment provides requisite infrastructure like National Seed Council, Provincial Seed Councils and Federal Seed Certification and Registration Department. The National Seed Council addresses all pursuits of seed both of public or private seed sector organizations. The Federal Government entrusts the Provincial

Seed Councils function within the provincial territories for the purpose of this act. The department regulates and controls the quality seed through crop inspection and seed testing. Seed production/multiplication and distribution is carried out by public and private seed sector organizations like Punjab Seed Corporation, Sindh Seed Corporation (now as Foundation Seed Cell), Agricultural Development Authority, KPK (now as Department of Agriculture Extension and Research), Department of Agriculture Extension, Balochistan and private seed companies". http://www.minfal.gov.pk/.

"Certified seed availability in the country is about 14% in wheat, 60% in cotton, 15.5% in paddy and 15% in maize. The MlNFAL has fixed the seed renewable target at 20% for wheat and paddy, 100% for cotton and 30% for maize. To meet the targets broad based seed policy is required enabling public and private sectors access to the basic seed and equal opportunities of production and marketing crop seeds". http://www.minfal.gov.pk/

11. **Water and Power Development Authority (WAPDA):** "This agency is responsible for the construction and operation of irrigation systems down to the watercourse outlets serving an average of around 150 ha each. In recent years, the Water and Power Development Authority (WAPDA) has done considerable pioneering research in studying the problems of on-farm distribution and use of irrigation water in such systems. Continued studies leading to the more efficient functioning of irrigation system deserve increased attention and support, and the close cooperation of WAPDA and the central and provincial agricultural research agencies. Research on water management aimed at increasing crop productivity and efficiency of utilization of irrigation water should be accelerated through collaboration among WAPDA, PARC, and provincial agricultural research institutions. PARC could encourage and help fund such research" (ISNAR, 1983).
12. **International Water and Salinity Research Institute (IWASRI):** "The International Waterlogging and Salinity Research Institute (IWASRI) was established under Ministry of Water and Power (MOWP) Government of Pakistan in 1986 to conduct and coordinate research pertaining to waterlogging, salinity, irrigation and drainage.
13. **Centre of Excellence in Water Resources Engineering (CEWRE):** "It is realized that training at Bachelor's level is not enough to solve intricate and complex engineering problems being faced in the development and management of water resources. To solve water resources problems, a team of hydrologists, irrigation and drainage engineers, water resources managers, water resources engineers, geologists, economists, social scientists, agronomist, soil scientists and environmentalists is required. The basic training that an engineer receives during his initial degree is limited and cannot cope with the highly specialized and rapid technological advancement in the development and management of water resources. He cannot solve complex water resources problems with the knowledge of the elementary principles learnt in the basic degree programs http://www.cewre.edu.pk/

"The Centre of Excellence in Water Resources Engineering started two M.Phil degree programs in 1979 in the fields of Hydrology (HYD) and Water Resources

Management (WRM). A 3rd M.Phil degree program was started in 1994 in the discipline of Water Resources Engineering (WRE). The degree program in Hydrology was redesigned as Engineering Hydrology (EHY). In addition M.Sc. degree was initiated in the fields of Water Resources Management WRM, Engineering Hydrology EHY, and Water Resources Engineering WRE. The Centre offered a 4th postgraduate M.Sc. degree program in the discipline of Hydropower Engineering (HPE) in 2000. More than 250 students have so far successfully completed M.Sc., M.Phil. and Ph.D. degrees in different programs and presently 80 students are engaged either in course work or research thesis in the four degree programs of the Centre. The Centre's graduates are highly demanding and are employed in national and international organization working in water sector". http://www.cewre.edu.pk/

14. **Centre for Applied Molecular Biology (CAMB):** "In order to build National capability in the, new bioscience, University of the Punjab established a nucleus Centre for Advanced studies in Molecular Biology. In 1986, the Ministry of Education upgraded the University Centre into a National Centre of Excellence in Molecular Biology. In April 1987, the Federal Ministry of Science & Technology (MOST) approved the establishment of a Centre for Applied Molecular Biology (CAMB), located back to back with the laboratory block of the Centre of Excellence in Molecular Biology (CEMB)". http://www.camb.edu.pk/Intro_camb.asp

    "The twin component Molecular Biology Laboratory Complex is spread over 60 acres of land, with a covered area of 7000 square meters including a Laboratory Block, a Teaching Block and a Hostel for Ph.D. Research Scholars. The Laboratory Block is divided into four separate research units comprising a total of 20 Research Labs and four Conference Rooms; one Production Unit ,and one Support Facilities Unit comprising a Lab-aid Section (for washing, autoclaving and media preparation), an Animal House, an Insectary, six large Plant Growth Rooms, and storage space for research materials. The Teaching Block consists of a well equipped Library, Seminar Hall, Photocopy, Photography, Computer Rooms, a Conference Hall, Director's Office and Administration and Accounts section. There is a self-service canteen, a dining hall and 11 rooms in the research scholars hostel. The objectives and functions of the centre are as under: (i) Teaching and training to generate a cadre of manpower specifically trained in molecular biology and recombinant DNA technology. (ii) To undertake goal oriented molecular biological research on specific problems related to economic needs of the country for agriculture, health & medicine, industry, energy and environment sectors. (iii) To create a repository of DNA modifying enzymes, DNA cloning vectors, novel bacterial strains and other such molecular tools for ready availability and use by various (iv) Research groups at this Centre and other DNA research laboratories in Pakistan. (v) To organize National and International seminars and conferences for detailed' discussions on scientific and technological developments, which will lead to new ideas and innovative applications of knowledge in gene cloning and recombinant DNA Technology". http://www.camb.edu.pk/Intro_camb.asp

15. **Agricultural Policy Institute (API) Islamabad:** "The Agricultural Prices Commission (APCom) was established in 1981 through a Resolution of the Ministry of Food, Agriculture and Livestock, Islamabad. It has been declared as an Attached Department of MINFAL in May, 2006. The main responsibility assigned to the APCom is to advise the Government on the price policy of important crops. The Agriculture commodity markets arenot only imperfect but also fragmented. During the post-harvest period, commodity prices in the open market tend to crash to the disadvantage of growers. Small farmers who dominate farm production system in the country neither have adequate storage nor sufficient staying power to hold on to their market able surplus in hope of getting better prices later on, are forced to part with their marketable surplus immediately after harvesting of the produce. In such a situation the farmers, particularly small farmers, are at the mercyof middlemen who tend to exploit the situation to their advantage. In order to safeguard the interest of growers, the government announces the support minimum price of important crops. The supportprice acts as minimum guaranteed price and is designed to provide a floor tothe market, especially during the post harvest period when the market pricestend to crash to un-remunerative levels, particularly in years of good crop" http//www.minfa.api.gov.pk
16. **Higher Education Commission (HEC), Pakistan:** "Under the leadership of the Chairman and Federal Minister, and administrative control of the Executive Director, the Higher Education Commission is divided into various departments, which are headed by Members and Advisors. The purpose of the study was to investigate the problems and prospects of higher education in Pakistan. Higher education plays the role of leadership in the society. The functions of the university are to develop the people physically, mentally and spiritually. It improves and promotes the economic, social, political and cultural life of the nation. All over the world universities are guiding and co-operating with the industrial and agricultural development organizations and they are developing their economics rapidly and meaningfully. In Pakistan, after more than five decades, the developmental indicators are not showing positive results. The participation rate at higher education is about three percent of age group (17-23) and this is 16.2 percent as world average of this age group. The advanced countries are achieving more than 40 percent participation rate in higher education. There are problems of quality of staff, students, library and laboratory. Relevance with society needs, research facilities, financial crisis, arts students more than science students, weaknesses of examination, ineffective governance and academic results are not at par with international standards. Considering the gigantic problems of higher education in Pakistan, the researcher selected this topic for research. The main objectives of the study were: (1) determining the present profile of higher education in Pakistan; (2) examining the past efforts done for the improvement of higher education; (4) highlighting the budget provisions for higher education; and (5) exploring problems of higher education in Pakistan. http://www.hec.gov.pk/

    "Experts dealing with education in the Ministry of Education, Ministry of Science and Technology, Higher Education Commission, Provincial Departments of

Education, university teachers, university administrators, planners, examination experts, university students and community leaders constituted the population of the study. Eight universities were selected randomly for the sample. Twenty university teachers and forty students from each university were included in the sample. Thirty community leaders and fifty experts were also included in the sample. Four questionnaires were developed after pilot testing for the collection of data. The data were collected by the researcher personally. He made many efforts for collection of data from the experts, leaders, teachers and students. Data were tabulated and analyzed using the Likert's five-point scale and chi-square. After drawing the conclusions, some workable recommendations were made for the improvement of relevance, quality, finances, effectiveness and access of higher education in Pakistan. Following conclusions were drawn from responses. (i) access was very limited in universities. (ii) quality was very low in the fields of academic, administration, research and equipment. (iii) faculty and staff need development in knowledge and skills. (iv) funds were provided inadequate and misappropriation was common. (v) character building of the students was ignored. (vi) there was no linkage between university and industry. (vii) examination system was faulty. (viii) good governance was non-existent. (ix) private sector was expanding without merit. Following recommendations were made on the basis of conclusions: (i) Enrolment in universities should be increased by providing adequate all types of educational facilities. (ii) Quality of faculty, staff, students, library, laboratory, research and equipment should be enhanced. (iii) Development of faculty and staff should be ensured through meaningful continuous in-service training. (iv) Funds for higher education should be increased reasonably. (v) Character building of students should be focused. (vi) Linkage between university and industry should be established. (vii) Good governance should be ensured. (ix) More open universities should be established. (x) New disciplines should be started to meet the need of the market. (xi) Night classes should be started with transport facilities. (xii) Summer vacations should be banned. (xiii) Political activities should not be allowed. (xiv) Rules and regulations should be enforced forcefully. Finance Division, Learning Innovation Division, Academics and Co-Curricular Activities, Quality Assurance, Human Resource Development, Research and Development, and Planning and Development. http://www.hec.gov.pk

ii. Provincial Agricultural Research Systems (ARIs)

Pakistan is divided into four provinces. At the provincial government level, agriculture is divided into five fields: crops, livestock and fisheries, food, natural resources (soil water, forestry, and wildlife), and education. Research conducted by the federal government agencies is largely long-term priority research, while the research conducted by the provincial research system is mostly adaptive in nature. Each of the four provinces has a main agricultural research institute (ARIs) under the administrative of the Department of Agriculture. The ARIs are Ayub agricultural Research Institute (AARI), Faisalabad in the province of Punjab, Agricultural Research Institute (ARI), Tandojam province of Sindh; Agricultural Research Institute (ARI), Sariab Queeta in the province of Balochistan and Agricultural Research Institute (ARI), Tarnab Peshawar in province of Khabar Pakhtoon Khah (KPK).

1. **Ayub Agricultural Research Institute (AARI), Faisalabad, Punjab:** AARI is the apex research body at the provincial level. It came into being in 1962 on the bifurcation of the Punjab Agricultural College into separate teaching and research establishments. The Institute has undergone evolution to build-up infrastructure and human capabilities, which has played a vital role in boosting research efforts to meet the needs of burgeoning population and accelerated industrial needs, and serve farming community.

3.1 Agriculture Research Institute (ARI) Sariab, Quetta, is the only multi-disciplinary institute functioning in whole of the Balochistan. This institute was established in 1958 as a Potato Research Station, after the dismemberment of one unit in 1970 the research station was renamed Agriculture Research Institute, Sariab, Quetta.

3.2 Agriculture Research Institute (ARI) Tarnab, Peshawar: In Khyber Pakhtoon Khah (KPK), systematic agricultural research was started in 1908 at Tarnab, Peshawar by the then Govt. which was further strengthened and expanded to the entire Province over the years by formation and establishment of new research stations and institutes. What distinguishes the organization of agricultural R&D in KPK from Punjab and Balochistan is that livestock research in KPK falls under the umbrella of the Department of Agriculture. Second, during the 1980s, under USAID funded TIPAN project, the Agricultural Research Wing of the department was merged with the KPK Agricultural University Peshawar to become the KPK Agricultural Research System. The aim was to improve the quality of agricultural education and research to become more responsive to farmers' needs. Although collaboration between the agencies has increased, the merger of education and research has not been fully successful because of the dual administrative control. The provincial government not only has financial control over the research entities, but also interferes in administrative issues. The university falls under the Ministry of Education and receives its funding from the higher education commission of the federal government.

3.3 Agriculture Research Institute (ARI) Tandojam, Sindh: Agricultural Research under Sindh's Department of Agriculture is less consolidated than in the other three provinces. The Agricultural Research Institute (ARI), Tandojam focuses on crops research except for rice, wheat, and horticulture – for which separate commodity research institutes exist. Livestock research is also separate and falls under the provincial Department of Livestock and Fisheries.

All four provinces have a number of other government agencies involved in agricultural research on areas such as veterinary sciences, water resources, fisheries, wildlife, and environmental issues. Unlike the provinces, Pakistan's federally administered areas (Azad Kashmir and Northern Areas) and the federally administered tribal areas do not have an official research infrastructure as such. Nonetheless, PARC has established the aforementioned KARINA in the Northern Areas. In Azad Kashmir, PARC conducts research through a Technology Transfer Institute in Muzaffarabad.

iii. The Agricultural Universities Systems

There are at present four agricultural universities in Pakistan, namely: (i) The University of Agriculture, Faisalabad, established 1961, on separation of the Faculty of

Agriculture from the Agriculture Research Institute (ii) Pir Mahir Ali Shah Arid Agricultural University, established 1985, on upgrading of Agricultural College Rawalpindi (iii) The Sind Agricultural University, Tandojam, established 1977, on upgrading of the Sind Agricultural College (iv) The KPK Agricultural University, Peshawar, established 1981, with the separation of the Agricultural Faculty from the University of Peshawar.

3.4 The University of Agriculture, Faisalabad: "The foundation stone of the Punjab Agricultural College and Research Institute was laid in 1906 and Sir Louis Dane, the then Lieutenant Governor of the Punjab, formally opened it in 1909. After independence in 1947, the government of Pakistan appointed National Commissions of Food and Education with the terms of reference to review, in all its ramifications, the prevailing agrarian system and to formulate measures for developing the full potential of our agricultural resources. The commissions made a strong plea for establishing an agricultural university, which could play a more vigorous role in promoting research and education in agriculture. Pursuant to these recommendations, the University of Agriculture, Faisalabad, was established by upgrading the former Punjab Agricultural College and Research Institute in the year 1961-1962 and the Faculty of Agriculture originated directly from old Punjab Agriculture College in 1961" http://www.phdeb.org.pk

3.5 Pir Mahir Ali Shah Arid Agricultural University: "This institution was established 1985, on upgrading of Agricultural College Rawalpindi The mandate of the university is to produce high quality agricultural scientists and to form an organised scientific infrastructure for teaching and research for the development of dry land regions of the country, thus minimizing the income gap between the rich and the poor" http://www.phdeb.org.pk.

3.6 The Sind Agricultural University, Tandojam: "Sindh, the fertile Mehran valley, is known for the production of a variety of agricultural commodities. This province of Pakistan was a net exporter of food supplies to the entire sub-continent during nineteenth century. After the completion of Sukkur Barrage system in 1932, need was felt for a thorough agricultural education so as to develop a healthy interest in the millions of hectares of neglected capital thirsty and poorly managed farm land and to equip the people with the necessary technical know-how for maximizing agricultural production.

Efforts in this direction culminated in the establishment of a premier seat of learning in 1939-40 with the name of King George V Institute of Agriculture of Sakrand, Nawabshah district. The institute was later on shifted to its present site in 1954-55 and was redesignated as the Sindh Agriculture College, Tandojam. It was in mid-sixties that the vital importance of agriculture for the economic development became crystal clear to the national planners and policy makers. The understanding that agricultural education is a major activity to foster rural reconstruction and agricultural development resulted in the preparation and approval of a plan for the establishment of an agriculture university for the province of Sindh. Subsequently, an agriculture college was upgraded to the status of an additional campus of Sindh University, Jamshoro, on 1-7-1976 and finally raised to the status of a present full-fledged Sindh Agriculture University under the Act on March 1, 1977.

The university possesses an academic complex of three faculties and Directorate of Advanced Studies and Research. The three faculties are Faculty of Agriculture, Faculty of Agricultural Engineering and Faculty of Animal Husbandry and Veterinary Sciences. Three graduate degree programmes are offered in the three faculties. These include the Doctor of Veterinary Medicine (D.V.M), Bachelor of Engineering in Agriculture (B.E. Agriculture) and Bachelor of Science (Agriculture) Honors in nine disciplines of Agriculture viz. Agronomy, Agricultural Chemistry, Agricultural Economics, Agricultural Education and Extension, Entomology, Horticulture, Plant Breeding and Genetics, Plant Pathology and Plant Protection" http://www.phdeb.org.pk.

3.7 The KPK Agricultural University, Peshawar, established 1981, with the separation of the Agricultural Faculty from the University of Peshawar. Agricultural University, Peshawar includes four faculties (Faculty of Crop Production Sciences; Faculty of Crop Protection Sciences; Nutrition Sciences; Faculty of Animal Husbandry and Veterinary Sciences) and two institutes (Institute of Business and Management Sciences; and Agricultural University Peshawar Schools and Colleges).

iv. Civil Society Institutions

Here, particularly **The Agha Khan Rural Support Program in Pakistan (AKRSP),** the **National Rural Support Program (NRSP**) and the **Punjab Rural Support Program (PRSP)** are two institutions with a long history and successful record. To achieve the desired aggregate impact, their community structure will be greatly expanded to provide complete coverage of the Punjab. The AKRSP was conceived as a unique approach to fostering the development of rural people. Its purpose is to involve the people of three remote districts of Northern Pakistan in their own self-sustaining development, and to provide a model of rural development applicable in other settings.

Filling a gap in government services, AKRSP has done a creditable job with limited resources in assembling and testing new agricultural technologies, but progress has been costly, difficult, and slow. More research and development specifically for the Northern Areas is urgently needed. AKRSP will need to continue in its role as the main technology broker until government line agencies can adequately fulfill their appointed roles. Lack of adequate technology for introduction at the farm level, and insufficient effort to develop technology, are among the commonest problems in rural development. Some of the projects that the Bank has financed have relied almost exclusively on technical aspects, neglecting the incentives for farmers' participation. The broader-based AKRSP model is more balanced, but it needs improved technology as much as any rural development program.

4. ORGANIZATION OF NARS

a. Institutes Involved in the NARS

Pakistan has the 2nd largest agricultural research systems in the SAARC countries with quite large number of scientific manpower. The research system includes approximately 5000 scientists. Although the total number of scientists working in

agricultural research in Pakistan is significantly lower than India. The present agricultural research system comprises essentially four main streams, the PARC the national level, provincial agricultural research institutes, the agricultural universities at the provincial level and several other agencies such as scientific organizations, scientific councils, centre of excellences and various ministries/ departments at the centre and as well as private sectors participate directly or indirectly in the NARS activities in the country. The information on the NARS institutes is given in Table 1:

Table 1. NARS institutes with their administrative status and headquarters

Institutes	**Status and Ministry**	**Headquarters**
1st Stream	**The PARC System**	
1. Pakistan Agricultural Research Council (PARC)	Autonomous, Ministry of Food Security and Research	Islamabad
1.1 National Agricultural Research Centre (NARC)	Establishment of PARC	Islamabad
1.2 Southern Agricultural Research Centre (SARC)	Establishment of PARC	Karachi, Sindh
1.3 Arid Zone Research Centre (AZRC)	Establishment of PARC	Quetta, Balochistan
1.4 Mountain Agricultural Research Centre (MARC)	Establishment of PARC	Gilgit, NAs
1.5 Technology Transfer Institutes (TTIs)	Establishment of PARC	Faisalabad, AJK, Tandojam, Quetta, Peshawar, Gilgit
1.6 Small Ruminants Research Institute (SRRI)	Establishment of PARC	Shoran, Balochistan
1.7 Shaheed Benazir Bhuttoabad Research Stations	Establishment of PARC	Nawabshah, Sindh
1.8 Neelibar Agricultural and Training Station	Establishment of PARC	Burewala
1.9 Hill Agriculture Research and Technology Demonstration Station (HARTDS)	Establishment of PARC	Lehtrar, Rawalpindi
2nd Stream	**Other Scientific Organizations/Councils/Centres of Excellence**	
Pakistan Central Cotton Committee (PCCC)	Min. of Textile Industry, GOP	Karachi

Federal Seed Certification and Registration Department (PSCRD)	MINFA, GOP	Islamabad
Agricultural Policy Institute (API)	MINFA, GOP	Islamabad
Pakistan Atomic Energy Commission (PAEC)	Autonomous body with President of Pakistan	Islamabad, Faisalabad, Tandojam, Peshawar
Pakistan Science Foundation (PSF)	Autonomous with Ministry of Science & Technology	Islamabad
Pakistan National Accreditation Council (PNAC)	Autonomous with Ministry of Science & Technology	Islamabad
Pakistan Council of Scientific and Industrial Research (PCSIR)	Autonomous with Ministry of Science & Technology	Islamabad, Lahore, Karachi, Peshawar, Quetta
Pakistan Council for Research in Water Resources (PCRWR)	Autonomous with Ministry of Science & Technology	Islamabad
Pakistan Institute of Development Economics (PIDE)	Autonomous body with Ministry of Planning	Islamabad
Pakistan Forest Institute (PFI)	Ministry of Environment, Govt. of Pakistan	Peshawar
Center for Applied Molecular Biology (CAMB)	Autonomous with Ministry of Science & Technology	Lahore
Center of Excellence in Water Resources Engineering (CEWRE)	Autonomous body Ministry of Education, GOP	Lahore
Water and Power Development Authority (WAPDA)	Autonomous body Ministry of Water and Power, GOP	Lahore
International Water & Salinity Research Institute (IWSRI)	Autonomous body Ministry of Water and Power, GOP	Lahore
Soil Survey of Pakistan (SSP)	Ministry of Defence, Govt. of Pakistan	Rawalpindi

Higher Education Commission (HEC)	Autonomous body Ministry of Education	Islamabad
3rd Stream	**The Provincial Agricultural Research Systems**	
2.1 Ayub Agricultural Research Institute (AARI), Punjab	Dept. of Agriculture, Government of Punjab	Faisalabad
2.2 Agricultural Research Institute (ARI) Sindh	Dept. of Agriculture, Government of Sindh	Tandojam, Sindh
2.3 Agricultural Research Institute (ARI) Balochistan	Dept. of Agriculture, Government of Balochistan	Sariab, Quetta, Balochistan
2.4 Agricultural Research Institute (ARI) KPK	Dept. of Agriculture, Government of KPK	Tarnab, Peshawar, KPK
4th Stream	**The Provincial Agricultural Universities Systems**	
The University of Agriculture	Autonomous, HEC, MoE	Faisalabad
Pir Mahir Ali Shah Arid Agricultural University	Autonomous, HEC, MoE	Rawalpindi
The Sindh Agricultural University	Autonomous, HEC, MoE	Tandojam
The KPK Agricultural University	Autonomous, HEC, MoE	Peshawar

Description of the NARS Organizations, Their Structural and Functional Outlays

The National Agricultural Research System (NARS) is supposed to generate outputs of public good nature, which can be equally utilized by everyone, but make these especially available to poor sector of the rural communities. It should not only focus on the farm, but also address off-farm issues to diversify incomes of small farmers and provide livelihood to landless laborers. The prevailing NARS in the country is not fully addressing the issues of off-farm to diversify incomes of the small farmers and landless laborers. The division of responsibilities between various components of Agriculture Research System in Pakistan is presented in Figure 1.

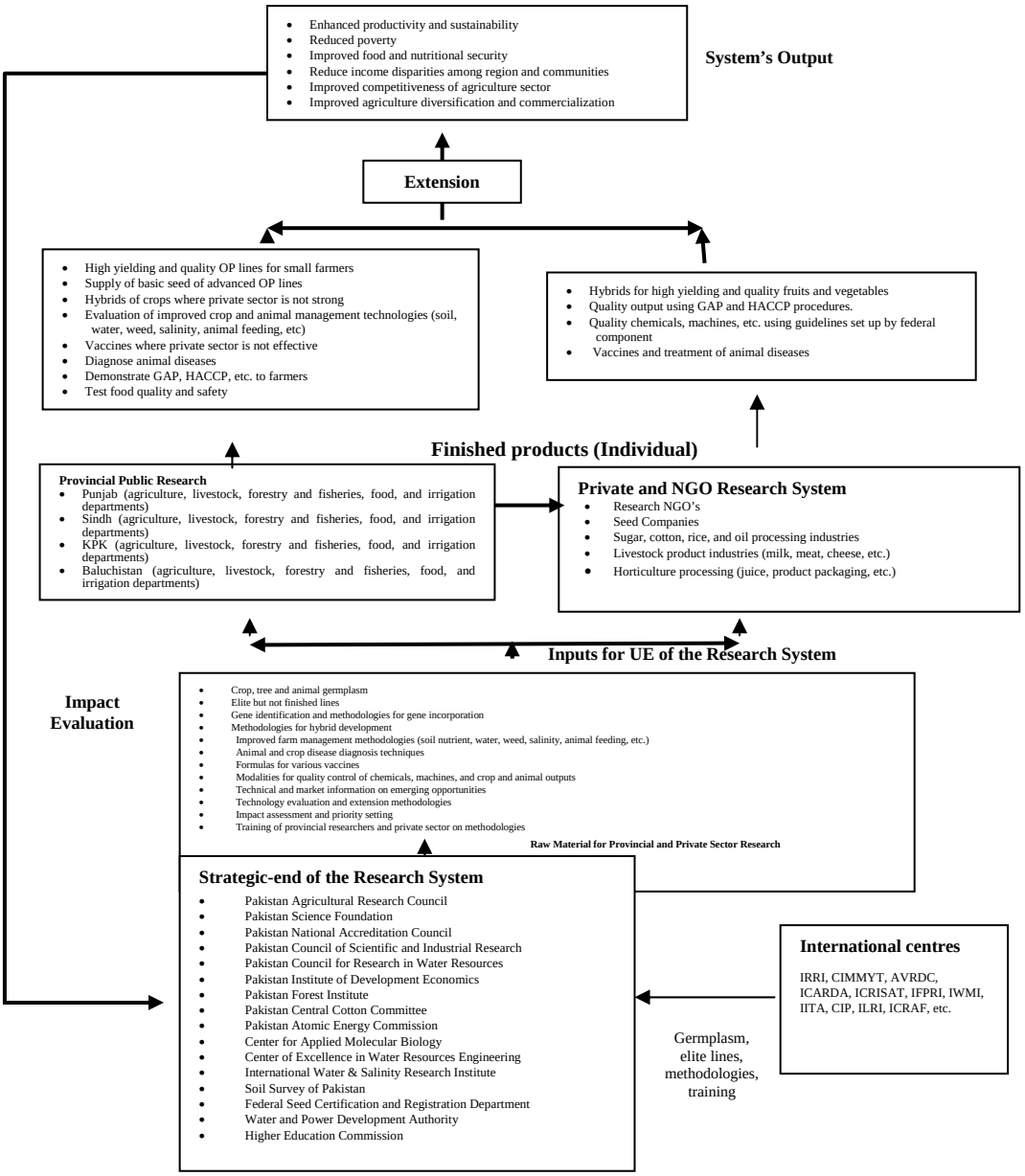

Figure 1. Division of responsibilities between various components of agriculture research system in Pakistan

Source: Adapted from Ali and Ashraf (2006)

The purpose of this section is to narrate the organizations of research, their organizational set-up and responsibilities. The stakeholder agencies involved in agricultural research mainly belong to the Ministry of Food and Agriculture (MINFA), Ministry of Livestock and Fisheries, Government of Pakistan. These ministries are the

highest and central body of the GOP for policy making. Generation of technology is mainly carried out by the NARS headed by PARC at federal level, provincial agricultural research institutes and agricultural universities at the province level.

i. The PARC System – 1st Stream

Although agriculture is a provincial subject, PARC has established many central research institutions since 1981 in order to cater the agricultural research needs of the country. These PARC research establishment are essentially meant for (i) undertake, aid, promote and coordinate agricultural research (ii) expedite utilization of research results (iii) establish research establishments (iv) train high-level scientific manpower (v) generate, acquire and disseminate agricultural information (vi) establish research library (vii) perform any other related functions.

Currently, PARC conducts strategic research on emerging challenges in agriculture and national and provincial priorities. It conducts exploratory research on new commodities and fills the gaps in the provincial research agenda. It provides services to the provincial system in conservation and supply of germplasm, agricultural informatics, and human resource development. It also ensures collaboration and linkages with the provincial and international research system.

PARC has seven major research establishments throughout the country, where it conducts research according to specific agro-ecological needs including the National Agricultural Research Centre, Islamabad; the Southern Zone Agricultural Research Centre, Karachi; the Arid Zone Research Centre, Quetta; the National Tea Research Institute, Mansehra; the Sugar Crops Research Institute, Thatta; the Himalayan Agricultural Research Institute, Kaghan; and the Karakoram Agricultural Research Institute for Northern Areas, Gilgit. NARC has 58 research labs, a national gene bank, and a technical staff of nearly 800 scientists and technicians, including over 100 Ph.D researchers. The organizational chart of the PARC is presented in Figure 2.

Major areas of Council's research include: crops, horticulture and floriculture, agricultural biotechnology, farm mechanization, natural resources, animal sciences, social sciences and agricultural informatics. PARC has contributed tremendous1y through the National Agricultural Research System (NARS) of Pakistan and has assisted in developing more than 264 improved varieties of wheat, rice, pulses, maize, sorghum, millet, fodder, cotton, sugarcane, oilseeds and horticultural crops. Many other varieties are in process as well. Special attention is being given on developing high yielding pest resistant varieties. Besides developing varieties, strengthening of agricultural research programs at the provincial levels, promoting linkages between research, education and extension; and introducing cutting edge technologies are other high priority areas of PARC (PARC, 2006).

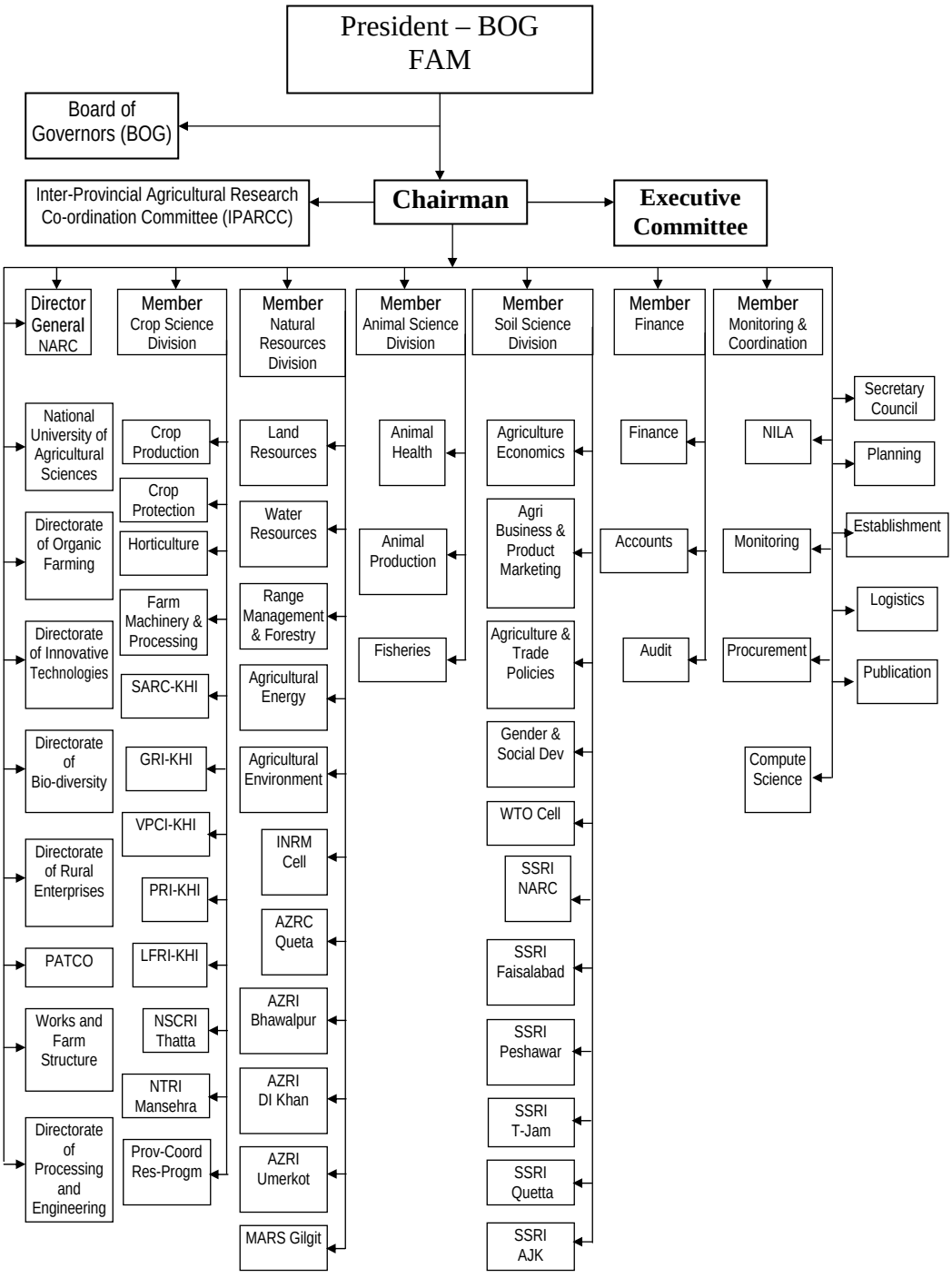

Figure 2. Organizational Chart of PARC

Major achievements of the Council in animal sciences' sector include livestock reproduction capacity enhancement from one to three offsprings per year through embryo transplant technology. Genetic improvement of dairy animals through artificial insemination has increased the milk production three times contributing an additional Rs. 5 billion to the national economy. Hydro pericardium vaccine production technology for poultry has been transferred to private sector with a success rate of 95%. Losses prior to the introduction of this vaccine were estimated at 75 to 80 percent. Annual financial savings during the past 10 years were approximately Rs. 30 billion, due to this vaccine. PARC has played the major role in the diagnosis, and prevention of bird flu in Pakistan. Through the introduction of balanced concentrate feeds, milk and meat production has increased and production cost reduced. Improved varieties of wheat, cotton, rice and sugarcane crops coupled with balanced fertilizer use have resulted in yield increases from 100-170%. Use of chickpea inoculums on large scale in Bhakkar (Punjab) area increased the chickpea yield by 45 to 65%. PARC has successfully undertaken commercialization and indigenization of rain-gun sprinkler and trickle irrigation system/technology (PARC, 2006).

The Cotton Leaf Curl Virus (CLCV) epidemics during 1992 – 94 caused serious havoc. Monetary loss only in 1992 was estimated to be Rs. 2000 millions. PARC scientists on the way to manage the crisis have diagnosed and characterized the virus and its vector. Virus-free potato seed and banana plantlets have been developed by the PARC scientists working at its various institutes. Consequently, seed potato import has reduced to almost nil as compared to thousands of tons in 1980s. Another breakthrough was the introduction of virus-free banana saplings. The Bunchy-top virus had almost eroded banana plantation in Sindh in mid 1990s. Now, this plantation is being replaced by PARC produced virus free banana plantlets in Hyderabad, Thatta and Gharo areas. Work on development of transgenic Basmati rice is also in progress at PARC.

In collaboration with Japan, PARC has established a, state-of-the-art plant genetic resources facility for conservation and exchange of germlasm including collection of seeds of all plants etc. In-vitro conservation facility of vegetatively propagated crops is also available in this institute. Screening of genetic stock for seed born diseases is undertaken along with in-vitro development of rice with bacterial blight resistant gene.

PARC has also developed a state-of-the-art grain quality laboratory to test the quality of the food grains in terms of physical, chemical, microbiological and pathological, pests and diseases, pesticides residues and heavy metals etc. The laboratory is now ISO-17025 certified. In order to minimize the indiscriminate and excessive use of harmful pesticides, PARC is promoting the concept of biological control of insect pests through Integrated Pest Management (IPM) programs for fruits and vegetables. Impact of IPM on cotton crop in six districts of Sindh and five districts in Punjab proved remarkably superior to conventional crop protection techniques. PARC established bio-control laboratories in five sugar mills and provided technical assistance to another eight sugar mills to do so. 100,000 acres around these sugar mills are applied biological control against sugarcane borers (PARC, 2006).

To reduce input costs and to produce health and environment-friendly crops, PARC has given special thrusts on organic wheat and vegetable production based on only EM-compost and humic acid. This year 600 acres of wheat and 65 acres of vegetables are being grown on organic basis at NARC. Intercropping of vegetables on ridge cultivation is also being propagated. Adoption of the concept would increase farmer’s income.

PARC has also developed technology for off-season vegetable production under different economically viable plastic structure which protects the crop from frost and cool wind. Production of early spring vegetables would enhance economic benefit and the span of availability during the year.

Very recently, PARC has initiated to establish two waste-water treatment plants for agricultural use through bio-remediation at NARC with capacity of 70,000 and 16,000 gallons/day, respectively. Feasibility study of used-water treatment facility of Jamshid Colony, Benezirabad (Nawab Shah) with a capacity of 3 – 3.5 million gallon/day has been conducted. Similarly, establishment of PARC/NARC sub-research station at village Neela, Chakwal for demonstration of biological treatment of used-water and solid organic matter for integrated farming is also under consideration. A campaign has been launched to plant fruit saplings and vegetables to cover the spaces available along road sides, green belts etc. in the urban areas including households (backyards, front-yards and other empty spaces). An urban agriculture centre is being established at NARC through public-private partnership to promote, aid and provide technical backup the initiative.

Pakistan is a major tea importer. Tea import to the tune of Rs.12 to 14 billion per annum is quite disturbing and a challenge to all concerned in Pakistan. PARC has been working to enhance indigenous tea production in the country since 1980s. As a result of sustained efforts, the Council has established a big nursery with 1.5 million tea plants. Tea plantation has been established on more than 400 acres at farmers' fields. Farmers and NGOs' workers have been trained in tea cultivation technology. Green and black tea processing plants of 50 kg/day and 1 ton/day capacity, respectively have been installed and private sector is being encouraged to come forward in a big way to help increase the area under tea. MoU was signed with a local company to promote the indigenous tea production and make the country self- reliant in tea. However, more work on this project is needed to make tea cultivation a sustainable and profitable venture for the farmers (PARC, 2006).

Another remarkable achievement of PARC's research and development has been the introduction of European honeybees in Pakistan in the 1980s, which made Pakistan a leading exporter of honey in the region. Now, more than 300,000 bee colonies exist in Pakistan which increased honey production from 4 kg in 1982 to 28 kg per colony per annum in 2009. We also trained around 8000 farmers in modern beekeeping.

Farm Machinery Institute (FMI) under PARC has designed, developed and modified variety of farm mechanization technologies and transferred these to about 30 private sector engineering firms/companies for commercial production. The machines developed by PARC include reaper-windrowers, groundnut-diggers, paddy-threshers and sunflower-threshers. A rice-transplanter has been designed, developed and introduced by PARC to suit the local socio-economic and agro-ecological conditions. It has given satisfactory performance in rice fields of Punjab and Sindh. It is being manufactured by Heavy Mechanical Complex (HMC), Taxila on commercial scale. Tractor mounted reaper-windrower, wheat drill, wheat straw chopper-cum-blower and mobile seed processing units have also been recently developed and introduced. Realizing the importance of straw, FMI has developed wheat and rice clipper-cum-blower, facilitating the farmers to save the uncut and un-chopped wheat straw after combine harvesting of these crops. FMI has also introduced phosphate band placement fertilizer drill, which saves 50% fertilizer.

Covering diverse socio-economic aspects of agricultural research and a wide variety of production technology packages developed by PARC research scientists, the Social Sciences discipline takes care of agri-economics, agribusiness, socio-economics, biometrics, gender development and WTO opportunities and challenges for Pakistan's agriculture. A variety of surveys and studies are conducted every year to gauge the suitability and profitability of various agricultural technologies.

As a result, PARC has more than 100 off-the-shelf available technologies for immediate transfer to farmers through various mass media and technology transfer/extension channels. The new management has desired that the new technologies will be demonstrated at farmers' fields in more aggressive manner so that the technologies developed at PARC research stations disseminates fairly rapidly. Work on such activities is likely to start soon.

PARC has already established a network of Technology Transfer Institutes (TTIs) at Faisalabad, Tandojam, Peshawar, Quetta, Gilgit and Muzaffarabad for efficient transfer of developed technologies and generated knowledge. PARC management realizes that the process of technology transfer will be successful if it is done through closed collaboration with the provincial extension departments. The emphasis is on development and dissemination of site-specific solutions and technology transfer according to local needs of the farming community. PARC has imparted training to about 15000 people (farmers, extortionists, junior scientists, technicians) through 750 organized training courses, published booklets/brochures (300), audios (160) and videos (300) programs, held exhibitions (60), seminars/workshops (70). More than 16000 farmers benefited by PARC helpline.

In this age of information technology where Internet and email has become a household item, PARC also inaugurated its own web site in August 2000. It contains more than 500 pages with more than 160,000 hits by visitors from over 50 countries. The web site has both English and Urdu Sections to cater the information needs of a wide variety of clientele including scientists, researchers, policy makers, planners, students as well as farmers. The site contains 25 English and more than 100 Urdu commodity papers. As mandated, PARC has maintained a National Library for Agricultural Sciences at NARC with more than 25000 books/documents and about 1100 scientific journals.

In line with the new challenges in the WTO regime PARC has established a WTO-Food and Agriculture Related Matters (WTO-FARM) Cell in 2000. The Cell has conducted more than 50 workshops and seminars in close collaboration with key stakeholders across the country to create awareness of WTO regime for food and agriculture. It has also conducted research in this area and published 10 policy research papers, a training manual and a bulletin for farmers. Council has recently obtained post-graduate degree awarding status by establishing National University of Agricultural Sciences (NUAS) which will teach cutting-edge knowledge to students at M.Phil and Ph.D level. PARC has registered a company, PARC Agrotech Trading Company (PATCO), to patent and commercialize the technologies, services and produces developed and provided by the agricultural scientists. It has already started functioning although humbly. PARC oversees a number of institutions that conduct agricultural research in a wide variety of agro-ecological zones within the country. *One of these agencies is National Agricultural Research Centre (NARC); the country's largest in terms of research staff and spending* (NARC, 2009).

National Agricultural Research Centre (NARC): NARC is the largest research institution of the Pakistan Agricultural Research Council (PARC) and is one of the several research establishments of PARC functioning at the federal and regional levels. At the federal-level, NARC is the largest one subsidiary organization of PARC. It was established to support the provincial system by conducting the upstream research and provide raw materials and inputs that can be used in the provincial system to produce the finished products. In particular, research requiring sophisticated instruments like electron microscopes, ultracentrifuges, and elaborate analytical and quality testing facilities is undertaken at NARC, supported by highly qualified and trained manpower. The adaptation of technologies available from the international research systems is also managed by NARC. The location of NARC at Islamabad facilitates liaison with international and national scientists. The coordination of research activities in major crops across the country also became the responsibility of NARC, which was in fact one of the major functions of PARC (Ali and Ashraf, 2006). The goals and purposes for NARC as stated *in* the brochure on the "Agricultural Research System of Pakistan," prepared by the chairman of PARC (1982), from which we quote the following: "The major goal of NARC is to conduct research in areas of national importance where such research is not currently being undertaken, or is seriously inadequate, and it can best be done at a well-equipped, properly staffed and funded central institution, where facilities are available to all scientists in the country".

"Besides laboratory research on selected aspects of plant and animal genetics, pest management, soil and water management, etc., NARC will also have a Training School to impart theoretical as well as practical training in crop production and related techniques to provincial scientists. The training school will conduct special courses on important agricultural commodities and will have the necessary facilities including lecture rooms, laboratories, and experimental fields, besides a cafetaria and hostel for the trainees. Eminent national and international experts on different commodities will teach these courses, which will also include extensive field experiments to be done by the trainees".

"The other facilities at NARC include a reference library and a centralized information service to provide the latest research information to all the research scientists in the country. A centralized facility for repair and maintenance of sophisticated laboratory equipment is also being established at NARC, which will provide service to all the research institutions".

"The repair and maintenance division will have adequate trained staff and technicians to undertake repairs of most of the laboratory equipment in the country. The division will organize training courses to build up the capabilities of the major research institutions to repair their equipment by training a large number of technicians for various institutions. The Agricultural Machinery Division (AMD) will undertake research in developing designs for urgently needed farm machinery in cooperation with the relevant provincial institutions. AMD will develop linkages with the agricultural machinery manufacturers in the country so that the successful designs, after testing in farmers' fields can be manufactured in sufficient numbers and made available to the farmers within a short period".

"The Plant Introduction Centre (PIC) and the National Unit of Plant Genetic Resources (PGR) will also be located at NARC. The main objective of these groups is to collect and preserve the genetic resources of various crops and animals to save them from

extinction in order to transfer their desirable traits for development of high yielding varieties with other desirable characters like resistance to diseases, insects and other environmental stresses. The group will also systematically (arrange to) test exotic plant and animal species under various ecological conditions prevalent in different parts of the country, to select those which could be directly used *by* the farmers with minor modifications. The successful strains/cultures selected *by* PIC will be passed on to the provincial institutions for adaptive research and large scale introduction in their areas".

"Research in Social Sciences related to agriculture will also be concentrated at NARC so that the social scientists could interact with biological scientists and undertake research on various socio-economic problems of different categories of farmers and the agroecological regions. In addition to a strong research group at NARC, small research groups on agricultural economics will also be established in each province to interact and support the applied research on different aspects of agriculture in the provincial institutes".

"NARC will provide a focal point for all the agricultural research scientists of the country to jointly discuss and plan their research activities on different commodities, and to undertake research on common problems, which can best be done at a National Centre rather than at each of the provincial institutions. In particular, research on problems requiring sophisticated equipment like electron microscopes, ultracentrifuges, and elaborate analytical and quality-testing facilities, will be undertaken at NARC. The facilities at NARC will also be available to research scientists of the provincial institutes who will work at the Centre as visiting scientists to use the specialized facilities for undertaking research on their projects, especially when such facilities are not available in their own institutions". NARC is managed by a Director General and assisted by Research Committee and Technical Working Groups (TWGs) for various disciplines. Institutes are managed by Senior Directors/Directors. The NARC is organized into 13 institutes (Figure 3).

Regional Centers: The information about regional centers of PARC as stated *in* Ali and Ashraf (2006) from which we quote the following:

"The center is mandated to conduct research in crops, natural resources, livestock, and agricultural production resources. In addition, NARC test and disseminate germplasm of various food grains, vegetables, and fruit crops. Moreover, maintenance research like Geographical Information System (GIS), developing and maintaining insect (may be in the future weed) museum, etc. are also being established at NARC headquarter. Other research institutes under the PARC umbrella and directly managed by PARC are as follows":

- "National Tea Research Institute (NTRI) is located in Mansehra, Hazara District and conducts research on all aspects of tea production and processing. A large number of MSc and BSc students of the North-West Frontier Province (KPK) Agricultural University conduct thesis-related research on tea cultivation and processing issues".
- "The National Sugar Cane Research Institute (NSCRI) at Thatta in Sindh's delta coastal zone conducts research on the breeding and testing of improved sugarcane varieties".
- "The Karakoram Agricultural Research Institute (KARINA) consists of four affiliated agencies in the Northern Areas and one in the North-West Frontier Province (KPK). Research activities encompass food grains, vegetables, and fruit crops for high-altitude arid areas".

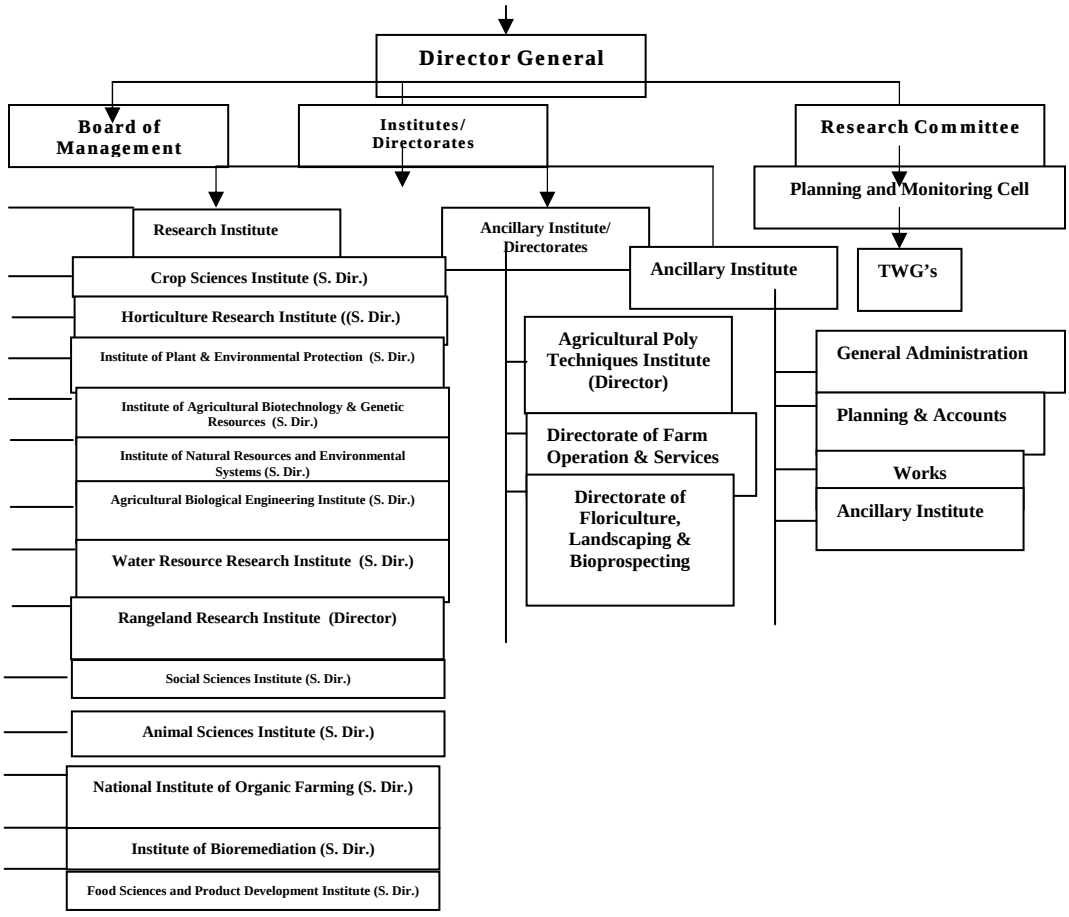

Figure 3. Current Administrative Structure of NARC

- "The Arid Zone Research Centre's (AZRC) headquarters in Quetta, Balochistan has affiliated institutes in the other three provinces. AZRC's research focuses on crops and livestock problems that are related to Pakistan's arid zones".
- "Southern Zone Agricultural Research Centre (SARC): This center is located at Karachi and conducts research on grain storage, pesticide use and control. SARC consists of six research institutes and stations".

"Extension is formally the responsibility of the provincial governments, but with the pretext of weaker linkages between PARC and extension departments, PARC established technology transfer institutes in four provinces (Balochistan, KPK, Punjab, and Sindh) and one each in the federally administrated Northern Areas and *Azad Jammu Kashmir* (AJK). In addition, PARC has three liaison offices (in Karachi, Lahore, and Tarnab)".

ii. Other Scientific Organizations/Councils/Centres of Excellence – 2nd Stream

Other scientific organizations/councils/centres of excellence include the Pakistan Central Cotton Committee, Pakistan Atomic Energy Commission, Pakistan Science Foundation, Pakistan National Accreditation Council, Pakistan Council of Scientific and

Industrial Research, Pakistan Council for Research in Water Resources, Pakistan Institute of Development Economics, Pakistan Forest Institute, Center for Applied Molecular Biology, Center of Excellence in Water Resources Engineering, International Water & Salinity Research Institute, Soil Survey of Pakistan, Federal Seed Certification and Registration Department, Water and Power Development Authority, and Agricultural Policy Institute.

4.1 Pakistan Central Cotton Committee (PCCC): The Committee is semi-autonomous body with the Federal Minister of Food, Agriculture and Livestock as the president. It supports research on cotton production and genetic improvement in stations at Multan and Sakrand, and on fiber technology at a laboratory in Karachi. In addition, the committee does promotion and development work on cotton production and marketing. Punjab also has a research station devoted to cotton production and improvement at Multan, adjacent to the central station. www.ccri.org.pk/pccc.htm

4.2 Pakistan Atomic Energy Commission (PAEC): This organization has four research establishment in the provinces which are focusing on research in agriculture sector. The brief description of these institutes are as under:

Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad: Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad, is a research and development centre functioning under the auspices of Pakistan Atomic Energy Commission. The project was approved by Government of Pakistan in 1967. Research activity was started in 1970 and the institute was formally inaugurated on April 6, 1972. From the outset, the mandate was to create and maintain new genetic material for sustained agriculture development and to conduct research on applied problems in the field of agriculture and biology using nuclear and other related techniques. NIAB is located on Jhang Road, Faisalabad at a distance of 7 km from the city centre. Its laboratories and related facilities are built on an enclosed area of 60 acres (24 hectares) with an attached experimental farm having an area of 140 acres (56 hectares). http://www.niab.org.pk/.

National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad: PAEC has clear mandates on the safe use of modern sciences with an aim to improve the socio economic growth of the country. NIBGE is one of the main biotechnology institutes of the four bioscience centers of PAEC and was formally inaugurated by the President of Pakistan in 1994. It is also an affiliate center of ICGEB. The institute is a focal point of modern biotechnology and provides a technology receiving unit to help the development of country through applications of modern biotechnology and genetic engineering. The research programs at NIBGE are mainly aimed at improving agriculture, health, environment and industry and are supported by national and international financial grants. The institute's research facilities include state of the art equipments supported by technical services, IT facility and a National Library for Biological Sciences. The institute now offers several services and marketable products. The educational programs leading to MPhil and PhD degrees have also been incorporated in the institutes mandate for the development of human resources in modern sciences. http://www.nibge.org/.

Nuclear Institute for Food and Agriculture (NIFA), Peshawar: Nuclear Institute for Food and Agriculture (NIFA), one of the four agricultural research institutes of

Pakistan Atomic Energy Commission (PAEC), was established in 1982. The institute works for the enhancement of crop production and protection, soil fertility, water management and conservation and value addition of food resources, employing nuclear and other contemporary techniques. NIFA is committed to help ensure sufficient, nutritious and environment friendly food production in the country. With its dedication to excellence and continuous improvement in our processes and system, it strives to meet rather exceed the expectations of end-users. It accomplishes this through human resource development and the use of nuclear and other contemporary advanced research techniques that are commensurate with its resources. http://www.nifa.org.pk/.

Nuclear Institute of Agriculture (NIA), Tandojam, Sindh: Nuclear Institute of Agriculture (NIA) is the first agricultural institute of PAEC. It was established forty years ago and was formally inaugurated as AEARC on 22 November, 1963. the institute has been conducting goal-oriented research on agricultural and biological problems, related to improvement of major crops, physiology of plants from different aspects related to enhancement of crop productivity, entomological studies related to development of non-polluting techniques such as biological insect control of crop pests and disease and soil science studies related to chemistry, fertility of soil and efficient use of fertilizer and irrigation. A biotechnology laboratory has been established at NIA in which the efforts are mainly focused on the production of virus free plants of banana. The significant achievement of the institute is the evolution of sixteen high yielding, disease resistant and improved quality varieties of important crops such as wheat (7), rice (4), cotton (2), sugarcane (2) and mungbean (1). These varieties are very popular among the growers and are being cultivated on majority of the area in the province of Sindh.

The research work of the institute is regularly published in the renowned national and international journals and in comprehensive annual reports which is a regular feature of the institute since its inception. The present souvenir is being published on the celebration of 40^{th} anniversary of this institute. Every scientist, research worker and supporting staff members deserve congratulations on all the outstanding achievements of the institute, publication of this souvenir and celebration of successful forty years of NIA.

Pakistan Science Foundation (PSF): This agency is the establishment of comprehensive scientific and technological information dissemination centers, promotion of basic and fundamental research in the universities and other institutions/centers, establishment of science centers, clubs, museums, herbaria and planetaria, promotion of scientific societies, organization of periodical science conferences, symposia and seminars, exchange of visits of scientists and technologists with other countries and grant of awards, prizes and fellowships to individuals engaged in developing processes of consequence to the economy of the country. http://www.psf.gov.pk/

4.3 Pakistan National Accreditation Council (PNAC): The Pakistan National Accreditation Council (PNAC) has been established under the administrative control of the Ministry of Science and Technology, Government of Pakistan as the national apex agency to accredit conformity assessment bodies such as laboratories and certification bodies. The accreditation services of PNAC were launched during the year 2001. To become the most competent accreditation body of the region. PNAC strives for improvement, competence and integrity of conformity assessment bodies by providing

them an internationally recognized accreditation service and also promote quality culture, which ultimately benefit the consumers, producers, regulators and other stakeholders. http://www.pnac.org.pk/

4.4 Pakistan Council of Scientific and Industrial Research (PCSIR): "There are eleven Laboratories / Units and five HRD Centres established throughout the country, headed by Director Generals / Directors who directly report to the Chairman. In Head Office 150 officers / staff including 07 Directors are working in different divisions / wings. There are 767 Scientists / Engineers / Technologists working in different Laboratories supported by 742 technicians/skilled workers/supporting staff and 1096 administrative staff". http://www.pcsir.gov.pk

4.5 Pakistan Council for Research in Water Resources (PCRWR): "The PCRWR is an apex autonomous body established with the objective to conduct, organize, coordinate and promote research in all aspects of water resources. Since its inception, PCRWR has played its role as a national research organization by undertaking and promoting applied as well as basic research in various disciplines of water sector, more specifically, irrigation, drainage, surface and groundwater management, groundwater recharge, watershed management, desertification control, rainwater harvesting, , water quality assessment and monitoring, and development of innovative water resource management, conservation and quality improvement technologies, etc". http://www.pcrwr.gov.pk

"The overall decision-making body of the PCRWR is its Board of Governors (BoG), responsible for the control, direction and superintendence of the affairs of the PCRWR. Technical and Executive Committees assist the Board in its operation. The Federal Minister and Secretary (Scientific and Technological Division), Ministry of Science and Technology are the President and Vice President of the Board respectively. Undertake research on development, management, conservation, utilization and quality of water resources. Develop and maintain National Water Resources Database. Design, develop and evaluate water conservation technologies. Undertake contractual research and provide consultancy services to the private and public sector. Establish liaison and collaborate with other related national and international research and development organizations. Publish scientific papers, reports, periodicals, arrange seminars, training workshops and conferences on water related issues". http://www.pcrwr.gov.pk

4.6 Pakistan Institute of Development Economics (PIDE): "PIDE is located at the Quaid-i-Azam University Campus in Islamabad, the capital of Pakistan. The campus rests against the backdrop of the Margalla hills on the Potohar Plateau, within a short distance of the remains of Taxila, which once housed the world's oldest university. Archaeological remains discovered in this area show that it has been a center of civilization for some 5,000 years. The Institute, neighbor to several other academic outfits situated in this historic and scenic part of the green foothills of the great South Asian mountain ranges, is the hub of economic and social science research in this part of the world. In November 2006, PIDE was granted the degree awarding status and hence our top priority now is to provide quality education which is affordable but of world class standard in this region along with a truly stimulating learning environment. The advice of PIDE's International Advisory Board is also sought on various aspects of the Institute's academic activities.

This Board comprises outstanding scholars (including Nobel Laureates) in the fields of Economics, Demography and Anthropology". www.pide.org.pk

4.7 Pakistan Forest Institute (PFI): "This division is providing research and training services to the Government and non-Governmental organizations in the field of Wood Anatomy (wood identification), Timber testing, Wood Seasoning and preservation, Composite Wood Products and Pulp and Paper science and technology. Our aim is to help the local forest products industry in improving the quality of their products by disseminating the recent advances in the field of wood sciences. We fully realize this fact that Pakistan is one of Forest deficient countries. Our research must be focused on the economical uses of our forest resources for the benefits of our peoples". http://ilm.com.pk/admissions/pakistan-forest-institute-peshawar/

4.8 Federal Seed Certification and Registration Department (FSC&RD): "Certified seed availability in the country is about 14% in wheat, 60% in cotton, 15.5% in paddy and 15% in maize. The MlNFAL has fixed the seed renewable target at 20% for wheat and paddy, 100% for cotton and 30% for maize. To meet the targets broad based seed policy is required enabling public and private sectors access to the basic seed and equal opportunities of production and marketing crop seeds". http://www.minfal.gov.pk/

4.9 Water and Power Development Authority (WAPDA): "This agency is responsible for the construction and operation of irrigation systems down to the watercourse outlets serving an average of around 150 ha each. In recent years, the Water and Power Development Authority (WAPDA) has done considerable pioneering research in studying the problems of on-farm distribution and use of irrigation water in such systems. Continued studies leading to the more efficient functioning of irrigation system deserve increased attention and support, and the close cooperation of WAPDA and the central and provincial agricultural research agencies. Research on water management aimed at increasing crop productivity and efficiency of utilization of irrigation water should be accelerated through collaboration among WAPDA, PARC, and provincial agricultural research institutions" (ISNAR, 1983).

4.10 International Water and Salinity Research Institute (IWASRI): "The International Waterlogging and Salinity Research Institute (IWASRI) was established under Ministry of Water and Power (MOWP) Government of Pakistan in 1986 to conduct and coordinate research pertaining to waterlogging, salinity, irrigation and drainage. The administrative control of IWASRI was given under WAPDA. The Member (Water) WAPDA is Chairman of the Executive Committee of IWASRI. The Institute works under the general supervision and guidance of Board of Directors. The Secretary MOWP is Chairman of the Board. WASRI has a mandate to conduct research pertaining to waterlogging, salinity, irrigation and drainage and water management. The basic objective of IWASRI is to unify and coordinate research; to develop economical solutions to problems of Waterlogging and Salinity and to disseminate these solutions to beneficiaries. The Institute forms the nucleus for research in the field of waterlogging and salinity and is now recognized as an International Research Institute". http://www.wapda.gov.pk/pdf/5IWaterloggingSRI.pdf

4.11 Centre of Excellence in Water Resources Engineering (CEWRE): "The Government of Pakistan established the Centre of Excellence in Water Resources Engineering (CEWRE) in 1976 as a semi-autonomous institution of higher learning under the control of Higher Education Commission and the Ministry of Education, Government of Pakistan. The Centre is academically affiliated with University of Engineering and Technology, Lahore, which awards degrees to Centre's graduates". http://www.cewre.edu.pk/

"The Centre of Excellence in Water Resources Engineering started two M.Phil degree programs in 1979 in the fields of Hydrology (HYD) and Water Resources Management (WRM). A 3rd M.Phil degree program was started in 1994 in the discipline of Water Resources Engineering (WRE). The degree program in Hydrology was redesigned as Engineering Hydrology (EHY). In addition M.Sc. degree was initiated in the fields of Water Resources Management WRM, Engineering Hydrology EHY, and Water Resources Engineering WRE. The Centre offered a 4th postgraduate M.Sc. degree program in the discipline of Hydropower Engineering (HPE) in 2000. More than 250 students have so far successfully completed M.Sc., M.Phil. and Ph.D. degrees in different programs and presently 80 students are engaged either in course work or research thesis in the four degree programs of the Centre. The Centre's graduates are highly demanding and are employed in national and international organization working in water sector". http://www.cewre.edu.pk/

4.12 Centre for Applied Molecular Biology (CAMB): "In April 1987, the Federal Ministry of Science & Technology (MOST) approved the establishment of a Centre for Applied Molecular Biology (CAMB), located back to back with the laboratory block of the Centre of Excellence in Molecular Biology (CEMB)". http://www.camb.edu.pk/Intro_camb.asp

4.13 Agricultural Policy Institute (API) Islamabad: "The Agricultural Prices Commission (APCom) was established in 1981 through a Resolution of the Ministry of Food, Agriculture and Livestock, Islamabad. It has been declared as an Attached Department of MINFAL in May, 2006. The main responsibility assigned to the APCom is to advise the Government on the price policy of important crops. The Agriculture commodity markets arenot only imperfect but also fragmented. During the post-harvest period, commodity prices in the open market tend to crash to the disadvantage ofgrowers. Small farmers who dominate farm production system in the country neither have adequate storage nor sufficient staying power to hold on to their market able surplus in hope of getting better prices later on, are forced to part with their marketable surplus immediately after harvesting of the produce.In such a situation the farmers, particularly small farmers, are at the mercyof middlemen who tend to exploit the situation to their advantage. In order to safeguard the interest of growers, thegovernment announces the support minimum price of important crops. The supportprice acts as minimum guaranteed price and is designed to provide a floor tothe market, especially during the post harvest

period when the market pricestend to crash to un-remunerative levels, particularly in years of good crop". http//www.minfa.api.gov.pk

4.14 Higher Education Commission (HEC), Pakistan: "The purpose of the study was to investigate the problems and prospects of higher education in Pakistan. Higher education plays the role of leadership in the society. The functions of the university are to develop the people physically, mentally and spiritually. It improves and promotes the economic, social, political and cultural life of the nation. All over the world universities are guiding and co-operating with the industrial and agricultural development organizations and they are developing their economics rapidly and meaningfully.

In Pakistan, after more than five decades, the developmental indicators are not showing positive results. The participation rate at higher education is about three percent of age group (17-23) and this is 16.2 percent as world average of this age group. The advanced countries are achieving more than 40 percent participation rate in higher education. There are problems of quality of staff, students, library and laboratory. Relevance with society needs, research facilities, financial crisis, arts students more than science students, weaknesses of examination, ineffective governance and academic results are not at par with international standards. Considering the gigantic problems of higher education in Pakistan, the researcher selected this topic for research.

The main objectives of the study were: (1) determining the present profile of higher education in Pakistan; (2) examining the past efforts done for the improvement of higher education; (4) highlighting the budget provisions for higher education; and (5) exploring problems of higher education in Pakistan. http://www.hec.gov.pk/

b. The Provincial Agricultural Research Systems --- 3rd Stream

All of the four provinces have agricultural research institutes which are supported and directed through the provincial ministries of agriculture.

4.15 Ayub Agricultural Research Institute, Faisalabad: The institute has 22 directorates and 10 sections. The main campus is located at Faisalabad, and comprises directorates and research sections in both crops and allied subjects besides–setlite research institutes and research stations functioning in specific agro-ecological zones in the Punjab Province. The organizational structure of AARI, Faisalabad is presented in Figure 4.

4.16 Agricultural Research Institute, Tandojam: Agricultural Research under Sindh's Department of Agriculture is less consolidated than in the other three provinces. The Agricultural Research Institute (ARI), Tandojam focuses on crops research except for rice, wheat, and horticulture – for which separate commodity research institutes exist. Livestock research is also separate and falls under the provincial Department of Livestock and Fisheries. The organizational structure of ARI, Tandojam is presented in Figure 5.

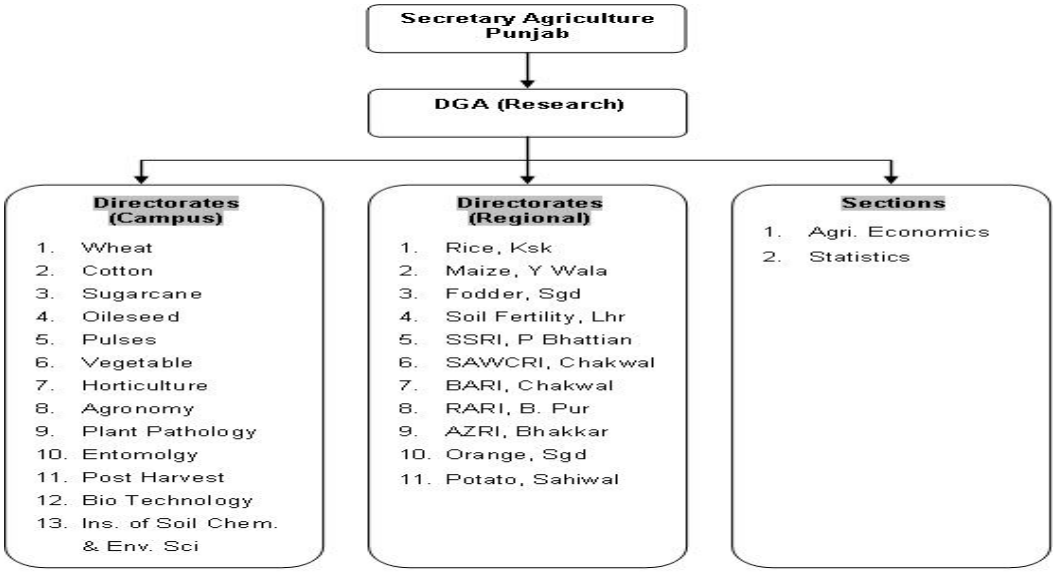

Figure 4. Organizational Structure of AARI, Faisalabad

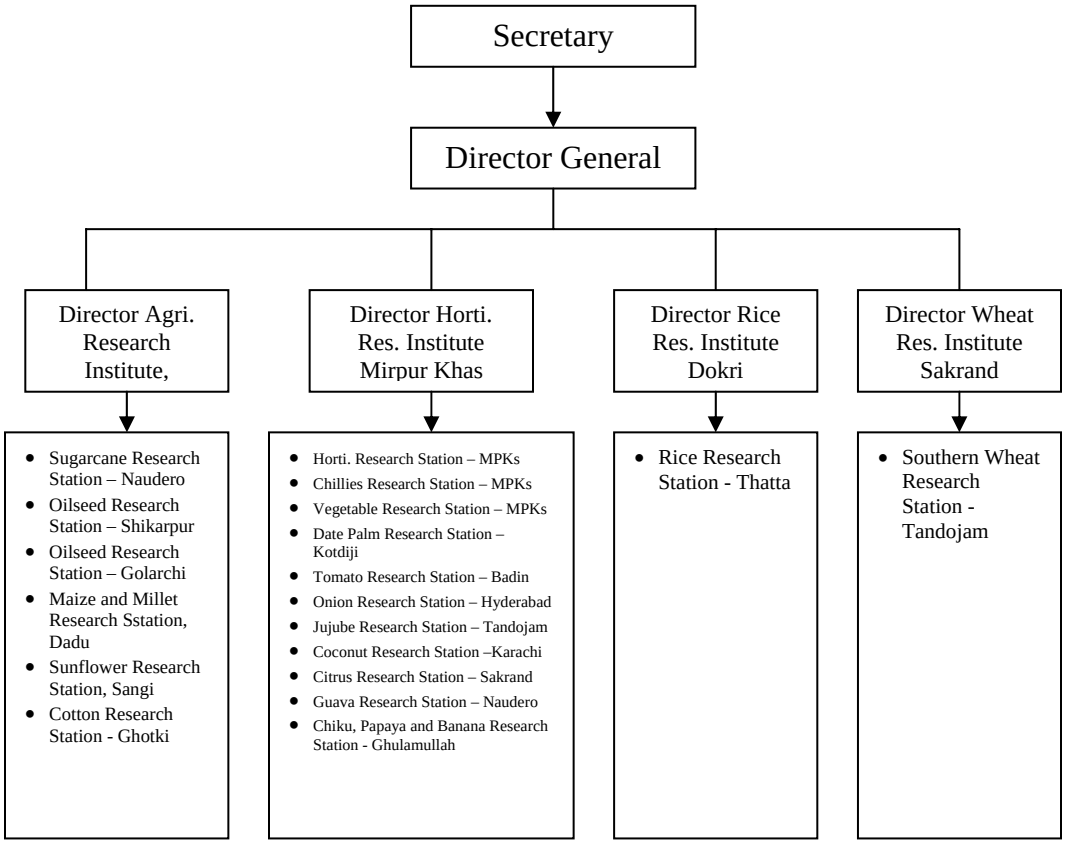

Figure 5. Organizational Structure of ARI, Tandojam

4.17 Agriculture Research Institute (ARI), Tarnab, Peshawar: It has a network of 13 Agriculture Research Institutes/stations with several substations is functioning in the province under the supervision of Director General Research (BPS-20). The Outreach Directorate is headed by Director Outreach, which promote and transfer improved technology to the end users. Research institutes/station can be split into two categories, one with the mandate of research on multiple disciplines, Agriculture research Institutes Tarnab, Dera Ismail Khan Research Mingora and Agriculture Research Station Baffa, Mansehra falls under this category.

The other category is of commodity institutes/stations like Cereal Crops Research Institute, Pirsabak, Sugar Crops Research Institute, Mardan. In 1980's, Government of KPK according to an agreement signed with US-AID, under Project Transformation and Integration of Provincial Agricultural Network (TIPAN), handed over the Agricultural Research Wing of Agriculture Department to KPK Agricultural University, Peshawar, which was later called KPK Agricultural Research System. This arrangement was made with the aim to enhance quality of agriculture education and research according to the need of farming community. This System is working under KPK Agricultural University, Peshawar administration and financed by the Government of KPK.

The following Institutes/Stations are established in the Province under Agricultural Research System KPK: (i) Agricultural Research Institute, Tarnab, Peshawar (ii) Agricultural Research Institute, D.I.Khan (iii) Cereal Crops Research Institute, Pirsabak, Nowshera (iv) Sugar Crops Research Institute, Mardan (v) Agricultural Research Station Mingora, Swat (vi) Barani Agricultural Research Station, Kohat (vii) Agricultural Research Station, Baffa, Mansehra (viii) Livestock Research Station, Jaba, Mansehra (ix) Potato Research Centre, Abbottabad (x) Agricultural Research Station, Chitral (xi) Agricultural Research Station, Serai Naurang (xii) Agricultural Research Station, Ahmad Wala, Karak (xiii) Livestock Research and Development Farm, Surezai, Peshawar (xiv) Directorate of Outreach, KPK Agricultural University, Peshawar.

4.18 The Agriculture Research Institute (ARI) Sariab, Quetta: It is the only multi-disciplinary institute functioning in whole of the Balochistan. This institute was established in 1958 as a Potato Research Station, after the dismemberment of one unit in 1970 the research station was renamed Agriculture Research Institute, Sariab, Quetta. Presently this Institute comprises of: (i) Directorate of headquarters (ii) Directorate of Agriculture Research Fruit (iii) Directorate of Agriculture Research Tropical Fruit (iv) Directorate of Agriculture Research Soil & Water Testing (v) Directorate of Agriculture Research Water Management (vi) Directorate of Agriculture Research Oil Seed and Cotton Crops (vii) Directorate of Agriculture Research Vegetable & Potato Seed (viii) Directorate of Agriculture Research Cereal Crops (ix) Directorate of Agriculture Research Fodder Pulses and Cereal Crops (x) Directorate of Agriculture Research Plant Protection (xi) Directorate of Agriculture Research Economics & Marketing.

c. The Provincial Agricultural Universities System --- 4th Stream

The organizational structure of University of Agriculture, Faisalabad includes Faculties (Faculty of Agriculture; Faculty of Veterinary Science; Faculty of Sciences; Faculty of Animal Husbandry; Faculty of Agricultural Engineering & Technology; Faculty of

Agricultural Economics and Rural Sociology; and Division of Education & Extension) Institutes (Institute of Horticultural Sciences; National Institute of Food Science and Technology; Institute of Soil & Environmental Sciences; and Institute of Animal Nutrition & Feed Technology) and Directorates (Directorate of Academics; Directorate of Advanced Studies; Directorate of CABB; Directorate of Students Affairs; Directorate of External Linkages; Directorate of Research; Directorate of Sports; Directorate of Water Management Research Centre; and Directorate of Student Financial Assistance and University Advancement).

4.19 The University of Agriculture in Faisalabad (Punjab): It is by far the largest of the four, employing 377 faculty staff in 2003. They spent an estimated 25 to 40 percent of their time on research, resulting in 120 fte researchers. The university's research activities are coordinated through the Directorate of Research, which is also responsible for communication with national and international partners and funding agencies and advises the university's management on all issues related to the promotion of research and its results (Nienke et al, 2007).

4.20 Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi: It includes four faculties (Faculty of Crop and Food Sciences**;** Faculty of Sciences**;** Faculty of Forestry Range Mang & Wildlife**;** and Faculty of Veterinary & Animal Sciences), two institutes (University Institute of Information Technology and University Institute of Management Sciences) and three divisions (Division of Continuing Education; Home Economics; and Women Development).

4.21 Sindh Agriculture University, Tandojam: It includes five faculties (Faculty of Agricultural Engineering; Faculty of Animal Husbandry and Veterinary Sciences; Faculty of Agricultural Social Science; Faculty of Crop Production and Faculty of Crop Protection and two institutes (Information Technology Centre and Institute of Food Sciences and Technology). Sindh Agricultural University (SAU) in Tandojam is the second-largest university in Pakistan in terms of agricultural R&D staff and spending. In 2003, the university employed 73 fte researchers involved in a wide range of crop, livestock, and socioeconomic research themes (Nienke et al, 2007).

4.22 Agricultural University, Peshawar: It includes four faculties (Faculty of Crop Production Sciences; Faculty of Crop Protection Sciences; Nutrition Sciences; Faculty of Animal Husbandry and Veterinary Sciences) and two institutes (Institute of Business and Management Sciences; and Agricultural University Peshawar Schools and Colleges).

5. STATUS OF AUTONOMY AND THE GOVERNANCE OF THE NARS ORGANIZATIONS

a. Status of Autonomy

PARC, PAEC, PSF, PNAC, PCSIR, PCRWR, PIDE, CAMB, CEWRE, WAPDA, IWSRI, HEC and four agricultural universities at provinces are autonomous organizations where PCCC, PSCRD, API, AARI-Faisalabad, ARI-Sindh, ARI-Balochistan, and ARI-KPK are run as government organizations.

b. GOVERNANCE OF THE INSTITUTIONS

As far as the governance of the NARS institutions are concerned, there are many non-uniformities among them. The governance system of these organizations are described briefly here:

i. **Governance of PARC:** PARC is the apex national organization working in close collaboration with other federal and provincial institutions in the country to provide science based solutions to agriculture of Pakistan through its statutory functions. The governance structure of PARC is presented in Figure 6:

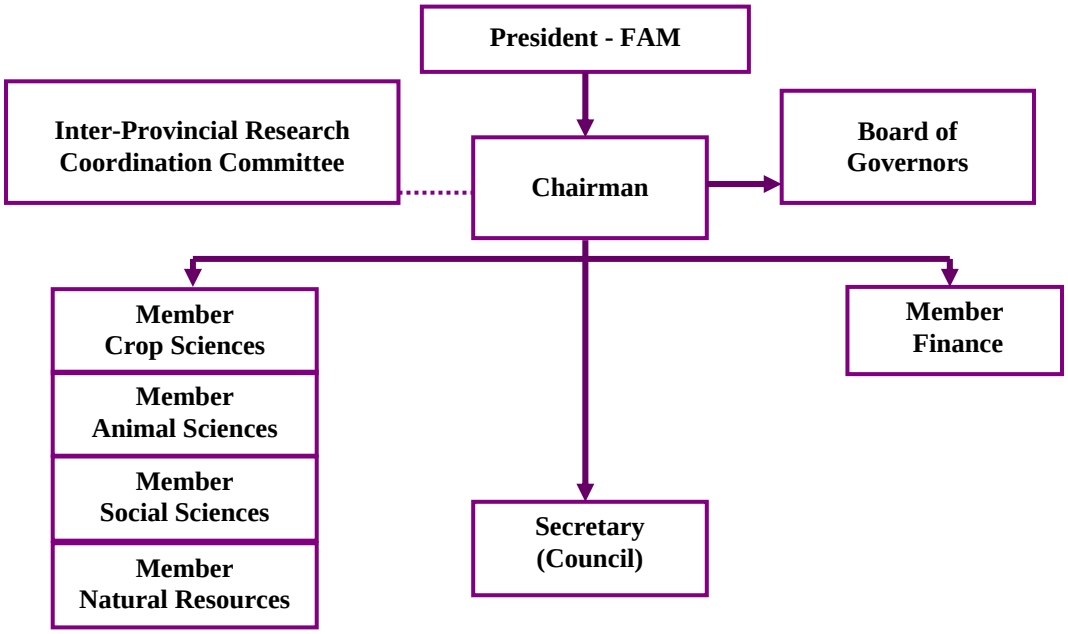

Figure 6. Governance Structure of PARC

The overall decision-making body of PARC is its Board of Governors (BOG) responsible for the control, direction and superintendence of affairs of PARC. The Board is assisted in its operation by a number of Committees. The Federal Agricultural Minister (FAM) is the President of the Board. PARC reconstituted BOG with 15 Members representing all major stakeholders with the approval of President of BOG/FAM in 2007. BOG constituted also 25-Members Inter-Provincial Agriculture Research Coordination Committee (IPARCC), 4 Technical Expert Committees each for Animal Sciences, Plant Sciences, Social Sciences and Natural Resources. BOG is empowered for Administrative and Financial matters.

IPARCC with Chairman, PARC as its convener and Secretary, PARC as the Secretary of this Committee. This is the highest level coordination committee. This committee has 25 members (4 Vice-Chancellors of Agricultural Universities at provinces, 4 Director Generals of Provincial Agricultural Research Institutes, 4 Director Generals of Provincial Livestock and Dairy Development Departments, Director Applied Economics Research Centre Sindh, Chief Economists from Balochistan and Khaber Pakhtoonkhaw and 4

Technical Members of PARC and 1 Member Finance from PARC). Each Technical Expert Committee has 9 experts.

Executive Committee of PARC: Executive committee comprising Chairman and Members of the Council is the principal administrative body responsible for executing all policies and discharging the functions of the Council. Matters relating to research planning, coordination, budget and policy formulation are referred to the Board of seeking its guidance and general direction.

ii. **Governance of PCCC:** The Chief Executive of the Committee is full time Vice President of grade-21 of the Federal Government. He is assisted by the Secretary PCCC in Administrative & Financial matters, and the Directors at the Headquarter and the Institutions in all Technical Aspects. The PCCC is supported by a cess on marketed cotton.

iii. **Governance of PAEC:** PAEC incorporated as a statutory body under an Act, with considerable autonomy. In 1972 the commission was transferred from the Science and Technology Research Division to the President's Secretariat. This is run by the Board of Governor. The President of Pakistan is the Chairman of Board of Governor.

iv. **Governance of PCSIR:** The Governing Body is the executive organ of the Council and comprises of the Chairman and three full-time members viz Member (Science), Member (Technology) and Member (Finance), nominated by the Government. The Head Office of the PCSIR is functioning at Islamabad where offices of the Chairman, Member (Science), Member (Technology), Member (Finance) and Secretary PCSIR are located. The Science Wing is headed by Member (Science), who supervises matters relating to R&D, Training, International Affairs and Scientific Information Services. The Technology Wing is headed by the Member (Technology), who looks after the matters relating to Technology, Industrial Liaison and Civil Works. The Finance Wing is headed by the Member (Finance) who is in charge of activities in Finance and Audit and Accounts Divisions. The Chairman is assisted by the Secretary and Administration and Establishment Wings, working directly under him.

v. **Governance of PCRWR:** The PCRWR is mandated to conduct, organize, co-ordinate and promote research in all fields of water resources engineering, planning and management, so as to optimally use the available land and water resources and to help achieve sustainability in the agricultural sector. The Act of Parliament for establishment of the Pakistan Council of Research in Water Resources received the assent of the President on April 14, 2007. The 1st meeting of the Board of Governors (BoG) was convened on September 17, 2007 at the PCRWR Headquarters, Islamabad. Chaudhary Naurez Shakoor Khan, Federal Minister for Science and Technology chaired the 1st meeting of BoG.

The overall decision-making body of the PCRWR is its Board of Governors (BoG), responsible for the control, direction and superintendence of the affairs of the PCRWR. Technical and Executive Committees assist the Board in its operation. The Federal Minister and Secretary (Scientific and Technological Division), Ministry of Science and

Technology are the President and Vice President of the Board respectively. Undertake research on development, management, conservation, utilization and quality of water resources. Develop and maintain National Water Resources Database. Design, develop and evaluate water conservation technologies. Undertake contractual research and provide consultancy services to the private and public sector. Establish liaison and collaborate with other related national and international research and development organizations. Publish scientific papers, reports, periodicals, arrange seminars, training workshops and conferences on water related issues.

vi. **Governance of IWASRI:** The administrative control of IWASRI was given under WAPDA. The Member (Water) WAPDA is Chairman of the Executive Committee of IWASRI. The Institute works under the general supervision and guidance of Board of Directors. The Secretary MOWP is Chairman of the Board. WASRI has a mandate to conduct research pertaining to waterlogging, salinity, irrigation and drainage and water management. The basic objective of IWASRI is to unify and coordinate research; to develop economical solutions to problems of Waterlogging and Salinity and to disseminate these solutions to beneficiaries. The Institute forms the nucleus for research in the field of waterlogging and salinity and is now recognized as an International Research Institute.

vii. **Governance of CEWRE:** The Government of Pakistan established the Centre of Excellence in Water Resources Engineering (CEWRE) in 1976 as a semi-autonomous institution of higher learning under the control of Higher Education Commission and the Ministry of Education, Government of Pakistan. The Centre is academically affiliated with University of Engineering and Technology, Lahore, which awards degrees to Centre's graduates.

viii. **Governance of HEC:** Under the leadership of the Chairman and Federal Minister, and administrative control of the Executive Director, the Higher Education Commission is divided into various departments, which are headed by Members and Advisors. The purpose of the study was to investigate the problems and prospects of higher education in Pakistan. Higher education plays the role of leadership in the society. The functions of the university are to develop the people physically, mentally and spiritually. It improves and promotes the economic, social, political and cultural life of the nation. All over the world universities are guiding and co-operating with the industrial and agricultural development organizations and they are developing their economics rapidly and meaningfully.

c. Governance of Provincial Agriculture Research Institutes

Each provincial research institute is a government department. Secretary Agriculture, each Provincial Government is the Policy Decision Maker. Each provincial research institute is headed by a Director General and has a Research Management Committee (all the Directors of the institutes) as its Governing Body. The basic budget to each provincial institute is provided from the respective provincial government.

d. Governance of Provincial Agricultural Universities

Each university is an autonomous body. The governor of the province is ex-officio chancellor. In the Punjab the Minister of Agriculture is pro-vice-chancellor, while the Ministers of Educations are pro-vice-chancellors in the Sindh and KPK provinces. Each university is headed by a vice-chancellor and has a syndicate as its governing body.

The basic budget for each is provided from central government through the Higher Education Commission, which in turn obtains the funds from the federal government through the Ministry of Education. The faculties of the agricultural universities constitute the largest single pool in the national of agricultural scientific manpower with advance academic training from abroad.

6. ROLE OF PARC IN RESEARCH MANAGEMENT AND ITS COORDINATION MECHANISM

Role of PARC in Research Management

PARC is committed to provide leadership to agricultural research system of the country. Since agriculture is a provincial subject and mainly undertakes applied research through provincial agricultural research institutes and basic research through provincial agricultural universities. PARC through its research establishments spread all over the country undertakes strategic research on national and provincial priority and emerging challenges in agriculture. PARC also conducts exploratory research on new commodities and gaps in provincial research agenda to provide solutions to the existing gaps and emerging problems of national importance.

It provides services to the provincial system in conservation and supply of germplasm, agricultural informatics, and human resource development. It also ensures collaboration and linkages with the provincial and international research system. PARC is managed by a Board of Governors, and is responsible for the overall control and direction of PARC. The Board is assisted by the Research Advisory Committee, which includes representatives from PARC, farmers, politicians, and agricultural business community. The day to day activities of the council is run by Executive Committee (EC) which is consisted of PARC Chairman and five Members of the Council. The five members do not correspond to the above functions of PARC, rather heading the discipline based Division, i.e., Crop, Natural Resources, Livestock, Social Sciences, and Finance and Administration.

The central management of PARC is supported by a number of units, including general administration; personnel; physical plant construction, management and maintenance; procurement; financial management; planning, monitoring, and review; international liaison; scholarships and training; and publicat10n and information. In addition to its headquarters, various institutions under PARC’s umbrella conduct agricultural research in the wide number agro-ecological zones within the country. The role of PARC in the research management and coordination in the NARS of Pakistan is presented in Figure 7.

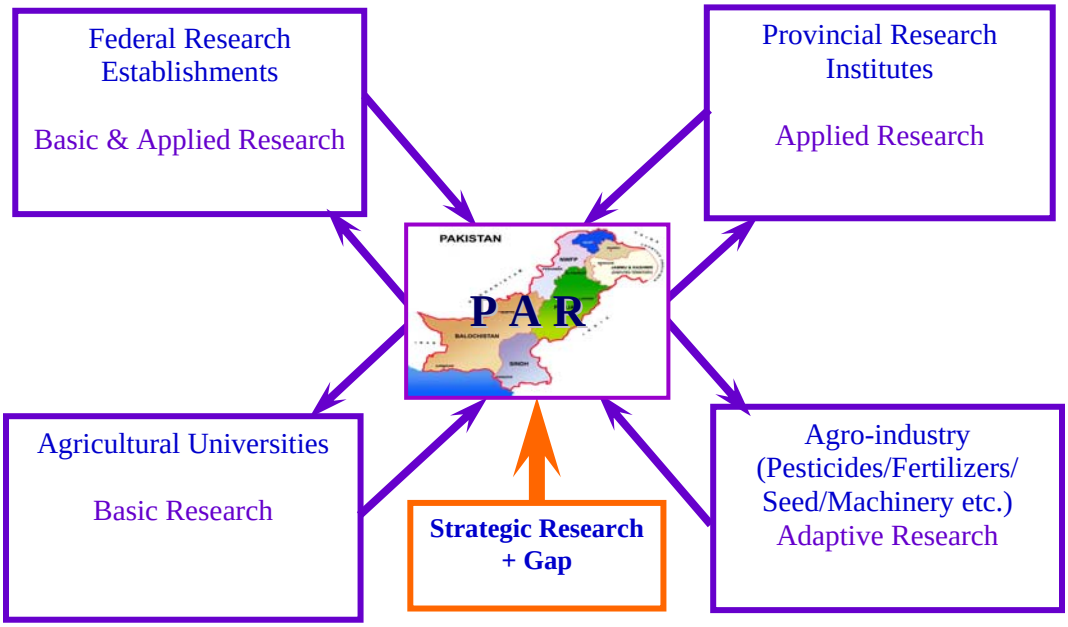

Figure 7. Role of PARC in the Research Management and Coordination of NARS

Role of PARC in Research Coordination

PARC is closely coordinating research activities with special emphasis on: Knowledge Sharing; Germplasm Sharing; Resources Sharing; Joint Planning; and Joint Implementation. PARC coordinates with Federal Institutions and Provincial Research Institutes in different ways some of which are presented below: (i) Board of Governors of PARC constituted the Inter Provincial Agricultural Research Coordination Committee (IPARCC); with Chairman, PARC as its convener and Secretary, PARC as the Secretary of this Committee. This is the highest level coordination committee. PARC also coordinates with various institutes through Technical Expert Committees (TECs). (ii) PARC is also coordinating with other Federal Research Organizations like PSF, HEC, PAEC, etc. through combined research projects. (iii) PARC is also coordinating with all the provinces as well as Azad Jammu and Kashmir by funding different agricultural research projects through a competitive grant system which is mainly financed through Agricultural Linkages Porgramme (ALP) and research for Agricultural Development Programme (RADP). (iv) PARC is also working in various provinces through the Government Funded Projects (Pakistan Sector Development Project (PSDP) and Memorandum of Understanding (MOU), etc. (v) It has its own research centres in various provinces. The major research centres of PARC include: Southern Agricultural Research Centre, Karachi with its sub-centres in various parts of Sindh; Arid Zone Research Institute, Quetta with its sub centres at Bahawalpur, D.I. Khan; Mountain Agricultural Research Station, Gilgit with its sub stations in various parts of Northern Areas. PARC is also in the process of establishing two new research centres at Burewala and Nawab Shah. (vi) PARC also has its Technology Transfer Centres in all the four provinces as well as AJK, through which PARC shares its technologies with the provincial extension departments as well as directly with the farmers. (vii) PARC also used to have National

Coordinated Programmes in the areas of Wheat, Rice, Fodders, Pulses, Sugarcane, Maize, Oilseeds, Fruits, Vegetables, Potato through which annual joint research planning was done in all these fields with the provincial scientists. (viii) PARC also used to coordinate with provincial scientists through traveling seminars in all the above mentioned areas. In the field of Animals Sciences PARC ran the national coordinated projects in the fields of Large Ruminants Breeding as well as Small Ruminants Breeding. (ix) PARC also coordinates with whole of Pakistan through the arrangements of National Uniform Yield Trials (NUYT) for various crops, through which different varieties of crops are developed. (x) PARC also provides trainings in various fields to the provincial scientists as well as the farmers. (xi) The international and national research coordination is presented in Figure 8:

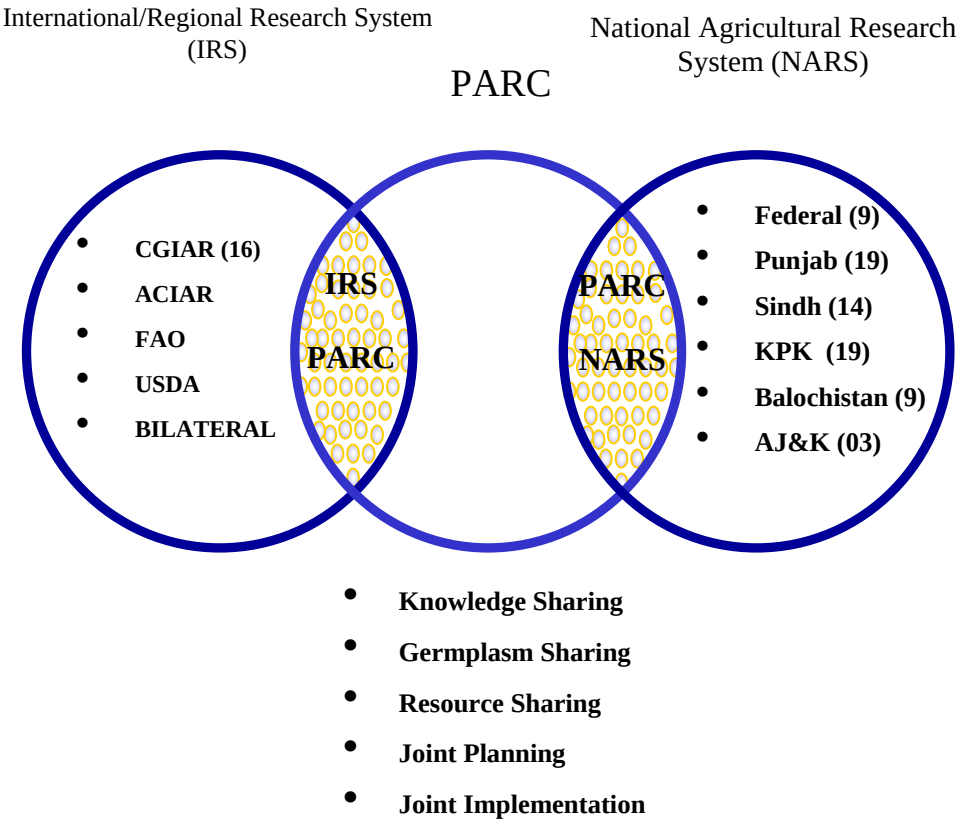

Figure 8. National and International Research Coordination

7. PROSPECTS, CHALLENGES AND WEAKNESSES OF PARC

Policy makers and donor agencies are deeply concerned about problems and issues facing agriculture research system and affecting its overall performance. Many reports were written in the past and main ones are: (i) Rationalization of the Agriculture Research System: A Proposed Agenda for Action. FAO-GoP (October, 2002) (ii)

Agriculture Knowledge and Information System for Rural Development in Pakistan: A Case Study by FAO. (November, 2002) (iii) PARC: Organization and Management Study for the Institutional Reforms of the National Agricultural Research System. (April, 2002) (iv) Strategic Environment for Research: Environment Analyses and Strategy for NARC. ISNAR (2003) (v) National Agricultural Research System: Five Year Plan (2005-2010). Report of the Sub Working Group on Agricultural Research System (October, 2004).

The major problems/issues identified in the present Agricultural Research System are: (i) Lack of Effective Autonomy (ii) Inadequate Funding (iii) Weak Coordination (between federal and provincial, federal/federal & provincial/provincial institutions) (iv) Lack of Incentive Framework (v) Poor Transfer of Technology to Farmers (vi) Overlapping Role of PARC and its Centers (vii) Over-staffing and lack of Professionalism in Admin. & Finance (viii) Over-bureaucratization of Admin and Financial Procedures.

The future research strategy is as under: (i) Science-based technologies for improved agricultural productivity and profitability at farm level - Per unit of land, water, labour and capital (ii) Diversification into high value crops (iii) Post harvest technologies and value-chain (iv) Export competitiveness and WTO compliance (v) Sustainable management of resources (land, water etc.) (vi) Capacity-building of NARS (vii) Transfer of technologies to farmers (new approaches, methodologies).

The research priorities are as under: (i) Emphasis on farming system approach (ii) Emphasis on the quality and diversification of genetic stock (iii) Increased use of biotechnology (iv) Productivity improvement per unit of land, water, labour and capital (v) Emphasis on high value agriculture and value-chain (vi) Improved export competitiveness (vii) Sustainability of resource use (land, water and range) (viii) Impact of climate change.

The prospects of organization and management of PARC are as under: (i) Improving governance in operational and financial management (ii) Emphasizing basic & strategic research (iii) Catalyzing scientific & technological advances (iv) Nurturing ‘science ethics’ and rewarding innovativeness (v) Promoting merit-based recruitment/career progression system (vi) Acting as a resource centre of knowledge and policy on Agri. Research and Development in the country.

8. DECENTRALIZATION OF AUTHORITY ACROSS THE NARS

PARC is an autonomous research organization to promote sciences and technology programmes in agricultural research in the country. Chairman, PARC is the Chief Executive of the Council. The Chairman may, delegate such of his powers as he may consider necessary to any officer of the Council. In scientific matter, the Chairman is assisted by 4 Technical Members, 1 each for Plant Sciences, Animal Sciences, Natural Resources and Social Sciences. The member of each division looks after the research institutions falling under his division. The members are technical advisor to the Chairman, PARC. Members ensure effective functioning of the institute through periodic visits to the institute and discussions with the Director and other scientific staff. Members guide both technically and financially to the institutes under his domain. There are 7

Director Generals for 7 research establishment with 1 at NARC and 6 in other agro-ecological zone in the country. These D.Gs operate through respective technical members.

All D.Gs exercise all the power of the head of the centre for the purpose of various rules and regulation of PARC as amended from time to time. There are various Directors under each D.G. All the Directors exercise of the power of head of the institute for the purpose a various rules and regulation of PARC as amended from time to time. The D.Gs and Directors exercise such power for their functioning as are delegated to them by the Chairman, PARC. There are principal investigator running some of the development projects exercise all the power of Incharge of the Project for the purpose of various rules and regulation of the PARC, as amended from time to time.

In the provincial research institute, Secretary Agriculture, Director General's ARIs, Director of the institute, Incharge of the research station exercise of the power of the sector, institute, section and programme respectively for the purpose of various rules and regulation of provincial government as amended from time to time.

Likewise, Vice-Chancellor, Dean, Faculties and Head of Department exercise of the power of the Chief Executive, Faculty and Department respectively for the purpose of various rules and regulation of provincial government as amended from time to time.

9. MODE OF RESORUCE ALLOCATION (Financial, HR, Logistics, Equipments, Infrastructural facilities) AND INVOLVEMENT OF PARC IN RESOURCE ALLOCATION

PARC receive public fund from Government of Pakistan through Ministry of Food and Agriculture (MINFA) for conducting and coordinating agriculture research in the country. Funds requirements for every year detailing of different heads of account both for recurring and non-recurring expenditures are proposed by each institute and centre and submitted to concern division of the council. The proposed funds are thoroughly discussed at the technical division level of the council and funds proposals of each institute/centre aggregated for demand at technical division level. All 4 technical divisions of PARC submit their requirements and it further aggregated at PARC level and submitted to MINFA a main coordinating/supervising body with Government of Pakistan. The MINFA submits total fund requirement along with its own other institutions to the Government of Pakistan for funding. The approved budget from the Government of Pakistan is allocated to the technical divisions of the PARC and they allocate to different centres/institutes accordingly.

10. PRIORITY FIXATION OF RESEARCH

Research priority of NARS Pakistan is approved through long process. The Planning Commission of Government of Pakistan constitute task force and working groups before the start of five year plan to recommend areas of agricultural research in Pakistan. These task force/working groups are further sub-divided into sub-groups in order to identify and proposed topical and future agricultural research thrust based on national and international experiences. Then this becomes the basis for fixing research priority at PARC's technical division level, provincial research institute level and provincial

agricultural university level. The Research Advisory Committee, Management Committee, Technical Working Group also discusses the issues to be addressed and accordingly research programme to be pursued during the financial year.

11. RESEACH PLANNING PROCESS

At the national level, PARC is responsible for planning for strategic research and gap in the field agriculture. At the provincial level, provincial ARIs and provincial agricultural universities are responsible for the planning of applied and basic research. The research projects received from various establishment of PARC, provincial ARIs and provincial agricultural universities are first technically examined by the Technical Working Group (TWG) at institute level. Each institute has its own TWG which meets annually. After examining at TWG levels, these schemes are put up for consideration before the research implementation and management committee (RIMC). After clearance from the RIMC, these projects are put up for the consideration of Research Advisory Committee and then put up for the consideration of inter provincial research coordination committee (IPRCC). After the schemes are examined by IPRCC, they are finally placed before the BOG which approved them.

For the development projects (PSDP, MOUs) are prepared on PC-1 which are examined by TWG. After TWG, the projects are put up for the consideration of RIMC. After the approval from RIMC, the projects are submitted to the Planning Directorate of PARC which put up these projects to MINFA for the approval. If the projects costs are upto the authority of the Federal Secretary Agriculture, then the projects are approved at the MINFA. Otherwise from the clearance from the MINFA projects are put up for the consideration of CDWP in the Planning Commission of Pakistan which approves the projects.

12. RESEARCH SCIENTISTS OF NARC (NUMBER AND EDUCATIONAL QUALIFICATION)

Agricultural research is mainly carried out in the public domain in Pakistan. PARC, provincial ARIs and agricultural universities are the main entity of Pakistani NARS. The precise estimates of scientific staff of federal institutions, provincial ARIs and universities as well as private sectors are not available. The only authentic source for reporting scientific staff engaged in agricultural research is the data generated by Nienke et al. (2007).

During the period 1991–2003, the total number of agricultural researchers in Pakistan's public sector grew slowly, from 3,291 to 3,477, averaging 0.4 percent per year (Figure 9). Most of this growth took place at NARC, where total researcher numbers increased by 75 percent from 287 fte researchers in 1991 to 500 in 2003. This was the result of the filling of longstanding vacant positions following two recruitment freeze periods during 1988–94 and 1996–99. The total number of research staff at PARC was fairly stable during the 1990s, but dropped by more than 20 percent in 2003. This was the result of the departure of 80 research staff at PARC headquarters (a decline of more than 40 percent) during that year. Total fte researcher numbers also declined in the provincial government agencies in the Punjab throughout this period, but there was an increase of

roughly 10 percent at provincial government agencies in Balochistan and Sindh provinces. Researcher totals at KPK remained fairly stable (Figure 10). The institutional composition of public agricultural research staff in Pakistan showed only minor shifts during 1991–2003. The share of NARC rose gradually from 9 to 14 percent, while the Punjab-based provincial government agencies showed a steady decline throughout this period. The share of the remaining institutional categories remained more or less unchanged.

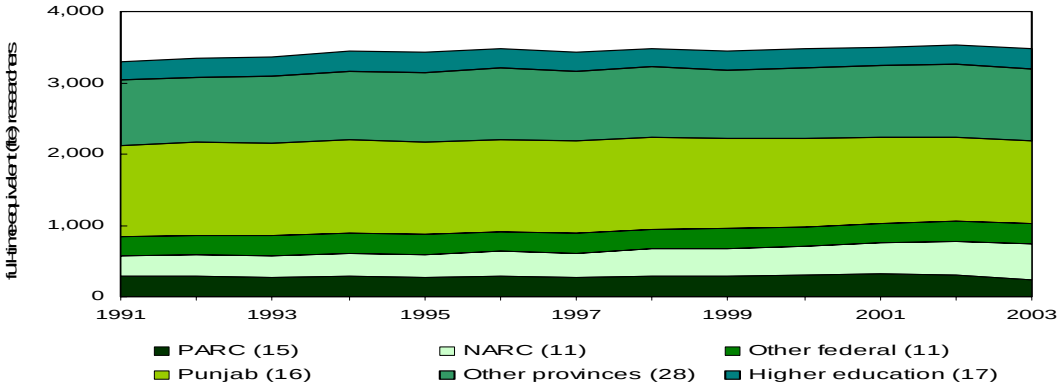

Figure 9. Longterm composition of public agricultural researchers 1991-2003

Source: Nienke et al. (2007).

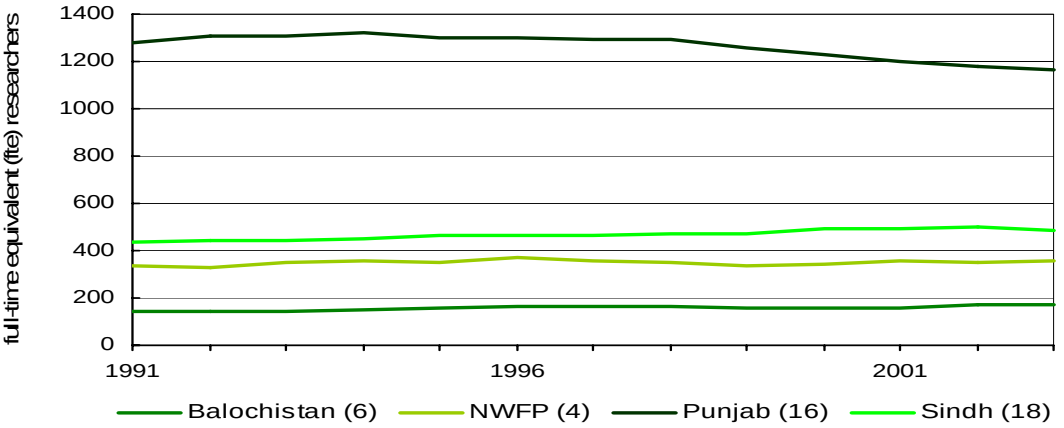

Figure 10. Trends in total research staff at the provincial governments, 1991-2003

Compiled by authors from ASTI survey data (IFPRI–PARC 2003–05).

Source: Nienke et al. (2007).

The estimate of scientists in federal and provincial ARIs, provincial agricultural universities and private sectors is updated approximately during this exercise and presented in table 2.

Table 2. Distribution of scientist in PARC and provincial ARIs

Institutions	Total Agricultural Scientists (2010)	
	Number	Percent
A. Federal Agencies/Institutions		
PARC System – Stream-1	680	13
Other Federal Agencies – Stream-2	653	13
Provincial ARIs – Stream-3	2810	54
Provincial Agricultural Universities – Stream-4	1048	20
Total	**5191**	**100**

Department of Agriculture; Livestock and Dairy Development Department; Forestry, Wildlife, Fishery Department; Planning and Development; Agricultural Engineering

13. REFORMS FOR ENHANCING EFFICIENCY

The major problems/issues identified in the present Agricultural Research System of the country are: (i) Lack of Effective Autonomy (ii) Inadequate Funding (iii) Weak Coordination (between federal and provincial, federal/federal & provincial/provincial institutions) (iv) Lack of Incentive Framework (v) Poor Transfer of Technology to Farmers (vi) Overlapping Role of PARC and its Centers (vii) Over-staffing and lack of Professionalism in Admin. & Finance (viii) Over-bureaucratization of Admin and Financial Procedures.

Reform Agenda for Improving the NARS is covered under the heads of (i) Organization and Management (ii) Administration and Finance (iii) Research Coordination (iv) Human Resource Development (v) Implementation of Reforms Agenda-I and (vi) Implementation of Reforms Agenda –II. The brief description is given as under:

13.1 ORGANIZATION AND MANAGEMENT: (i)Improving governance in operational and financial management (ii) Emphasizing basic & strategic research (iii) Catalyzing scientific & technological advances (iv) Nurturing 'science ethics' and rewarding innovativeness (v) Promoting merit-based recruitment/career progression system (vi) Acting as a resource centre of knowledge and policy on Agri. Research and Development in the country.

13.2 ADMINISTRATION AND FINANCE: (i) Revision of PARC financial and service rules and regulations to enable PARC exercise autonomy (ii) Right sizing to minimize redundancies and overstaffing (iii) Introducing performance based management system (iv) Simplification of procedures (procurement, budgeting, accounting, auditing and administration) (v) Exercising financial prudence and due diligence in all operations (vi) Rationalization and management of satellite offices (vii) Modernization of admin and financial systems and procedures (viii) Changing the role of Administration and Finance Divisions from 'Control and Command' to 'Support Services'.

13.3 RESEARCH COORDINATION: There is a need of improvement in both national and international research coordination. Under national programme the reform agenda is as under: (i) Strengthening coordination with federal & provincial agencies (research, education and extension) (ii) Adequate funding of high priority coordinated programs in strategic/applied research (iii) Increased coordination with HEC/Universities and (iv) Exchange of PARC/NARS scientists to enhance capacity building. Under international programme the reform agenda is as under: (i) Enhancing strategic partnership with IARC/CG system (ii) Attendance at selected international seminars, conferences, training programs and (iii) Improving mechanism of MOU funded projects

13.4 HUMAN RESOURCE DEVELOPMENT: The reform agenda of human resource development includes (i) Rationalization of technical and support staff vis-à-vis workload, skill mix (ii) Career progression, staff development and training (iii) Performance evaluation system and accountability (iv) Transparency in decision making – recruitment and promotions and (v) Enhanced communication at all levels

13.5 IMPLEMENTATION OF REFORMS AGENDA: The implementation of reforms agenda includes internal studies underway which covers (i) Strategic Planning and Research Priorities (ii) Financial and Administrative Regulations (iii) Procurement Procedures (iv) Human Resource Management (v) Grievance and Conciliation Procedures (vi) Review of PSDP Projects to Accelerate Progress and Funds Utilization and (vii) Actions on major issues concerning finance, administration and house keeping of PARC/NARC campuses, security and satellite offices (on-going exercise).

13.6 ACTIVITIES/ACTIONS PLANNED: For the implementation of reform agenda the planned activities and actions includes organization and management study which will focus on (i) Governance Structure (ii) Ordinance, Rules and Regulations (iii) Organizational Structure (iv) Human Resource Development – right sizing, career progression, training and development (v) Strengthening of Coordination/Partnership with the Provinces in Agri. Education, Research and Extension (vi) Strengthening Technology Transfer Mechanism and (vii) Service Delivery and Income Improvement.

14. INVESTMENT TREND IN AGRICULTURAL RESEARCH (TOTAL, CAPITAL, OPERATIONAL AND DONOR SUPPORT)

Nienke et al. (2007) estimated the investment trends in Pakistan. Her findings regarding investment trends are reproduced as such in the following paragraphs.

"Total agricultural research spending for our sample of 98 agencies (excluding the private sector) fell by about one-third between 1991 and 1999, partly because of the completion of various projects at PARC funded by the United States Agency for International Development (USAID) and other donors, and partly due to declining public funding overall (Figure 11). PARC's spending levels rebounded during 1999–2003, largely due to the US-financed Agricultural Linkage Program (ALP). ALP was launched in 2000 and its main objective is to promote and support agricultural R&D activities in accordance with Pakistan's long-term development goals and to promote long-term scientific cooperation between Pakistan and the United States in the agricultural sector (see Financing Public Agricultural R&D section). In contrast, NARC's spending more than doubled during the 1991–2003 period, reflecting growth at most, if not all, of the

center's institutes. The primary cause for this increase was a rise in salary expenditures following the aforementioned hiring of new staff when the recruitment freeze ended. Since 2003, government allocations to federal agricultural research agencies increased slightly, with a sharp increase during the 2006/07 budget period" ----- Nienke et al. (2007).

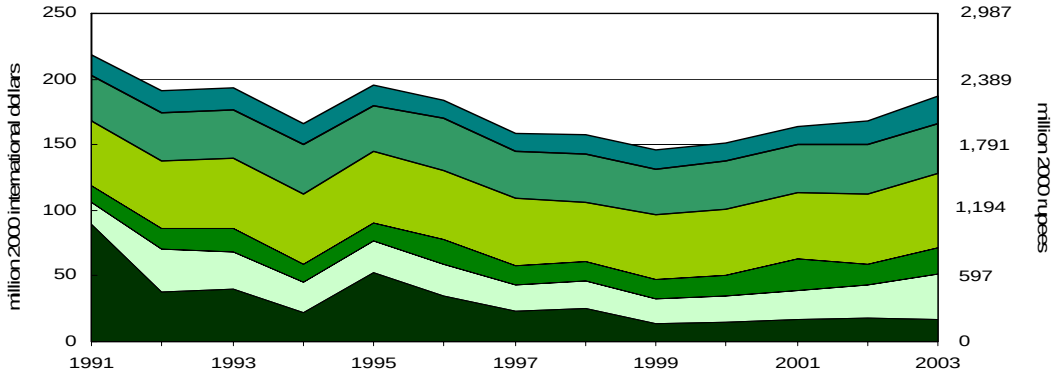

Figure 11. Longterm composition of public agricultural R&D expenditures, 1991-2003

Source: Nienke et al. (2007)

"Total agricultural R&D spending at provincial government agencies in Balochistan and KPK declined slightly during 1991–2003, at rates of 0.4 and 1.4 percent per year, respectively, while spending remained fairly stable in the Punjab and increased by 2.3 percent per year in Sindh throughout the same period (Figure 12). Agricultural R&D spending by the higher education sector grew at an average rate of 0.5 percent per year during 1991–2003" (Nienke et al., 2007).

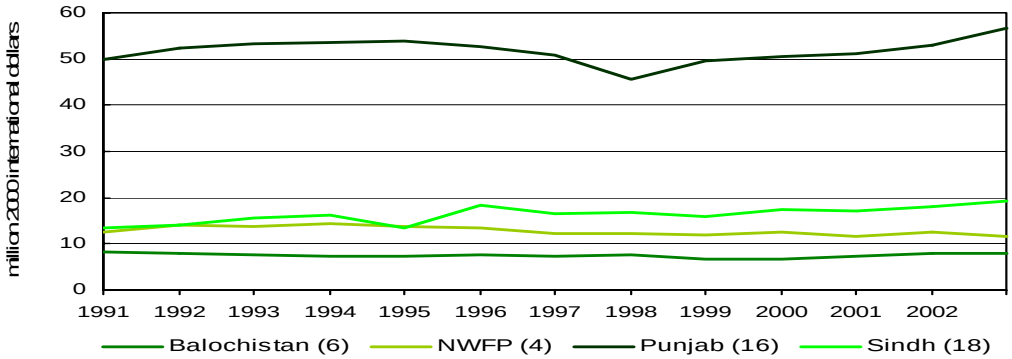

Figure 12. Trends in R&D spending at provincial governments, 1991-2003

Source: Nienke et al. (2007)

Spending per Scientist: "Agricultural R&D expenditures per researcher in Pakistan for our sample of 81 federal and provincial government agencies fell from $66,000 in

1991 to $42,000 in 1999. The federal government agencies' average expenditure showed a rapid decline during 1991–99, due to the aforementioned completion of World Bank and USAID-financed projects. In contrast, average spending at the provincial agencies remained relatively stable throughout this period. After 1999, average spending levels at both the federal and the provincial government agencies showed an upward trend to roughly $54,000 in 2003. "In 1991, provincial government agencies in Balochistan spent an average of nearly $60,000 per scientist, nearly twice the amount than their colleagues in Sindh were spending. During 1991–2003, average expenditure per researcher improved for provincial government agencies in Punjab and Sindh. Their counterparts in KPK and Balochistan, on the other hand, experienced a fall in average expenditure per researcher throughout this period. Therefore, by 2003, the differences in average spending per researcher from one province to the next had become somewhat less pronounced" " ----- Nienke et al. (2007).

15. INSTITUTIONAL GOVERNANCE (Research Management and Governance a the Institutional Level) or (Research Advisory Body, Management Body)

15.1 Sources of Administrative Regulations

Endowments funded from the sale of commodities under the Food for Progress program are used to support agricultural research and development activities in accordance with Pakistan's long-term development goals and to promote scientific cooperation between Pakistan and U.S. agricultural scientists. According to the Department of Agriculture, endowments have been established with the Pakistan Agriculture Research Council ($23 million), the Pakistan Science foundation ($15 million), the University of Agriculture, Faisalabad ($12 million), the Ministry of Agriculture/Economic Wing ($3 million), the Peshawar Agriculture University ($1 million), and the Peshawar Forestry Institute ($1 million). The interest generated on these endowments, which is used for program purposes, reportedly totals about $5 million per year.

Technical assistance exchange programs are used to develop linkages between Pakistani scientists and their counterparts in the United States. During the Green Revolution, many Pakistani agricultural scientists were trained in the United States through funding provided by the U.S. Government under various initiatives. However, according to the Department of Agriculture, the current generation of Pakistani scientists has had few opportunities to develop similar linkages with American scientists, resulting in an overall decline in Pakistan's agricultural research system. The Department of Agriculture plans to expand the number and quality of exchanges between Pakistani and U.S. scientists to improve the capacity of Pakistan's agriculture research system.

One of the outcomes of the May 2009 Afghanistan-Pakistan-United States Trilateral Summit meeting in Washington, DC was the establishment of a Trilateral Secretariat on Agriculture, under which three working groups were agreed upon: Food Security and Applied Research, Water Management, 22 and Trade Corridors. According to the Department of Agriculture, the Secretariat has met and is finalizing budgets and detailed action plans for the first phase of project implementation.

The Department of Agriculture also expects to receive $20 million from USAID to implement an agricultural investment strategy that will build Pakistani Government capacity in the agriculture sector. It is envisioned that the USAID funding will help the Department of Agriculture partner with the Government of Pakistan's Ministry of Food and Agriculture and core agriculture institutions to increase agricultural productivity by building capacity to develop new technologies, improve management practices and institute policy measures that increase economic returns.

15.2 Method of Priority Fixation of Research

Every scientist prepares its own work plan and presents it in the annual meeting of Technical Working Groups (TWGs) of each institute/program. The plan is discussed and revised in the meeting and sent to Research Planning and Monitoring Cell of NARC who forward it to the relevant Technical Committee at PARC. After review they sent back the plan to the institute/program for appropriate revision. After receiving the revision, the plan is sent to Research Committee of PARC which provides a rubber stamp on the program.

15.3 Research Planning Process

Sixteen technical working groups represent the programs and projects of the NARC institutes. The Technical Working Group functions are to assess research terminations and proposals; and set prioritize using established criteria as well as endorse ongoing research activities as well as fresh research proposals to research committee for approval.

There are thirteen technical working groups (TWG) at NARC and the purposes of these TWGs are as under: (i) review progress made on approved research experiments/proposals. (ii) Encourage and advance multidisciplinary research teams and experimentation. (iii) Conduct in-house reviews/seminars to assist proper assessment/monitoring of research projects with appropriate feed back to the RMC. (iv) Ascertain training needs of working scientists in different sectors. (v) Assist RMC compile and communicate research generated information to various clienteles.

In large projects or schemes involving substantial Government of Pakistan funds, research proposals are submitted on prescribed forms (PC-I), and screened by the Technical Committee at PARC. This body is headed by the technical member of the respective division and includes members from PARC/NARC and the provinces. Approved projects are submitted by PARC for the approval by the Secretary, Research Division, Ministry of Food and Agriculture, and then examined by the central development working party (CDWP).

15.4 Management of Outreach Programmes/Installations

The outreach establishments are headed by either Director General/Director for centre/institutes respectively. They are controlled by technical member in case of PARC system. Under provincial agricultural research institutes they are controlled and managed by Director General of the provincial agricultural research institutes. The detail of outreach programmes has already been discussed under research management section.

15.5 Performance Evaluation (Individual Scientist)

Performance of each individual scientist is evaluated through filling up annual confidential reports (ACRs) at the end of each year. The format has been developed by the Government of Pakistan as well as provincial governments. Both federal and provincial ARIs utilize their ARCs for evaluating the individual scientist working either in the federal or provincial research agencies.

15.6 LEADERSHIP DEVELOPMENT

Both federal and provincial ARIs do not have a tradition of developing second line leadership in Pakistan. The normal promotion to higher positions, assignments to specific jobs help in bringing out the talented quality for leadership in a scientist.

15.7 Private Sector Involvement/Partnership with aris

The private sector accounts for only a small share of agricultural R&D in Pakistan. During the 1970s and early 1980s, many agribusiness firms were nationalized and merged under state-owned corporations. It was not until 1988 that the government took a more favorable stance toward private investment, and that the privatization of agricultural enterprises began in earnest. Most private investors are still relatively cautious, however, especially when it comes to investing in research with a long-term payoff (Nienke et al., 2007). Pakistan's political and economic climate, coupled with unresolved intellectual property rights, is still regarded as unfavorable by many private investors (Ahmad and Nagy 2001). We identified 13 private-sector agencies involved in agricultural R&D in Pakistan. In 2003, these agencies accounted for 4 percent of agricultural research staff and 6 percent of agricultural R&D spending. Nevertheless, the share of the private sector involved in agricultural R&D appears to have been rising in recent years, although we do not have time-series data for all agencies in our sample (Nienke et al., 2007).

Nienke et al. (2007) argued that private-sector agricultural R&D in Pakistan ranges from research conducted by local companies to research carried out by multinationals. In 2003, the 13 agencies included in our survey sample employed 128 fte researchers and spent $11 million on agricultural R&D (in 2000 constant prices). Most of the private-sector agencies were small, employing 7 fte researchers or less. Only three companies employed 25 fte researchers or more: the Pakistan Tobacco Company (PTC), Ali Akbar, and Lakson Tobacco Company (LTC).

The Pakistani government has undertaken various steps to increase private-sector involvement in agricultural R&D. The recently launched Science and Technology for Economic Development (STED) program initiates joint projects on the technology-based production of high-value-added goods between research institutions and private-sector companies. Projects should be designed in such a way that they improve or add value to products, enhance productivity, and sustain development through import substitution or export promotion. The STED program is a public–private partnership program where the public sector contributes 75 percent and the private sector 25 percent. Agriculture and biotechnology are among the priority areas of STED. Some of the approved projects include the development of maize hybrids, the establishment of a modern citrus nursery, the production of value-added fruit products, and the production of export-quality cut flowers (PCST, 2007).

15.8 Human Resource Development (Hrd)– Higher Studies/ Training Opportunities

The latest agricultural research manpower survey indicated a total of 4,725 scientists within the Pakistan agricultural research system made up of 455 Ph.Ds, 3,006 MScs, and 1,264 B.Scs [Dukesbury (1990]. The proportion of Ph.Ds to total scientific staff in Pakistan, roughly 10 percent, would be considered very low relative to the proportion in developed countries. The latest figures show a ratio of scientists to population in Pakistan in 1988 at 44 per million down from 60 per million in 1973. Comparable international figures indicate that the USA had 2,360 and the UK 1,400 agricultural scientists per million population. Egypt had 300 agricultural scientists per million population which is 6 to 7 times the number in Pakistan [Mellor Associates (1994)]. The number of agro-ecological zones, the various types of agriculture production systems, and a range of 130 commercial crops that the agricultural research system has to support would on its own suggest that there is a requirement for a greater number and for more qualified scientific and support staff.

During the period 1991–2003, the total number of agricultural researchers in Pakistan's public sector grew slowly, from 3,291 to 3,477, averaging 0.4 percent per year. Most of this growth took place at NARC, where total researcher numbers increased by 75 percent from 287 fte researchers in 1991 to 500 in 2003. This was the result of the filling of longstanding vacant positions following two recruitment-freeze periods during 1988–94 and 1996–99. Nienke et al (2007) studied that the total number of research staff at PARC was fairly stable during the 1990s, but dropped by more than 20 percent in 2003. This was the result of the departure of 80 research staff at PARC headquarters (a decline of more than 40 percent) during that year. Total fte researcher numbers also declined in the provincial government agencies in 14 percent in Punjab throughout this period, but there was an increase of roughly 10 percent at provincial government agencies in Balochistan and Sindh provinces. Researcher totals at KPK remained fairly stable. The institutional composition of public agricultural research staff in Pakistan showed only minor shifts during 1991–2003 (Nienke et al. (2007). The share of NARC rose gradually from 9 to 14 percent, while the Punjab-based provincial government agencies showed a steady decline throughout this period. The share of the remaining institutional categories remained more or less unchanged.

15.9 Research Extension Linkages

The basic function of agricultural extension is to transfer the latest production technologies generated at research institutes and universities to the farmers. During the MTDF, the Provincial Governments were responsible to improve and strengthen the agriculture extension services. The electronic media are supposed to extensively used for broadcasting/telecasting special production packages of different farm operations. A section on transfer of technology need to be established as an integral part of all research institutes to ensure that the latest research findings and packages will be communicated to the farmers. Extension services in each district will establish an adaptive research farm having its own team of mobile extension experts, which will undertake crop maximization/adaptive research programmers.

Trainings/refresher courses will be organized for the extension staff to enhance their knowledge and latest technologies. The Punjab Province is implementing a new approach of farmer's group participation in four districts which will be extended to the whole province in phases. This may be adopted by other provinces. The new system involves a "Group Participatory Approach" aiming at integrated crop management through Training of Trainers (TOT), Training of Facilitators (TOF) and Farmers' Field Schools (FFS) where the farmers will be trained. The success of the new approach lies in its focus on the farmers as decision makers in soil, crops and pest management techniques and the use of non-formal methods using the farmers' fields for training and learning process. Women will be involved in agriculture extension activities.

It being an important instrument to provoke new knowledge for expansion of agricultural productivity, research has been given prime importance. Several MOUs have been signed with China for collaborative research programs which will be undertaken by PARC. New research institutes such as Benazir at Benazirabad (Nawabshah), Neelibar (Vehari), Organic Agriculture (Islamabad), Cotton (Rahim Yar Khan), Mountain Research (Gilgit-Baltistan), Plant Tissue Culture Labs Network, Participatory Research and Development (Sulman Range), Salinity Research (Islamabad), Agriculture Research (Muzzafarabad) and Teaching Research (Balochistan) will be established in coming days. To popularize research technologies, technology transfer units will be established in R&D institutes.

15.10 Education– Link with Agricultural Universities

National Agriculture Education Accreditation Council (NAEAC) was established in 2006 by Higher Education Commission (HEC) vide notification 1-4/AGR/QAA/2006-07 dated February 11, 2006 with the mandate to carry out a comprehensive program of accreditation of agriculture degree programs in private and public sector agriculture education institutions in Pakistan. The over all objective of accreditation is to improve the capacity of institutions in the form of academic and physical infrastructure in relation to the set targets. Accreditation is a mandatory process for all relevant academic programs offered by public and private sector institutions. The purpose of such accreditation is to enhance recognition of the institution in the agriculture community and prospective students/employers. All institutions in Pakistan which provide a recognized agriculture degree are required to apply to the Council to have such degree programs accredited. The NAEAC is responsible for the accreditation of educational programs leading to degrees in the agriculture disciplines. All agriculture degree programs (except veterinary sciences) comprising about fifteen (15) disciplines of agriculture fall under the purview of the Council. The major functions of the National Agriculture Education Accreditation Council are (i) organize and carry out a comprehensive program of accreditation of agriculture programs leading to degrees/diplomas based on approved policies, procedures and criteria, and publish a list of ranking of degree programs. (ii) develop accreditation policies, processes, guidelines, and procedures for program evaluators. (iii) approve the list of evaluators selected through an approved criteria (iv) participate in the process of accreditation of academic programs and constitute Accreditation Inspection Committees (AICs) from approved list of evaluators. (v) develop program evaluator's training

manual/self study material, questionnaire, forms and templates. (vi) collect information and statistics on accredited programs of higher education of agriculture and its respective institutions and publish them as deemed necessary.

15.11 Linkages Between Federal, Provincial and Private Sector Research System

Although both components have different responsibilities, they are synergistically linked with each other to produce the system-level outputs. In fact the efficiency and success of the strategic end of research system (SE) depends on how effectively the users-end of the research system (UE) utilizes its materials, methodologies, models and inputs, while the success of the UE also depends on the relevance of the materials supplied by the SE to the problems of the agriculture sector in different ecologies of the country. The interaction among various components of agriculture research system is presented in Figure 13.

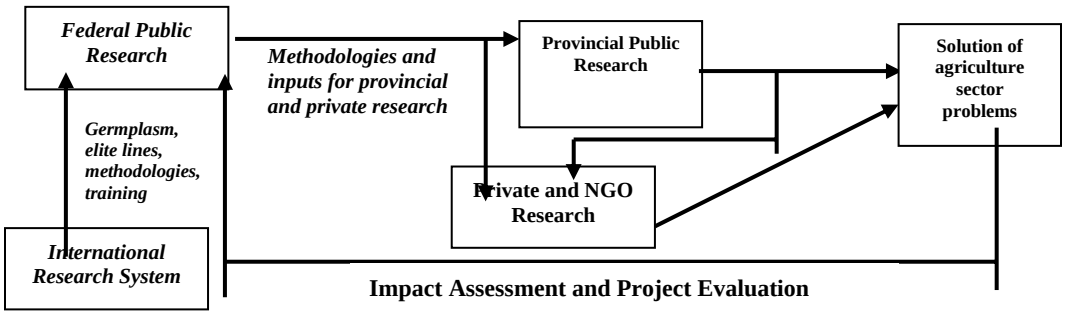

Figure 13. Interaction among various components of agriculture research system

Source: Ali and Ashraf (2006).

To improve the efficiency of each component, it is important to draw boundaries of each component to avoid duplication and confusions and suggest ways to improve the synergistic links between the two components. The agricultural research system is just like a service industry with its defined inputs, activities and outputs. Like any service industry, the structure of the system should be organized on scientific lines so that its employees are motivated and its resources are fully and efficiently employed. For this purpose, inputs (or resources), activities 9or functions), and outputs (or targets) of each production line of the system need to be clearly specified. This study was designed to analyze the structure and operation of the SE component at the federal level that drives the whole system – and to draw boundaries between the federal, provincial and the private continuum of the research system. It is expected that such analysis will improve the efficiency of every component as well as overall efficiency of the whole system.

15.12 Management Information System (Mis)

Management Information System (MIS) has also been institutionalized and a web based ‘Project Monitoring and Evaluation System’ (PMES) has been developed in the Planning Commission for effective implementation through continuous sharing of e-information amongst all stakeholders.

Following progress has been made in MIS during 2009-10:

- Evaluation, Result Base Monitoring (RBM) and Working Paper modules have been incorporated in the Project Monitoring & Evaluation System (PMES)
- PMES software has been successfully operationalized in 21ministries/divisions while other ministries will be looped within two years.
- 1477 Project Directors / Project Officers got the training on PMES.
- PMES currently houses a data base of 1600 development projects and is available online.
- Cash / Work Plans of 592 projects were processed online through PMES.
- PMES facility has also been endowed to the Government of Sindh for reporting implementation on the provincial ADP projects.

PARC has also established a National Agricultural Information System and audio-visual communication facility to pass on research results to farmers. A result, Pakistan is now not only self-sufficient in honey but has a surplus for export. PARC web site has been established and Home Pages containing vital information about the organization have been developed. It counted more than 80,000 hits from all over the world. PARC has published more than 100,000 copies of scientific publications during the past 15 years including periodical publications. The Audio Visual Communication facility of PARC is passing on research results to farmers effectively (NARC, 2009).

16. REVIEW/EVALUATION/MONITORING

a. Programme Review, Institutional Review and Frequency of Reviews

i. Programme Review

The research programmes are reviewed mostly on yearly basis in the federal research establishment where these programmes are reviewed bi-annually (during Kharif and Rabi season) in the provincial ARIs. The review of research programme is a regular events with research planning. At the time of planning process, firstly, previous research programmes are reviewed and then new research programmes are put-up for consideration.

ii. Institutional Review

Institutional review is also performed mostly on yearly basis and institutes also go under the same process as research programmes goes on.

iii. Monitoring of Research Programmes during Implementation

Based on the funding sources, review process is adopted for evaluation of activities performed. Review means checking the design and work plan by the concerned ministry. If during review some activities are not according to the plan then we shift these to the next quarter. After completion of one year of the project annual review are held that is called the evaluation. These reviews are organized by the planning division, concerned members and Chairmen PARC and MINFA. They all review the projects and give the suggestions for further improvement of the project. Reviews are carried out by the Government, planning division of Pakistan, deputy secretary and chairmen of council.

The planning directorate / agriculture linkages program secretariat of PARC organizes annual review. The project prepares annual report of the project consisting progress, achievement and result of the project for the period under report. The planning directorate organizes review meeting to be attended by the members of the technical advisory committee (TAC) of ALP. The TAC reviews the annual progress reports of the projects and offered their observation and suggests recommendation for modification. The planning directorate will prepare and compile one or two pages summary of each project showing the project's outcome, observations and recommendations of TAC. These are submitted to the members of board of directors (BOD) of ALP for final recommendation and decisions. The planning directorate than prepare and compile one or two pages summary of each project showing the project's outcome, observations and recommendation of TAC. These are submitted to the members of board of directors (BOD) of ALP for final recommendation and decisions. The planning directorate and concerned technical division of PARC in collaboration also review the progress at their own and see their on farm and field or lab activities in the concerned institutions.

At the end of successful project hold a review with the team. All the projects running in the NARS and its research establishment review according to time period writing a report give the recommendation and remaining work shifted in to the next work plan or in the next quarter. This procedure called the follow up of review.

b. Evaluation

Evaluation is an integral part of the planning process and play key role in the project success. It is necessary to know the outcome and effect of project. It helps to know whether the desired objectives are achieved and also to learn lesson for further strategy and planning. Planning Commission, besides monitoring of the on-going projects, undertakes evaluation of completed development projects for assessing their efficiency, effectiveness relevance, impact and sustainability in relation to planned targets, goals and objectives. During the year 2009-10, 15 projects of various sectors of the economy were targeted for evaluation, of these 10 projects have been evaluated up to March 2010. The evaluation reports were forwarded to the concerned ministries/divisions for taking necessary actions and guidance for future project planning and management. The evaluation of the projects has sensitized the implementing agencies towards ensuring completion of projects within the approved cost, scope and time to realize their impacts and delivering benefits to the target groups.

Mid term evolution of ALP projects help to know whether the projects are going in right direction and achieving the desired objectives. The project will, therefore, be evaluated during the mid period or before completion. The planning directorate will organize the evaluation. Services of subject specialists/experts of related will be obtained for the purpose. The reports will be submitted to PARC, TAC and BOD for compliance and other necessary action.

Mid term evaluation of PSDP projects organize mid of the project life e.g. if project life is 5 year the Mid-term evaluation will be held after 2 years. After completion of the programme final evaluation will be held and report submitted to the RAC and they give their comments on the report.

c. Monitoring

Monitoring assesses the implementation status of projects during execution period on a regular basis. The project monitoring helps in timely identification of bottlenecks and suggesting suitable remedial measures. Evaluation looks at the elements of success and failure of the project with regards to achieving the objectives in an efficient and effective manner besides assessment of impact and sustainability. For effective development spending monitoring and evaluation system needs to be strengthened. Monitoring of projects funded under ALP are conducted and organized by ALP secretariat of PARC. It is responsibility of project in charge will ensure timely supply of resources and inputs (Human, financial and material etc.) to deliver the desired results and outputs. Monitoring is the checking the activities or work plan of the project on day to day or it may be on weekly bases. Every project has some objectives for achieving these objectives researcher makes some work plan. Checking the work plan is called the monitoring of the project. Main objective of the monitoring is to check the commitment of concerned department. If they find any hardle this solves the problem.

The Technical divisions of PARC also monitor the progress of ALP projects. The project incharge submit the progress of the projects to the directorate of planning/ALP secretariat on six monthly and annual bases. The six monthly progress/ technical reports are provided within 15 days after six month of the project is over. The reports will be examined by the technical division with reference to the work plan and suggest recommendation/ changes if required. The planning directorate give technical advice and slove their problems. Releases to the projects will also make on the basis of performance of the report to be recommended by the concerned technical division.

PSDP 2009-10 contained 2243 development projects, out of these 611 projects were earmarked for monitoring during 2009-10. These 525 projects have been monitored till third quarter.

17. INCENTIVE STRUCTURE

By definition “incentive structure” means that which incites to action or inciting to action or inciting as to action; stimulating, provocative etc. in the present treatise various components of financial and other benefits that provided to a scientific in lieu of the services rendered to the public sector agricultural research institutions are described.

a. Basic Salary Structure

The incentive structure includes basic salary, house rent, medical allowances and other benefits. The basic salary scale of Govt. bodies and autonomous bodies are shown in table 3.

Table 3. Special Pay Scale of NARS Scientists.

Post	Scale of Pay
Scientific Officer	12970 - 27770
Sr. Scientific Officer	18205 - 36805
Principal Scientific Officer	22710 - 42110
Chief Scientific Officer	23345 - 44485
Dirctor General	27055 - 50855

Other benefits like House rent allowance, Medical allowance, Research allowance and Conveyance Allowance etc are shown in Table 4.

Table 4. Total incentives structure of NARS Scientists compared to some other services in Pakistan

Organization	Equivalent designation	Salary Scale (Rs)	Hose Rent Allowance*	Medical Allowance (Rs)	Conveyance Allowance (Rs)	Research Allowance (Rs)
NARS (Govt. body) BPS Basic Pay scale	Scientific Officer	9850 - 24650	45%	820	2480	-
NARS (Autonomous) SPS Special Pay scale	Scientific Officer	12970-27770	45%	2594	2480	3891
Agricultural University BPS	Lecturer	9850 - 24650	45%	820	2480	-
PDA BPS	Research Officer	9850 - 24650	45%	820	2480	20%

* 45% of Basic pay scale and Special pay scale.

b. Age of Retirement and Retirement Benefits

An employee of the council shall retire from the services. on such date after he is completed 25 years of the services qualifying for pension and other retirement benefits as the competent authority may in the public intrest, direct or,Where no direction is given under sub clause. Employees should retire from service on the Completion of sixty (60) years of his age.

i. Retirement Benefits

As per existing scheme following benefits are admissible. Monthly pension 35% of gross pension to retired employee. In case of death after retirement is transferable to family members i.e. wife, legitimates children etc.Retirement benefits are (i) Gratuity (ii)Commutation of Pension

Gratuity: Gratuity is a lump sum benefits to whom who retire/died before completing 9 years of services. Under pension-cum-Gratuity Scheme, 1954. Five(5) years qualifying or more but less than ten years qualifying service qualifies for gratuity not exceeding one months emoluments for each completed year.

Retirement Gratuity: Not exceeding one month emoluments for each completed years qualifying service for 5 years or more but less than 10 years service is payable. If a person retired before completion of 9 years of qualifying regular service.

Death Gratuity: If a person died before completion of 9 years of qualifying regular services. In case of death during service, the rate of gratuity will be 1-½ month's pay for each completed years if service is 5 years or more and less than 10 years. The gratuity is payable to the family of deceased employee. The family includes wife and legitimate children of the employee. But in this case pension is not calculated.

Leave Encashment: If a person do not avail the benefits of LPR (leave preparatory to retirement) he will be granted leave encashment. Leave encashment is a monetary benefit equal to six months pay granted in the year of retirement. Encashment of LPR upto 180 days is admissible is admissible to employees who rendered 30 years or more qualifying service and who seeks voluntary retirement etc. It is admissible to the employees concerned at their own option. Leave pay for 180 days is payable. The employee should have to perform duty during the entire period upto the date of retirement and not entitled to avail himself of any kind of leave except in cases of illness, supported by medical certificate or for Hajj etc.

Farewells grant: Admissible equivalent to one month pay on retirement after 25 years or more continuous service.

Medical facility: Re-imbursement of cost of medicine of out door treatment/consultation with approved AMAS/Specialists. Lab tests from approved Labs/Govt. hospitals/ Labs/Govt. hospitals/ Dispensaries etc.

c. Human Resource Development

Recruitment and promotion process are major component of human resource development in any organization/institutions. The recruitment and promotion process of NARS have briefly described in the following sub-sections:

i. Recruitment Process

Chair man of the council has the authority to recruit any person from the post of BPS-3 to 19 on the basis of requisite Qualification**.** The recruitment of any scientist in a research organization is base on its efficiencnt performance, experience and qualification. In agriculture organization the staff demanded in an institute or division send its staff demand request to the establishment office. Where the establishment office advertise the post with the approval of the Chairman, Concerned department head or Directorial General. Establishment office received the applications and sends those applications to the appointment committee made by the Chairman. That committee short list the candidates according to the criteria of the post and made the list of short listed candidates and send it to the establishment office. Where call letter for the test and interview were issued. After the test and interviews the appointment committee select the candidates who

fulfil the criteria of the job and made a list of selected candidates with signature and send to establishment office for issuing of appointment letter with the approval of Chairman. After the approval of the chairman appointment letter are being issued to the contestant.

ii. Promotion Process

Promotion of an employ will be based on the work done by an employee in an organization. In PARC the promotion is based on the achievement of the scientist including those in planning, organization, administration, project work and experimental research are taken into consideration. Promotion and incentives should be given to those who work harder and produce good results on in form of qualitative and quantities. Promotion is also based on the production of scientific research papers of high quality as an indicator of research achievement or addition or development of new varieties of techniques.

d. Career Advancement Schemes/Process

Initially there was an actual shortage of trained man power for agriculture research in the country Shortages of trained manpower is especially acute in case of group leaders who can devise research projects and provide leadership for planning and conducting of research experiment. For these purposes PARC has paid a special attention on the development of scientific man power for agriculture research. The measurement being taken include recruitment of outstanding young graduates through rigorous tests and interviews etc and their grooming into professional by providing them special training, both with in the country and abroad. PARC has developed a talent Pool scheme in which sufficient posts in different grades (up to grade 20) have been provided so that senior scientists with sufficient research achievement can look up to promotions to higher grades.

To coordinate, organize and execute this programme, the Training Institute has been declared as Research Graduate School and the facilities of the Institute shall be used for the purpose of postgraduate teaching. Similarly the laboratory facilities and outreach areas of NARC and allied institutions of PARC have been declared as adjunct campus of the University. PARC has also developed a programme for different categories of training i.e i)short courses for improving productivity of major crops, ii)academic training courses in Pakistan institutes iii) short term training courses and academic training leading to M.Sc and Ph.D in NARC, iv) six month farmers training programme regarding different field.

e. Prize and Reward System

To appreciate once work performance it is necessary to give him reward in the form of incentive or prize. In PARC annual incentives shall be on accrual by grated by chairman or officer authorized by him on his behalf. The annual incentive in employees pay scale shall increase on completion of every year of service on the first day of December, each year, provides that the last annual increment was grated on or before the 1st of June or that Year. Ph. D scholars have additional incentives in his pay.

f. Technology Marketing

To develop a technology is a great task but the other task is how to market it and provide that technology to the farm gate. For this purpose PARC develop a Technology Transfer Institute TTI. The Technology Transfer Institute regularly holds field days, exhibitions, fairs, colloquias, disease and pest control and promotional campaigns for agro based industry. About 200 audio and 80 video programmes have been produced and broadcasted through electronic media.

PARC has signed more than 30 contracts with private sector firms for commercialization of many new technologies in seed, farm machinery, vaccines and livestock feed production areas over the past 15 years. Twenty-eight engineering companies in the private sector have purchased production rights for the agricultural machinery, developed by PARC. PARC has signed two agreements; one with International Irrigation Management Institute (IIMI) to initiate collaborative research on Root Zone Salinity Management using Skimming Wells and Pressurized Irrigation, and the other with National Rural Support Programme (NRSP) of UNDP to accelerate the pace of technology transfer through community based efforts. The Training Institute at NARC has conducted about 380 training courses with more than 6500 trainees from federal as well as provincial institutions to transfer its technology to the farm gate level so the best utilization of technology farmer can increase its productivity.

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NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN SRI LANKA

Appendix F

Country Study

NATIONAL AGRICULTURAL RESEARCH SYSTEM (NARS) IN SRI LANKA

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Grain Legumes & Oil Crop Research & Development Centre
Sir Lanka

December, 2010

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1. HISTORICAL BACKGROUND AND ESTABLISHMENT OF INSTITUTES

Sri Lanka is a country where agriculture plays an important role in its economy since ancient times. The existence of tank based irrigation net works in drier parts of the country and the presence of mixed cropped home gardens in wetter parts of the island testify the sustainable farming systems existed since ancient times.

According to contemporary concepts, agriculture research in Sri Lanka was reported to be initiated in1822 with the establishment of the Royal Botanical Garden, at Peradeniya, which then later extend to Hakkgala and Gampaha. These gardens introduced plants for economic development and results the development of plantation crops in the country. Though these gardens served as the centre primary initiative, the formation of the Ceylon Agrarian Society in 1904 played a pivotal role in promotion of plantation and peasant agriculture. The establishment research institutes for plantation crops namely Rubber, Tea and Coconut in early nineties marked the formation of commodity based agriculture research and development in the country. The Department of Agriculture established in 1912 was the main agency responsible for agriculture research and development of the non-plantation crop sector and livestock. The establishment of Department of Export Crops (earlier Department of minor export crops) in 1973, Department of Animal Production, and Health in 1983 made the Department of Agriculture to be responsible only for the food crop sector of the country. Most recently, Department of Botanic Gardens was extracted from the Department of Agriculture in 2006. Other institutes that come under NARS at present did not come under the Department of Agriculture at any stage of their developmental phase but established separately.

Council for Agricultural Research Policy (CARP) established in 1987 considers as the apex body at national level charged with the responsibility of adding, promoting and coordinating research in agriculture and related fields. National Agricultural Research System at present includes twelve research organizations scattered island wide that are closely linked with the CARP. The Council has recognized universities and postgraduate institutes as partners of the national agricultural research system but they are not included in the NARS at present. This may be because unlike in some other countries, universities in Sri Lanka do not directly engage in applied or strategic research but generally involve with basic research activities and mostly confined to uplift the standards of higher education. Hence, this report deals only with the research organizations that actively forms NARS in Sri Lanka, which are;

- Department of Agriculture
- Coconut Research Institute
- Tea Research Institute
- Rubber Research Institute
- Sugarcane Research Institute
- Hector Kobbekaduwa Agrarian Research and Training Institute
- Institute of Post Harvest Technology

- National Aquatic Resource Agency
- Department of Animal production and Health – Veterinary Research Institute
- Department of Export Agriculture
- Department of Forest Conservation
- Department of National Botanic Gardens

1.1. Department of Agriculture:

- Rice Research and Development Institute
- Field Crops research and Development Institute
- Horticulture Crops Research and Development Institute
- Extension and Communication Centre
- Socio Economics and Planning Centre
- Seeds Planting Material Development Centre
- Seed Certification and Plant Quarantine Centre

Department of Agriculture (DOA) established in 1912 is the largest organization involved in NARS of Sri Lanka. It has been handling almost all the agriculture related commodities and activities until the establishment of other departments and statutory bodies in different periods. Presently it deals with research and development of the food crop sector that has broadly been categorized into three major commodity groups namely rice, horticulture and other field crops. The department was reformed by parliament acts at two instances in 1994 and 1996 to establish the commodity based research institutes within the department itself. These commodity-based institutes are Rice Research and Development Institute (RRDI), Field Crops Research and Development Institute (FCRDI) and Horticultural Crops Research and Development Institutes (HORDI). Grain Legume and Oil seed Crops Research and Development Centre (GLORDC) and the Fruit Crop Research and Development Centre (FCRDC) were formed with the reformation in 2001 and the later two centers comes under the purview of the two mother institutes namely the Field Crops Research and Development and Horticultural Crops Research and Development. In addition, DOA engages in the activities of plant protection, seed certification and plant quarantine, seeds and planting material production, natural resource management including the soil and water conservation, and socio- economics and planning of the food crop sector. Thus, the organization consists of three major commodity based research and development institutes namely Rice Research and Development, Horticultural Crpos Research and Development, Field Crops Research and Development. The other major technical divisions of the DOA are Extension and Communication Centre, Seed Certification and Plant Protection Centre, Seeds and Planting Material Production Centre and Socio-Economics and Planning Centre.

The chief executive officer of the Department of Agriculture is the Director General of Agriculture (DGA) and DGA is responsible to the secretary to the Ministry of

Agriculture and Agrarian Services. Out of eight directors who perform under the guidance of the DGA, three directly heads of the three commodity institutes exists within the DOA. One director commands the extension and communication arm of the DOA while two others are engage in the fields of seeds and planting material production and seed certification and plant quarantine. Additional directors and deputy directors ably assist the directors to carry out the programme of the DOA. In addition, Director administration deals with the general administration of the DOA and Director finance deals with the financial management of the department. DOA has its research centers and other units scattered all over the island thus forming a comprehensive network covering all the regions.

1.2. Coconut Research Institute

Coconut Research Institute (CRI) established in 1928 as Coconut Research Scheme under the Coconut Research Ordinance No. 24 of 1928. The scheme established its headquarters at Lunuwila and began its research activities. The enactment of the Coconut Research Act No.37 in 1950, made it renamed as the Coconut Research Institute of Ceylon. The Coconut Research Board established in 1972 functions as the Board of Management of the Coconut Research Institute under the Coconut Development Act No. 46 promulgated in 1971. The Coconut Research Institute is a semi-autonomous research institution coming under the purview of the Ministry of Plantation Industries. Coconut Research Institute is the first ever institute established in the world devoted for coconut.

Director is the chief executive officer of the institute who is a member of the coconut research board that contains members from the respective ministry and the ministry of finance. Deputy Director Research and deputy director administration and finance assist the director in executing the work plan of the Institute. The heads of the different research disciplines comes under the direct command of the deputy director research. Coconut Research Institute at Lunuwila in Negambo has nine research divisions:

- Agronomy
- Biometry
- Crop Protection
- Genetics and Plant Breeding
- Plant Physiology
- Processing Research
- Soils and Plant Nutrition
- Tissue Culture
- Technology Transfer

1.3. Tea Research Institute

Tea Research Institute (TRI) established by a government ordinance in 1925 at Talawakele. It functioned as a division of the Planters' Association of Ceylon from 1925 to 1957 and became a Government institution since then. TRI operates under the Tea Research Board Act, No. 52 of 1993. Minister of Plantation Industries appoints the Tea

Research Board and the director of the institute is a member of the board that has representatives from the ministry of finance and the ministry of plantation industries. Tea Research Institute has 10 research divisions.

- Soil & Plant Nutrition
- Agronomy
- Plant Breeding
- Plant Physiology
- Entomology
- Plant Pathology
- Technology
- Bio chemistry
- Agricultural Economics
- Advisory & Extension Services

1.4. Rubber Research Institute

Rubber Research in Sri Lanka originated in 1909 with the engagement of a chemist and a group of rubber planters to study the coagulation of rubber. This association was later extended to the establishment of Rubber Research Scheme in 1913. Rubber Research Ordinance was incorporated on 30th August 1930 leading to the establishment of the Rubber Research Institute (RRI) at its present place Dartonfield, Agalwatta in Kalutara. The scheme later named as the Rubber Research Institute in 1951. Rubber Research Board established as per the Rubber Research Ordinance governs the rubber Research Institute and the Director of the Institute is an ex-office member of the board. and Minister of Plantation Industries appoints the Rubber Research Board. Director is the Chief executive officer of the Rubber Research Institute and the directorate comprise of two deputy directors for research and one deputy director for administration. Rubber Research Institute has 9 research and four technology divisions.

- Genetics & Plant Breeding
- Plant Science
- Soils & Plant Nutrition
- Plant Pathology & Microbiology
- Biochemistry & Plant Physiology
- Advisory Services
- Biometry
- Adaptive Research
- Agricultural Economics

- Raw Rubber Process Development and Chemical Engineering
- Polymer Chemistry
- Rubber Technology and Development
- Raw Rubber and Chemical Analysis

1.5. Sugarcane Research Institute

Sugarcane Research Institute of Sri Lanka (SRI) is a statutory body established by Act No. 75 of 1981 and amended by a gazette notification, on September 27, 1991. It was formally inaugurated on 29th April 1983 in Kantale with an administrative office in Colombo and a research station under the Sri Lanka Sugar Corporation. It has been functioning as an independent institute since 1984 and presently under the purview of the Ministry of Supplementary Crop Development. The main research station was relocated at Uda Walawe in 1987. Management and administration of the Institute is vested upon the Board of Governors appointed by the Ministry of Supplementary Crops Development. Director Board consists of the chairperson, director of the institute, representatives from the respective ministry with a representative form the ministry of finance. The Director of the Institute is the chief executive officer of the Institute and two deputy directors one for research and one for administration assist the director. The institute has eight research divisions:

- Agronomy
- Biometry and data processing
- Breeding
- Chemistry
- Economics and extension
- Engineering
- Microbiology and byproducts
- Pest management

1.6. Hector Kobbekaduwa Agrarian Research and Training Institute

Hector Kobbekaduwa Agrarian Research & Training Institute (HARTI) established on 1st September 1975 under the Agrarian Research & Training Institute Act No 5 of 1972 at Colombo. HARTI is the organization established for conducting Socio-Economic Research and Training in the Agrarian sector. The present name of the institute was given in 1995, in honor of the late Hector Kobbekaduwa, the Minister of Agriculture ad Lands. Board of Governors governs the Institute that includes representation form various ministries and organizations concerned with the development of the rural agrarian sector. The Secretary of the Ministry of Agriculture Development and Agrarian Services acts as the Chairperson to the board. Director of the institute is an ex-officio member of the board of governors and the chief executive officer of the institute. Deputy Director

Research and the Registrar assist the director in overall management of the Institute. There are four research and training divisions at HARTI:

- Agricultural Policy Planning and Project Evaluation
- Human Resources and Institutional Development
- Irrigation, Water Management and Agrarian Relations
- Marketing, Food Policy and Agri-Business

1.7. Institute for Post Harvest Technology (IPHT)

By reorganizing the previous Rice Processing and Development Centre of the Paddy Marketing Board, Institute of Post Harvest Technology (IPHT) was set up in year 2000. Presently, this institute comes under the purview of Ministry of Agriculture Development and Agrarian Service. IPHT is an autonomous body governed by a director board. Minister of Agriculture Development and Agrarian Service appoints the chairperson of the five-member director board of the IPHT with a member from the Ministry of Finance. Director of the IPHT who is the Chief executive officer of the institute is an ex-officio member of the board. Two deputy directors ably assist director of the IPHT and one of them commands the research programmes of the institute.

1.8. National Aquatic Resource Agency

The National Aquatic Resource Agency (NARA) established in 1981 by the National Aquatic Resources Research and Development Agency Act No. 54 of 1981under the Ministry of Fisheries and Ocean Resources. It is the principal institute in Sri Lanka holds the responsibility of carrying out and coordinating research, development and management activities on the subject of Aquatic Resources. NARA is a statutory body, governs by a board in which the Minister of Fisheries and Ocean Resources appoints the chairperson. Director General is the chief executive officer of the organization and a member of the governing board that comprise of several members including the representations from the ministry of finance and universities.

It has following technical divisions:

- Inland Aquatic resources and Aquaculture Division
- Marine Biological Resource Division
- Fishing technology Division
- Environmental Studies Division
- Post Harvest Technology Division
- Oceanography Division
- Information Technology Division

1..9. Department of Animal Production and Health -Veterinary Research Institute

Research on livestock had an early start with the set up of Veterinary Laboratory in Colombo in 1911. This laboratory, moved to Peradeniya in 1939 upgraded as the Veterinary Research Laboratory in 1951, and finally institutionalized as Veterinary Research Institute (VRI) in 1967. Department of Animal Production and Health (DAPH) formed in 1978 and since then Veterinary Research Institute operates under the purview of DAPH, which belongs to the Ministry of Livestock Development. Director General is the chief executive officer of the Department assisted by assisted by an additional director general. There are seven Directors perform in DAPH and five of them are technical directors while the other two positions are held by the directors of administration and finance. Director Veterinary Research is the head of the VRI and responsible for the research and development programme of the institute.

1.10. Department of Export Agriculture

Department of Export Agriculture was reformed by the act No.46 of Parliament of the Democratic Socialist Republic of Sri Lanka in 1992 on promotion of Export Agriculture in Sri Lanka, empowering the functions and services pertaining to export agriculture crops. The major responsibility of the Department of Export Agriculture (DEA) is to make necessary actions to develop the Export Agriculture Crops (EAC) namely, Cinnamon, Pepper, Cardamom, Cloves, Nutmeg, Coffee, Cocoa, Citronella, Betel, Arecanut as well as new crops with export potential such as Lemon grass, Vanilla. This Department was previously referred to as the Department of Minor Export Crops setup in 19 73. Director General is the head of the department while a senior deputy director research is responsible for research progamme of the department. Research Division of the department deals with the following disciplines:

- Agronomy
- Entomology
- Genetics and Plant Breeding
- Pathology
- Plant propagation and Physiology
- Post harvest technology
- Soils and Plant Nutrition
- Socio-economics

1.11. Department of Forest Conservation

Under the provisions of Forest Ordinance Department of Forest was started in 1887. Systematic research activities of forest were however initiated in late nineteen seventies. The research division of the Forest Conservation Department is the smallest NARS organization of Sri Lanka today.

1.12. Department of National Botanic Gardens

Department of Botanic gardens was established under the gazette notification 1471 of the Democratic Socialist republic of Sri Lanka in 2006. Until then this remained as a division of the Department of Agriculture. Two technical directors and two non-technical directors (Finance and Administration) assist Director General - the chief executive officer of this department. Deputy Director Floriculture Research comes under the purview of the Director Research and Technology Transfer.

1.13. Council for Agricultural Research Policy

Council for Agriculture Research Policy (CARP) in Sri Lanka was formed in 1987 by the act No 47 of the Parliament of the Democratic Socialist Republic of Sri Lanka as the apex agency of coordination agriculture research in Sri Lanka. The council consists of 14 members appointed by the Minister of Agriculture Development and Agrarian Services. Executive Director is the chief executive officers of the council who also act as the Secretary to the council that is chaired by the Secretary of the Ministry of Agriculture and Agrarian Development.

CARP considers universities and post graduates institutes as partners of the NARS while the main research organizations forms the NARS. The chief executive officer of the CARP is the executive director and the council consists of 14 members including the representation form the Ministry of Finance.

2. ORGANIZATION OF NARS

Organizations involved in NARS in Sri Lanka consist of five government departments and seven autonomous statutory bodies. Major agencies involved and their respective ministries are shown in table 1. Out of all twelve agencies, Department of Agriculture is the largest and the oldest organization as it consists of three major commodity based research institutes together with five other major technical supporting centers to form the DOA.

Table 2 shows the distribution of major research centers in the Department of Agriculture. In addition DOA possess many research stations covering all the important agro-climatic conditions island wide under the purview of commodity based institutes. This spread is vital in the sense of developing more farmer friendly agricultural technologies as the food crops sector covers the whole country unlike in the case of plantation crops.

Apart from Department of Agriculture, Department of Export Crops has following centers mainly covering the growing regions of the export agricultural crops.

- Main Research Centre — Matale
- Economic research division — Peradeniya
- Betel and Intercropping Research Station — Narammala
- Cinnamon Research Station — Matara
- Plant Production and Tissue Culture Centre — Walpita
- Organic Farming Research Centre — Delpita
- Mixed Cropping and Upcountry Research Centre — Nilambe

Table 1. Major Agencies involved in Agricultural Research, their ministries and placement of head quarters in Sri Lanka

Agency	Ministry	H. O.
Council for Agricultural Research Policy - CARP	MAAD	Colombo
Department of Agriculture - DOA	MAAD	Peradeniya
Department of Export Agriculture - DEA	MAAD	Peradeniya
Department of Animal Production and Health Veterinary Research Institute VRI	MLD	Peradeniya
Department of Forest Conservation , Forest Research Centre	MENR	Kurunegala
Department of National Botanic Gardens	MSPR	Peradeniya
Rubber Research Institute - RRI	MPI	Agalawatta
Coconut Research Institute - CRI	MPI	Lunuwila
Tea Research Institute - TRI	MPI	Talawakele
Sugar cane Research Institute - SRI	MSPC	Udawalawa
National Aquatic Resource Agency -NARA	MFOR	Colombo
Institute of Post Harvest Technology -IPHT	MAAD	Anuradhapura
Hector Kobbakaduwa Research and Training Institute -HARTI	MAAD	Colombo

MAAD, Ministry of Agriculture & Agrarian Development; MLD, Ministry of Livestock Development; MPI, Ministry of Plantation Industries; MF OR, Ministry of Fisheries & Ocean Resource; MSPC, Ministry of Supplementary Crops Development; MENR, Ministry of Environment and Natural resources; MSPR, Ministry of Sports and Public Recreations; H O, Headquarter.

Table 2. Distribution of the major research centers of the Department of Agriculture

Centre	H. Quarters
Horticulture Crops Research & Development Institute	Gannoruwa
Fruits Crop Research & Development Centre	Horana
Regional Agriculture Research & Development Centre	Bandarawela
Regional Agriculture Research & Development Centre	Makandura
Field Crop Research and Development Institute	Maha Illuppallama
Grain Legume & Oil Crop Research & Development Centre	Angunakolapelessa
Regional Agriculture Research & Development Centre	Aralaganwila
Regional Agriculture Research & Development Centre	Vauniya
Rice Research & Development Institute	Batalagoda
Regional Agriculture Research & Development Centre	Bombuwala
Plant Genetic Resource Centre	Peradeniya
Socio-Economics and Planning Centre	Peradeniya

Tea Research Institute has its Low Country Research, Advisory and Extension Centre at Ratnapura and Mid Country Research, Advisory and Extension Centre in Kandy. National Acquatic Resource Agency has its sub centers at Kalpitiya, Rekawa and Trincomalee.

Each research organization in NARS acts independently in deciding research programmes and their implementation with the concurrent understanding of their line ministry. There is no specific institution involved in directing or identifying the research needs for different organizations. Each research institute identifies their research priorities and all organization acts independently in identifying their resource needs (both physical and human) and allocation. Council does not play a major role in decision making in any of the NARS organizations but formulate the National Agricultural Research Policies and Strategies with the concurrence of the organizations and Chief executive officers of NARS organizations represent their organizations at the council. Council helps to train the scientists of NARS abroad by providing necessary financial resources and finding necessary placement for the eligible candidates. In addition, council acts as an agency of providing necessary funds for NARS scientists through contract research programme.

3. PRIORITY FIXATION AND RESEARCH PLANNING

Department of Agriculture develops its five year plan with main emphasis on agriculture development in the food crop sector taking into consideration of the development programme of the line Ministry ie: ministry of Agriculture Development and Agrarian Services. Each commodity institute of DOA build up its own five year programme for research giving due attention to the five year plan of the main department. The goals and major thrust areas are identified in developing the five-year research plan at the institutes. The activities under taken are decided at the regional level and sub regional level by the scientists attached to the research centers of each institute. Thus research planning is not only a top bottom approach but also ensures bottom top approach as well. Research priorities are fixed at both regional level and the Institute level as most of the regional centers of the Department of Agriculture represents different agro-climatological settings specific to each centre. Therefore, each regional centre has focused on at least one research aspect. Hence, availability of funds to perform each research activity is also decided at the regional level. Research programmes of national interest such as coordinated trials receive priority at regional level.

When formulating the programmes at regional level researchers give due attention to the research problems brought from the extension agents to each regional centre thus the needs of the stakeholders also taken into consideration. A preliminary discussion on the research programme takes place at the regional level prior to the execution of the programme on their appropriateness to be implemented All the scientists engaged in research activities in a particular discipline discuss the regionally approved programmes at length especially for technical clarifications at the national level called as disciplinary working group meeting. Disciplinary working group meetings (eg Genetics and Plant Breeding, Plant Pathology, Soil Fertility and Plant Nutrition etc) held annually and attended by most of the research managers, all the scientists working in that particular

discipline irrespective of the institute to which he/she attached and by the extension officers of the DOA. A senior scientist of the same group coordinates the programmes presented by the scientists. It is the working group, which decides the suitability of the project/activity submitted and each scientist who submitted and presented the programme executes the technically approved programmes of the respective disciplinary working group. Each coordinator of a disciplinary working group has to submit a report to the overall coordinator of Disciplinary Working Groups. The overall coordinator has to submit the final report to the Director General of Agriculture.

Research planning and priority fixation process of the research division of the Department of Export Agriculture is similar to that of the Department of Agriculture. There too researchers formulate their research plans based on the research needs brought by the extension agents. These programmes are finalized at the Research Committee meeting held annually. The Director General of the Department chairs this meeting and Deputy Directors and all the researchers of the department attend. The researchers implement the approved programes. Spice Board of Sri Lanka also provide their input in research planning of the Export Agriculture Department as the need arise.

In Rubber Research Institute, Director and the two DDRs co-ordinate the research planning. Senior planters and the Senior Scientists of the institute discuss advances in the technologies developed by the RRISL and the research needs of the industry once in every three months. Scientists carry out the priority research projects identified. The corporate plan prepared in advance with the assistance of the stakeholders identifies the research needs of the institute and the research projects formulated need to be in accordance with the corporate plan of the Institute. Tea Research Institute makes the corporate plan of the institute with the stakeholders of the tea industry and the scientists need to submit their proposals to the consultative committee on research for approval and also to the external research advisory board. It seems that excessive framing of the scientists makes them less productive scientifically. Each scientist has to submit its proposal to the research advisory committee of the Institute of Post Harvest Technology. This committee has representations from Universities, National Engineering Research Development Center and the Department of Agriculture. This committee meets in every six months and evaluates the proposals submitted. Thus, the research advisory committee decides the research priorities. Scientists at IPHT identify their problems with the help of the provincial technical working groups of the DOA. These are the bi-annual meetings held at provincial level with the participation of the extensionists and researchers of the DOA to plan and formulate the agriculture development programme of the province.

Research scientists at National Aquatic Resource Agency have to submit their research proposals annually to the Research and Development Committee of the organization. Research and Development Committee should evaluate and screen the research proposals and decides the research activities to be performed and funds are allocated accordingly. Research and Development Committee of NARA prepares the list of priority research areas. The research needs of the organization are evaluated based on the cooperate plan prepared by the organization. Private sector expresses their views, concepts and problems at the stakeholders meetings and the outcome of these meetings certainly influence the final cooperate plan. Every five years a corporate programme is

formulated and yearly research programmes are prepared at the Sugarcane Research Institute. Sugar Industry also takes part in the preparation of the cooperate plan.

4. RESEARCH SCIENTISTS INSTITUTION WISE

Table 3 shows the distribution of scientists among the research organizations including the research mangers at various level of operation. It shows that greater share of them are with the Department of Agriculture (DOA) and this accounts for nearly 50% of the total scientific personnel in the NARS. However, table 3 further shows that majority of the personnel have not received formal training to undertake research in the organizations associated with the government departments such as DOA, DEA and DAPH except Department of Forest. This scenario is different with the other research organizations. It was reported that more than 1/3 of the time scientists spent non-research activities. This proportion would be greater with the researchers attached to different government departments.

5. RECRUITMENT PROCESS

In all government departments including the Department of Agriculture, Department of Forestry, Department of Export Agriculture and Department of Animal Production and Health candidates are recruited after a competitive examination followed by an interview. In other research organizations, too the recruitment process is similar to that of the government departments, as candidates have to appear for a competitive examination followed by an interview irrespective of the qualification one posses. However, the competitive examinations the candidates have to face differ depending on the organization. Only the successful candidates receive appointments depending on the availability of vacancies.

Table 3. Distribution of scientists and their qualifications in NARS organizations of Sri Lanka

Institute	Qualification				
	Non degree	BSc/ BA	PG diploma	MSc/ Mphil	PhD
Coconut Research Institute		12	-	12	13
Tea Research Institute		06		16	11
Rubber Research Institute	01	13	-	09	17
Sugarcane Research Institute		05		10	05
Institute of Post Harvest Technology		09	-	10	02
National Aquatic Resource Agency		13	02	27	09
Hector Kobbekaduwa Agrarian Research and Training Institute		10	01	17	08
Forest Department		01		05	02
Department of Animal Production and Health Veterinary Research Institute		16		15	04
Dept of Export Agriculture		21	-	24	08
Department of Agriculture	04	179	03	134	42
Horticulture	02	85	01	65	20
Field Crops	02	29	01	22	05
Rice		33		23	05
Socio-Economics		11		06	02
SCPPC*		21	01	18	10

SCPPC – Seed Certification and Plant Protection Centre; **Source:** INFORM 2007 (unpublished), Administration report 2007 of DOA

6. INVESTMENT TREND

Government departments depend on funds from treasury for their operation while research organization deals with the plantation crops are not fully depend on the treasury. They received their budget through the CESS funds that can be either export or import. Some of the statutory bodies however depend on the treasury for funds. Table 3 shows the recurrent budget allocation for the Institute from 2002 – 2006.

Table 4 shows that much of the funds (36%) are allocated to the Department of Agriculture however when considers the number of scientists involved at each organization there may not be a greater variation except in the case of Tea Research Institute which is totally depend on the tea export CESS funds. When considers the allocations across all the organizations the greater share goes to the research personnel cost and this amounts nearly 55% of the total allocation. In Sri Lanka, the research and development allocation was only a mere 0.19% of Gross Domestic Product in 2004.

Table 4. Recurrent budget allocation (Rs. Million) for different NARS organization from 2002 to 2006

Institute	Recurrent Budget Rs. Million (constant factor - 1996)				
	2002	2003	2004	2005	2006
Coconut Research Institute	59.83	57.49	59.53	57.12	46.32
Dept of Export Agriculture	15.56	16.78	18.55	35.38	29.12
Dept of Agriculture	132.72	128.57	173.23	172.59	212.08
Forest Department	4.34	4.54	5.11	5.26	6.30
Hector Kobbekaduwa ARTI	25.3	28.31	24.23	29.32	33.49
Institute of Post Harvest Technology	23.9	3.49	90.71	12.41	12.48
National Aquatic Resource Agency	55.61	60.76	72.76	62.27	58.42
Rubber Research Institute	29.63	40.04	39.06	49.55	NA
Sugarcane Research Institute	40.73	42.72	43.78	38.17	45.94
Tea Research Institute	160.27	158.87	127.57	137.05	121.77
Veterinary Research Institute	20.41	24.55	24.65	93.08	17.23

Source: INFORM 2006

7. INSTITUTIONAL GOVERNANCE

In DOA Director General of Agriculture is the responsible and the accountable authority for the whole programme of the department including the research of all the commodities it handles. The director of the commodity institute of DOA is the responsible and accountable authority for the research programme and the output of the institute. This responsibility and accountability has been delegated to the middle level research managers who are in charge of the other centers. Other commodity based research institutes, also similar line of delegation of authority could be observed. However, in these institutes the divisional heads are the middle level managers of the research programmes. Individual performance evaluation is practiced in the research organizations of the government departments but not at other research organizations such as Tea Research Institute, Rubber Research Institute etc. It should be noted here the individual performance evaluation process practiced presently is helping neither the research organization nor the researchers to uplift the standards. Leadership in scientific disciplines and research management goes with the seniority and the merit in all the organizations .In Sri Lanka, majority of the senior scientists prefer to be in the managerial positions rather actively engage in research activities as the managerial positions presently receive some additional incentives. This conduct conversely affects the research strength of each sector due to depart of the senior researchers from their scientific disciplines to the management positions. This is particularly true in the case of government departments.

There is a very good research – extension linkage exists in the Department of Agriculture, as it possesses a separate extension arm. Research – extension group meetings are held at the provincial level biannually with the participation of extensionist as well as researchers to plan and formulate the agriculture programme for each province. Researchable problems identified at these meetings are later employed in research planning. In addition extension officer have free access to the researchers in the DOA and extension staff ably assists the researchers in performing the adaptability testing process of the newly identified technologies. Department of Export Agriculture too has its own extension arm thus to disseminate technology and obtain the feedback. Most other commodity research organizations such as TRI, RRI have established extension arms to deal with and hence majority of the NARS organizations in Sri Lanka ahs good research-extension linkage. Institute of Post Harvest Technology relies on the biannual research – extension meetings of the DOA to gather information and partly disseminate the knowledge. Sugarcane Research Institute do not have a well established extension arm hence much depend on the extension workers attached to the sugar industry. National Aquatic Resource Agency also does not have a well-established extension net work but relies mostly on the stakeholders' responses and the output of the socio economic division of NARA.

Linkage with universities and other research organizations do exists however mostly at informal level for research purposes. Researchers who want to purse their studies should enroll a university and there are no deemed universities exists in Sri Lanka. Research organization if NARS in Sri Lanka promote their scientists to establish links with other countries for research purposes. All the research organization in NARA contributes for the Management Information System employed by the CARP. INFORM is the management information system adopted by CARP that includes a programme budgetary system and developed by ISNAR. In order to collect information CARP has appointed coordinators at each research organization and the collection and processing of information is performed by the council.

8. REVIEW, EVALUATION AND MONITORING

Regional research centers of the DOA bi-annually review the research programmes and evaluate the progress made by the scientists. Disciplinary working groups consist of the working group coordinator and senior scientists of the same discipline annually review and evaluate the research programmes of the scientist. Research mangers and senior extension workers often participate at these meetings and automatically included into the review panel. Each scientist has to submit his/her quarterly physical progress to his/her head at the research centre and progress and the problems of all the planned activities are reported back to the central progress monitoring and evaluation unit. Researchers should submit a separate report for each research activity performed at the end of the year to their immediate research manger. These reports are compiled and hence available future activities. External agencies such as also Council for Agriculture research Policy or the National Science Foundation periodically reviews each commodity Institute in the Department of Agriculture. Department of Export Agriculture too follows

a similar process also subjected to the external reviews. They do not have disciplinary working group but at research Committee Meetings.

There is a consultative committee to review and monitor the progress at the Tea Research Institute. Research programme of the scientists at Tea research Institute are reviewed externally and the process is practiced in every two years. The external advisory board too make periodic monitoring of the research projects by the scientists. In rubber Research Institute, an outside panel – Research Evaluation Committee, evaluates every year research program and their inputs are considered for the future research programs. Suggestions forwarded at the peer reviews are included in the preparation of corporate plan. The progress is reviewed by a board of the Sugarcane Research Institute together with the representatives from sugar industry. Periodic progress made in different research programmes are evaluated through the progress reports submitted periodically by the scientists at National Acquatic Resource Agency. The Research and Development Board of NARA monitors the research programmes of the scientists.

9. INCENTIVE STRUCTURE

Salary structure of the scientists at the government departments is not different to that of the civil service or other island wide parallel services. (e.g. Engineering service, Medical service, Accountancy service etc). However, the privileges and allowances given for different services are different. A newly appointed scientists receives around US $ 200 and the highest could be drawn is around US $ 500 and to reach this level a scientist has to work for more than 25 years while obtaining the necessary clearance at each efficiency bars. Only a language allowance and a cost of living allowance are added to the basic salary. The amount paid to the scientists at other research organizations are also similar as salary structure is governed by a common government circular issued by the treasury. All the scientists in government departments are eligible to receive a pension upon their retirement however those at the statutory boards do not receive a pension but their accumulated provident fund. Both employee and the employer contribute to the provident fund in which the contribution of the employer is greater. Age at retirement is not different among the organizations and it is 60 years at present.

Researchers attached to the government departments are entitled to receive housing facilities depending on the availability at the cost of 12% of their salary. Sugarcane Research Institute provides free housing facility however on priority basis. Researchers and their families are entitled to receive medical bill reimbursement at Sugarcane Research Institute. Researchers at TRI receive a house rent allowance depending on the location the person is serving. They are also entitled to receive a medical allowance. No sabbatical leave is granted to the researchers presently but they could obtain no pay leave for a period of five years at maximum. Full pay study leave is granted to the researchers to pursue their studies leading to a higher degree.

Department of Agriculture has its own system of presenting awards to the young scientists and the best scientist. The selection is done by an external board that represents academics from universities, and senior officers of the DOA and the agent from the sponsoring private agencies. There is no prize or reward system exists with the other research organizations at present.

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Regional Consultation Meeting
Photo Album


Consultation Meeting on
"National Agricultural Research System in SAARC Countries"
22-23 December, 2010


Consultation Meeting on


KEYNOTE SPEAKER


Pakistan Agricultural Research Council


DR. MD. ABDUR RAZZAQUE
Project Director, PCU, NATP
DR. MD. JAHANGIR ALAM

SAARC Agriculture Centre

Objectives

- To strengthen agricultural research and accelerate technology transfer through establishing regional networks in agricultural and allied disciplines, particularly among agricultural research and extension institutes, professionals, policy planners and stakeholders.
- To provide inputs for developing regional policies, strategies, projects, primarily through developing networks in crop, livestock and fisheries sectors; and for efficient management of soil, water and other natural resources.
- To promote new and innovative techniques and systems in agriculture including production, post-harvest and food processing.
- To facilitate collaborative studies, inter alia, on agricultural marketing and distribution systems, harmonization of agriculture related standards, promotion of agricultural trade, food security, risks and disaster management in agriculture.
- To facilitate and undertake collaborative capacity building programmes in agriculture and allied sectors with focus on skill development and research on frontier areas.
- To collate and disseminate information for agricultural advancement in the region.

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