Revitalizing the Agricultural Technology System in Bangladesh
Revitalizing the Agricultural Technology System in Bangladesh

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**GOVERNMENT'S FISCAL YEAR**

July 1 – June 30

**ABBREVIATIONS AND ACRONYMS**

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<thead>
<tr>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>ADP</td>
<td>Annual Development Program</td>
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<td>AEP</td>
<td>Aquaculture Extension Policy</td>
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<td>AERS</td>
<td>Agricultural Economics and Rural Sociology</td>
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<td>AETS</td>
<td>Aquaculture Extension and Training Strategy</td>
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<td>AGDP</td>
<td>Agricultural Gross Domestic Product</td>
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<td>ARI</td>
<td>Agricultural Research Institute</td>
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<td>ARMP</td>
<td>Agricultural Research Management Project (World Bank)</td>
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<td>ASIRP</td>
<td>Agricultural Services Innovation and Reform Project (World Bank)</td>
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<td>ASSP</td>
<td>Agricultural Support Services Project (World Bank)</td>
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<td>ATI</td>
<td>Agriculture Training Institute</td>
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<td>AVRDC</td>
<td>Asian Vegetable Research and Development Centre</td>
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<td>BADC</td>
<td>Bangladesh Agricultural Development Corporation</td>
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<td>BAEC</td>
<td>Bangladesh Atomic Energy Centre</td>
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<td>BARC</td>
<td>Bangladesh Agricultural Research Council</td>
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<td>BARF</td>
<td>Bangladesh Agricultural Research Foundation</td>
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<td>BARI</td>
<td>Bangladesh Agricultural Research Institute</td>
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<td>BBS</td>
<td>Bangladesh Bureau of Statistics</td>
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<td>BFRI</td>
<td>Bangladesh Forest Research Institute</td>
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<td>BIDS</td>
<td>Bangladesh Institute of Development Studies</td>
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<td>BINA</td>
<td>Bangladesh Institute of Nuclear Agriculture</td>
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<td>BJRI</td>
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<td>BLRI</td>
<td>Bangladesh Livestock Research Institute</td>
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<td>BRAC</td>
<td>Bangladesh Rural Advancement Committee (an NGO)</td>
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<td>BRRI</td>
<td>Bangladesh Rice Research Institute</td>
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<td>BSRI</td>
<td>Bangladesh Sugarcane Research Institute</td>
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<td>BSRTI</td>
<td>Bangladesh Sericulture Research and Training Institute</td>
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<td>BSTI</td>
<td>Bangladesh Standards &amp; Testing Institute</td>
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<td>BTRI</td>
<td>Bangladesh Tea Research Institute</td>
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<td>CDIL</td>
<td>Central Diagnostic Investigation Laboratory</td>
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<td>CEO</td>
<td>Chief Executive Officer</td>
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<td>CERDI</td>
<td>Central Extension Resource Development Institute</td>
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<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
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<td>CGP</td>
<td>Competitive Grants Program</td>
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<td>CGS</td>
<td>Competitive Grant Scheme</td>
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<td>CIMMYT</td>
<td>International Center for Wheat and Maize Improvement</td>
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<td>CIP</td>
<td>International Center for Potato</td>
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<td>CRP</td>
<td>Contract Research Program</td>
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<td>DAE</td>
<td>Department of Agricultural Extension (MOA)</td>
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<td>DAM</td>
<td>Department of Agricultural Marketing (MOA)</td>
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<td>DANIDA</td>
<td>Danish International Development Agency</td>
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<td>DFID</td>
<td>Department for International Development (United Kingdom)</td>
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<td>DLS</td>
<td>Directorate of Livestock Services (MOFL)</td>
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<td>DOF</td>
<td>Department of Fisheries (MOFL)</td>
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<td>EC</td>
<td>Executive Committee</td>
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<td>ECNEC</td>
<td>Executive Committee for National Economic Council (GOB)</td>
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<td>ESP</td>
<td>Extension Service Provider</td>
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<td>EU</td>
<td>European Union</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FD</td>
<td>Forest Department (MOEF)</td>
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<td>FDIL</td>
<td>Field Disease Investigation Laboratory</td>
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<td>FRI</td>
<td>Fisheries Research Institute (MOFL)</td>
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<td>FSR</td>
<td>Farming Systems Research</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>GMO</td>
<td>Genetically Modified Organism</td>
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<td>GOB</td>
<td>Government of Bangladesh</td>
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<td>HES</td>
<td>Household Expenditure Survey</td>
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<td>HIES</td>
<td>Household Income and Expenditure Survey</td>
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<td>HRD</td>
<td>Human Resource Development</td>
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<td>HVA</td>
<td>High Value Agriculture</td>
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<td>HYV</td>
<td>High Yielding Varieties</td>
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<td>ICAR</td>
<td>Indian Council of Agricultural Research</td>
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<td>ICRISAT</td>
<td>International Crops Research Institute for Semi-Arid Tropics</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IDA</td>
<td>International Development Association (World Bank Group)</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<td>IPM</td>
<td>Integrated Pest Management</td>
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<td>IRRI</td>
<td>International Rice Research Institute</td>
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<td>JBIC</td>
<td>Japan Bank for International Cooperation</td>
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<td>JICA</td>
<td>Japan International Cooperation Agency</td>
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<tr>
<td>LCG</td>
<td>Local Consultative Group</td>
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<td>LEAF</td>
<td>Local Extension Agent for Fisheries</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MOA</td>
<td>Ministry of Agriculture (GOB)</td>
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<td>MOEF</td>
<td>Ministry of Environment and Forests (GOB)</td>
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<td>MOF</td>
<td>Ministry of Finance (GOB)</td>
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<td>MOFL</td>
<td>Ministry of Fisheries and Livestock (GOB)</td>
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<td>MOP</td>
<td>Ministry of Planning (GOB)</td>
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<td>NAEP</td>
<td>New Agricultural Extension Policy (GOB)</td>
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<td>NAFTA</td>
<td>North American Free Trade Agreement</td>
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<td>NAP</td>
<td>National Agricultural Policy (GOB)</td>
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<td>NARS</td>
<td>National Agricultural Research System</td>
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<td>NATP</td>
<td>National Agricultural Technology Project</td>
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<td>NGO</td>
<td>Non-Government Organization</td>
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<td>OED</td>
<td>Operations Evaluation Department (World Bank)</td>
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<td>PETRA</td>
<td>Poverty Elimination through Rice Research Assistance</td>
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<td>PKSF</td>
<td>Palli Karma Sahayak Foundation (Bangladesh)</td>
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<td>PO</td>
<td>Producers’ Organization</td>
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<td>PRAN</td>
<td>Program for Rural Advancement Nationally</td>
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<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
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<tr>
<td>REA</td>
<td>Revised Extension Approach</td>
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<tr>
<td>RNF</td>
<td>Rural Non-Farm</td>
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<td>SHG</td>
<td>Self-Help Group</td>
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<tr>
<td>SRDI</td>
<td>Soil Resources Development Institute (Bangladesh)</td>
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<td>UAECC</td>
<td>Upazilla Agricultural Extension Coordination Committee</td>
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<td>UGC</td>
<td>University Grants Commission</td>
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<td>UNDP</td>
<td>United Nations Development Programme</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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Country Director: Christine I. Wallich
Sector Director: Constance A. Bernard
Sector Manager: Gajanand Pathmanathan
Task Team Leader: Mohinder S. Mudahar
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During the preparation of this report, the team had extensive discussions with various stakeholders dealing with the agricultural technology system in Bangladesh, including government agencies, the private sector, NGOs, academics, farmers and the development partners. We appreciate the support provided by W. Kabir of the Bangladesh Agricultural Research Council (BARC) in organizing, jointly with the World Bank, three stakeholders’ workshops during the preparation of this report. We are also grateful to the agricultural scientists, researchers, research managers, agricultural extension specialists and farmers for sharing their candid views about the problems, prospects and needed solutions for the agricultural technology system in Bangladesh. The team benefited greatly from extensive discussions with Drs. M. Nurul Alam, Z. Karim and M. Rahman, the current and previous management of BARC.

An earlier version of this report was shared with the Planning Commission, the Ministry of Agriculture, the Department of Agricultural Extension, Hortex Foundation, the Ministry of Fisheries and Livestock, the Department of Fisheries, the Directorate of Livestock Services and BARC on June 27, 2005. We are grateful for the valuable feedback and comments received. Most of the relevant comments have been incorporated in the revised version of the report.
Foreword

In the context of high initial poverty, limited resources and vulnerability to natural disasters, Bangladesh’s achievement of a steady economic growth and improvements in social development indicators have been remarkable. Despite this progress, however, 65 to 70 million people are still poor and the absolute number of people below the poverty line has not changed. With 85 out of 100 poor people living in the rural areas, poverty in Bangladesh is largely a rural phenomenon. The Government’s Poverty Reduction Strategy Paper (PRSP), released in November 2005, recognizes that future progress in social and economic development should be seen in the magnitude of poverty reduction and stresses the links between investment, growth, job creation and poverty reduction, especially in the rural areas.

The Bank Group’s assistance program for Bangladesh emphasizes good governance, improved investment climate, reduced trade restrictions, reduced administrative barriers and support for private sector-friendly credit, land and labor markets. The second pillar of the strategy is to give poor a voice through empowerment to improve access to quality services and accountability. This strategy also supports growth in the rural areas that benefits the poor, especially the agricultural sector with its on-farm and non-farm linkages. Without an accelerated agricultural growth, Bangladesh would find it difficult to reach the Millennium Development Goals (MDGs), especially the goal of halving poverty and hunger by 2015.

In Bangladesh, the strategic role of the agricultural technology system (research and extension) in increasing agricultural productivity has been well demonstrated over the last 30 years through contributions to increased cereal yields, in particular rice, and total food production. However, in more recent years, due to inadequate and unstable funding and institutional inefficiencies, the system has found it difficult to generate and transfer profitable technologies suited to the changing needs of farmers. The role of improved agricultural technology to improve productivity would be even more critical in the future to meet the increasing demand for food and fiber, including high value commodities, for increasing population, from a declining agricultural land base and the need to make the agricultural sector more competitive in the context of expanding globalization.

This report outlines the policy and institutional reforms needed to revitalize the agricultural technology system in Bangladesh in order to generate and disseminate appropriate agricultural technologies in the context of changing needs of the agricultural sector. The challenge for the Government of Bangladesh and the development partners is to implement the findings and recommendations of this report by intensifying support for agriculture in a way that promotes pro-poor agricultural growth, reduces rural poverty and improves the welfare of the rural people.

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Agriculture and Rural Development

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Country Director
World Bank Office, Dhaka
Executive Summary

1. Increased agricultural productivity (crops, livestock, fisheries and forestry) through sustainable intensification and diversification is critical to accelerating agricultural growth to meet the future food and fiber needs of a growing population from a declining land base. Higher agricultural productivity is also an important component of the rural development strategy for raising farm income; reducing poverty and making agriculture in Bangladesh more competitive in the global market. Availability of appropriate production and post-harvest technologies to farmers is essential to raising agricultural productivity. However, the technology (agricultural research and extension) system of Bangladesh is currently unable to effectively generate, transfer and promote the use of such technologies to increase productivity of both the food crops and high value agriculture, including horticulture, livestock and fisheries.

2. This report outlines the policy and institutional reforms needed to revitalize the national agricultural research and extension systems involving the public and the private organizations to meet the challenges confronting the Bangladesh agriculture in the 21st Century. The options included in this study are based on outcomes of consultations with various stakeholders (research managers, scientists, extension agents, government officials, NGOs, agro-processing enterprises, farmers and development partners). Consultations took place through workshops, field visits, group meetings and one-to-one discussions. Lessons learnt from reforms of national agricultural research and extension systems in other countries and from past interventions financed by the World Bank and other development partners in Bangladesh were also taken into account in preparing the reform agenda.

A. Agricultural Research

3. Over the last 30 years, the public national agricultural research system (NARS), especially the Bangladesh Rice Research Institute (BRRI) and the Bangladesh Agricultural Research Institute (BARI), aided by the International Rice Research Institute (IRRI) and the International Center for Wheat and Maize Improvement (CIMMYT), has made significant contributions towards increasing cereal yields and total agricultural production. Yields of rice, which received the largest share of funds invested in agricultural research, increased dramatically through the use of green revolution technologies incorporating the use of improved varieties, irrigation and fertilizers, as well as from increased cultivation of irrigated boro (dry season from December through April) rice. However, in more recent years, the system is finding it increasingly difficult to generate new and profitable technologies suited to the changing needs of farmers. The main barriers to better research include: inadequate and unstable funding; weak management of the research system, including inefficient allocation and use of available resources, declining quality as well as relevance of research and limited access to new sciences; ineffective institutional arrangements for coordination of research, including weak governance, poor scientific incentives and an eroding human resource base. The recommendations summarized below are aimed at addressing these constraints.

4. While other research service providers, e.g. agribusiness enterprises and NGOs, may play greater role in the future, a strong and productive network of publicly funded research system would be critical to meeting the technology needs of the small and marginal farmers, who constitute the majority of the rural poor, and to safeguard the nation’s natural resource base and the environment. A public research system that is responsive to the market signals can also help by enhancing productivity and the competitiveness of agriculture under the changing environment for regional and global trade. If implemented, the proposed reform program would help to reverse the continuing decline and commence the much needed revitalization of the national agricultural research system.
(a) **Augmenting Research Funding**

5. **Increase Public Investment and Stability of Funding for the Research System.** In view of the high impact of agricultural research on growth and poverty reduction vis-à-vis other public investments, GOB should increase public funding of NARS from its current level of around 0.2% of AGDP to about 2.0% of AGDP in phases. The immediate increase should be to 0.6% of AGDP, which is the average for all developing countries, and would include the establishment of an endowment Trust Fund discussed below. At the same time, to ensure stability of funding, GOB should channel funds through a single amalgamated development and revenue budget, along with a permanent advance equivalent to 12 months of expected operational costs of the NARS (agricultural research institutes (ARIs) and the Bangladesh Agricultural Research Council (BARC)) to reduce disruption caused by erratic quarterly releases of funds by the Ministry of Finance (MOF). At the same time, efficiency of the resource allocation process and resource use should be improved to finance priority research, along with effective financial management systems to monitor the use of these resources.

6. **Support Pluralistic Institutional Structure and Increase Research Efficiency by introducing an Independently Managed Competitive Grants Program (CGP).** To harness the additional agricultural research capacity available in the country with Universities, NGOs and the private sector and to improve system efficiency, GOB should establish a Competitive Grants Program (CGP) to finance time-bound peer reviewed research proposals on priority topics matched with demand led research needs. Possible options for institutional arrangements for implementing the CGP initiative are discussed below under the proposed institutional reforms, which include a mechanism for ensuring sustainability and stability of funding.

7. **Diversify Sources of Funding for Research.** In recent years, the agribusiness enterprises in Bangladesh have been pursuing contract farming for cultivation of selected cereals, oil crops, fruits and vegetables; seed production; and even commercial poultry production. Expansion of high value commercial agriculture is identifying technology gaps for poultry, livestock, fisheries and related to varieties, cultivation practices and post-harvest management systems for specific crops and locations. As these enterprises do not have the capacity and/or are unable to allocate sufficient resources to address critical constraints, NARS should examine opportunities for augmenting research funding from the private sector to address specific problems through: (a) fee-based contract research; and (b) need-based public-private partnerships.

(b) **Strengthening Research Management**

8. **Prioritize Research.** In the absence of a systematic approach to priority setting, the research system lacks consensus on the critical constraints to allocate scarce resources for maximum pay-offs. BARC/ARIs should re-evaluate the research plans prepared by each institute (under the Agricultural Research Management Project, which is now closed) to prioritize research programs using a common methodology that takes into account government policies and recommendations of the poverty reduction strategy paper (PRSP) as well as the emerging needs of farmers and revise resource allocations accordingly.

9. **Enhance Capacity in Social Sciences.** In view of the chronic weakness of NARS in social sciences and the importance of understanding the socio-economic issues in agricultural research and economic policy analysis, BARC/ARIs should take immediate steps to establish strategic partnerships with other institutions, including Universities, to build capacity in social sciences in NARS.

10. **Support Participatory Eco-regional Production Systems Research.** To better target research on needs of farmers under different agro-ecological conditions and to integrate research across disciplines, including input from socio-economic work, BARC should establish a team of experts to develop a framework and operational modalities for commencing decentralized eco-regional research based on farming systems as an integral part of the work program to be financed under the CGP.
11. **Enhance Access and Develop Capacity to Utilize New Sciences.** A recent joint study undertaken by GOB, UNDP and FAO concluded that the NARS faces serious institutional, regulatory and investment constraints in accessing tools and techniques of biotechnology. These weaknesses are now being addressed through an independent biotechnology support project being financed by UNDP. In view of this, NARS should develop close linkages with this project to enhance the role of biotechnology in agricultural research. At the same time, MOA, MOFL and MOEF should examine what other actions should be initiated to enhance access to other new sciences, including bioinformatics and information technology, in agricultural research. However, this would also require an appropriate and adequate attention to be given to biosafety of genetically modified organisms (GMOs). The United States Government is also financing agricultural research related to biotechnology.

(c) **Institutional Reforms for Enhanced System Efficiency**

12. During consultations with the NARS partners, special efforts were made to identify various options and to agree on critical actions for institutional reforms that are most likely to work under the Bangladeshi conditions. The areas of greatest concern highlighted by the NARS partners related to the institutional autonomy, working environment for the scientists and the level and sustainability of funding for the research system. The MOA officials, on the other hand, were more concerned about the weak responsiveness of the NARS to its main client – the farmer. In considering various options to address both sets of concerns highlighted by the consultation process, this study has drawn on the best practices and lessons learnt from the past work in Bangladesh as well as from the experiences of other countries, e.g. the United States, countries in Europe, India, Brazil, where the research systems (under ICAR in India and EMBRAPA in Brazil) have addressed similar issues.

13. **Enact Institutional Changes for Greater Autonomy of NARS, Sustainability of Funding and Enhanced Relevance of Research.** Three options, requiring different degrees of institutional restructuring, are proposed to address the problems faced by the NARS in Bangladesh. These options have their own advantages and disadvantages in terms of efficiency, sustainability and implementation feasibility. A brief description of these three options is given below.

**Option A**

Reconstitute BARC as the Bangladesh Agricultural Research Foundation (BARF). Under this option, GOB/MOA/MOFL/MOEF would convert and restructure BARC into an autonomous agency under the Companies Act as a ‘not-for-profit’ Association to be known as the Bangladesh Agricultural Research Foundation (BARF). The BARC Act 1996, currently in force, would be abolished in due course, but is not a prerequisite for the establishment of BARF.

The governance structure of BARF would have a Governing Board (GB), an Executive Council (EC) and a Secretariat. Establishment of BARF would provide the GB full autonomy and authority needed to guide and strengthen NARS and to prepare its own laws and by-laws. GB would have representation from all the stakeholders (government, ARIs, Universities, NGOs, the private sector and farmers) with a majority composed of non-officials. EC, with its membership largely drawn from the agricultural research community, would link BARF to the NARS partners. The Secretariat would manage the day-to-day business of the Foundation. All technical and general establishment positions needed for BARF would be assigned from BARC and funded by GOB under the revenue budget.

The focus of BARF’s mandate would to coordinate research and to help with prioritization, planning, review of annual research plans of ARIs, monitoring and evaluation of research, policy analysis and management of the Competitive Grants Program (CGP).
To ensure sustainability and stability of funding for the CGP, an endowment Trust Fund (TF) would be established to generate an income stream to finance CGP research. TF would be managed by an independent fund manager who would be accountable to the TF Trustees appointed in consultation with GOB. External assistance would be required to establish the Trust Fund of a size commensurate with needs of the priority research program to be financed through the competitive process. Other funding needs of BARC (and ARIs) would be met by GOB through annual budget allocations.

Option B

Under this option GOB/ MOA/ MOFL/ MOEF would amend the BARC Act 1996 and other Acts/ Ordinances governing individual institutes to give greater autonomy to BARC as the apex body of NARS.

The governance, roles and responsibilities, and funding of BARC would be changed. As is the case now, the ‘new’ BARC would have a Governing Board (GB), and EC and a Secretariat. However, under the revised Act, the GB would be an autonomous body with authority to suggest changes in the mandates and organizational structures of ARIs, formulate service and business rules for the ARIs and BARC and determine policies for human resource development. The membership of GB would be changed to increase representation of non-government members. The role of EC would be similar to that described under Option A. The Secretariat would be restructured to give greater focus to its role in research coordination, prioritization and allocation of available resources to agreed priorities. The capacity of the Secretariat to undertake socio-economic and policy analysis on issues of importance to agricultural sector/research would be strengthened. It would help ARIs in planning of annual research work plans. To provide the ‘new’ BARC a stronger role in research coordination, the NARS research budget (excluding salaries) would be allocated based on its recommendations to finance annual work plans of ARIs covering strategic public goods research on agreed priorities.

In addition, the Bangladesh Agricultural Research Foundation (BARF) would be established as a not-for-profit association under the Companies Act and operate under its own Governing Board (GB). The main function of the Foundation under this option would be to manage the CGP. As a Foundation, it would have autonomy to run the CGP with independence and transparency. With the exception of key management posts, the establishment positions needed to manage the CGP would be transferred from the BARC Secretariat. Other arrangements for management of the Foundation would be similar to those described above, under Option A. The income stream generated by the TF would finance the CGP. Financing arrangements for establishing the TF and its independent management would be similar to those described under Option A.

Option C

Under this option also GOB/ MOA/ MOFL/ MOEF would amend the BARC Act 1996 and other Ordinances/ Acts governing individual institutes to give greater autonomy to BARC as the apex body of NARS. GOB would also establish a separate Foundation, the Bangladesh Agricultural Research Foundation (BARF) to manage the CGP.

The changes in the governance structure, roles and responsibilities and funding of ‘new’ BARC would be similar to those described under Option B above. However, unlike Option B, BARF would operate under the overall policy guidance of the ‘new’ BARC’s GB. As in Option B, the main function of BARF would be to manage the CGP and the required establishment positions to run the program would be transferred from the BARC Secretariat. Other arrangements for management of the Foundation and establishment of a Trust Fund would be similar to those described above, under Option B.

14. Potentially, all the options can increase the system efficiency and provide the means for sustainable and stable funding for the CGP, with a reduced recurring burden on GOB’s annual budget for agricultural
research. However, the Option B would have the greatest chance of success due to greater autonomy of the BARC and BARF.

15. **Rationalize Research Institutes, Stations and Sub-stations.** In the light of emerging challenges and to correct any duplication in the mandates of ARIs, MOA/MOFL/MOEF should appoint an independent multi-disciplinary panel to: (a) review and make recommendations for the revision of ARI mandates; (b) assess staffing and skill-mix needs of different ARIs in the context of revised mandates; and (c) develop and implement an action plan for rationalization of the network of stations and sub-stations of ARIs through consolidation and/or closure of redundant facilities. This will not only streamline research activities but will also improve efficient utilization of available human and financial resources.

16. **Reverse Continuing Decline in Human Capital of the Research System.** MOA/MOFL/MOEF should prepare a human resource management plan for recruitment, skill improvement and retention of qualified staff for ARIs under their control and allocate increased resources for its implementation.

**B. Agricultural Extension**

17. More recently, a number of non-governmental organizations and the private sector agribusiness enterprises have started providing extension services to farmers. Some of them undertake this service as a part of 'contract farming' arrangement for the production of milk, poultry, seeds, oil crops, fruits and vegetables for domestic and export markets. This represents an important development for cost sharing of the extension service with the private sector and NGOs. Despite these developments, however, the government departments, especially the Department of Agriculture Extension (DAE), Department of Fisheries (DOF) and the Directorate of Livestock Services (DLS), remain the dominant extension service providers (ESPs) and this would continue to be the case in the foreseeable future.

18. Adoption of the New Agricultural Extension Policy (NAEP) by MOA represented a major shift in the public extension service as it required DAE to change from a centralized extension service to a decentralized pluralistic extension system. NAEP also required DAE to move from a top-down operational mode to become a participatory demand-led service provider. Similarly, adoption of the National Fisheries Policy (NFP) required a fundamental change in functioning of the DOF from 'regulation and control' to 'participation and cooperation', especially in the provision of extension services by involving the local communities, the private sector and NGOs. The DLS does not have a separate national livestock extension policy that takes into account the changing circumstances of the livestock sector in Bangladesh or the new approaches to delivery of extension services. While the new policies represented a significant advance over past practices, many of the changes required under the new policies are still to be fully implemented and internalized. At the same time, there is a lack of clarity in the public and the private role in the provision of extension services. As a result, DAE, since it has a large field force, wants to continue to manage projects and function as the main service provider. Not enough attention is paid to the need for inter-institutional coordination and support for greater involvement of other ESPs to encourage further strengthening of the emerging pluralistic institutional structure. Lessons learnt, since the adoption of NAEP, have also highlighted the need for addressing the funding, management and institutional issues that continue to constrain the efficiency and effectiveness of the public extension service provided by DAE, DOF and DLS.

(a) **Funding of Extension Service**

19. **Improve Cost-effectiveness of the Public Expenditure.** Lack of operational funds is an important cause of weak public extension service. It reduces effectiveness of the large expenditure on staff salaries, which in the case of DAE accounts for over 90% of the revenue budget. Operational funds for
extension under the development budget are largely provided to serve specific objectives of the projects being implemented by DAE. Since most of these projects cover a small area in different parts of the country and many are discipline/activity specific, e.g. crop protection, soil fertility and fertilizer, construction of small dams etc., very few farmers receive holistic support from the extension service. Same is true with DOF and DLS. In order to improve effectiveness of agricultural extension, DAE, DLS and DOF should change composition of the public expenditure on extension so that at least 30% of the total budget is allocated to cover operational costs of the service.

20. **Diversify Sources of Funding and Enhance Financial Sustainability.** Entry of other ESPs creates opportunities for cost sharing, e.g. under contract farming, as complete reliance on public funding may not ensure financial sustainability. DAE, DLS and DOF should reduce the burden on the government budget of public extension by: (a) empowering farmers and their organizations to share responsibility for planning, implementation and monitoring of extension; (b) increase private funding by facilitating: (i) provision of extension services as an integral part of an expanding contract farming system; and (ii) by developing cost sharing arrangements through public-private partnerships; and (c) reduce staff numbers and/or intensity of public service in areas covered by the private service providers.

(b) **Management Issues**

21. **Mainstream Innovations Already Pilot Tested.** Over the years, a number of different methodologies have been tried to enhance the impact of extension. While no single approach has emerged as the best option under all situations, the overall experience suggests that decentralization to allow involvement of farming communities in local planning, budgeting and implementation of extension can bring a number of benefits in terms of improved contact, relevance and ownership. Accordingly, the line departments (DAE, DOF and DLS) should: (a) mainstream the community-led decentralized extension partnership approach learning from the guidelines of a model already pilot tested; and (b) enhance the use of Information and Communication Technology (ICT), including internet connectivity, as an aid to extension and capacity building of the Zilla/Upazilla/Union level staff of all partners, including farmers.

22. **Improve Relevance of Extension Interventions.** The public extension staff often make limited efforts to understand the agro-ecological as well as the socio-economic circumstances of farmers they serve. As a result, the service is unable to respond to changing needs of farmers or to categorize potential clients to target interventions for different groups of farmers. DAE, DLS and DOF should: (a) enhance understanding of farmer’s priority needs in the context of their socio-economic circumstances by involving farming communities in the decision making process; (b) facilitate access to markets, market information and credit, which have emerged as common problems, by including representatives from the marketing and credit institutions in the coordination mechanism for decentralized extension; and (c) fund participatory on-farm validation and refinement of extension interventions to ensure location specificity and relevance.

23. **Improve Research-Extension-Farmer Linkages.** To strengthen linkages between research, extension and farmers, MOA, MOFL and MOEF should ensure: (a) adoption of farmer participatory approaches for research and extension; and (b) implementation of joint priority setting, planning and on-farm adaptation/validation trials by ARI scientists and extension staff.

(c) **Institutional Issues**

24. **Strengthen Decentralized Pluralistic Institutional Structure of Extension Service Providers.** The new extension service providers, e.g. the private sector and some large NGOs, are not only working with a different client base but have also brought about changes in the nature and approach to extension delivery. To strengthen the emerging pluralistic structure of the national system, DAE, DOF and DLS should: (a) expand decentralized partnerships involving the public agencies, NGOs, the private sector and producers’ organizations as providers of broad-based extension service; (b) establish Upazilla level coordination
mechanism, e.g. through Upazilla Agricultural Extension Coordination Committee (UAECC), for planning and funding of extension, along with transparent mechanism for fund flow, utilization, monitoring financial management and accounting; (c) support existing and form new farmer groups (commodity groups, Self-Help Groups, micro-credit groups and others) and develop them into self-managed producers' organizations that are able to take responsibility for planning, implementation and monitoring of extension activities; and (d) develop capacity of the Union level ESPs, to enable them to provide holistic service to farmers with close support from the multi-disciplinary team of Upazilla level line department (DAE, DOF and DLS) subject matter specialists and in liaison with the Union Parishadows, the elected local government.

25. **Enhance Organizational Efficiency.** To enhance the organizational efficiency of DAE, DLS and DOF and to provide pro-poor (e.g. small and marginal farmers) extension service, MOA and MOFL should: (a) re-define mandate of the line departments in the context of a pluralistic institutional structure of extension service providers; (b) rationalize core functions of various divisions/units of departments in line with the new mandate (c) reposition staff to Upazillas with higher density of rural poor; and (d) move from a project-based to a program-based planning and budgeting system to avoid duplication, maintain consistency in extension methodologies and improve coordination of funding from different sources. In addition, DLS should also develop a separate national livestock extension policy.

26. **Expand Scope and Coverage of the Extension Service.** To expand the scope and coverage of the extension service DAE, DLS and DOF should establish strategic partnerships with other public and private organizations, especially the input supply companies, agribusiness enterprises, financial institutions and marketing agencies to facilitate availability of critical inputs, credit and marketing information to farmers.

27. **Give Higher Priority to Human Resource Management.** DAE, DLS and DOF should: (a) assess skill gaps of field staff to support a decentralized farmer participatory extension service and implement training programs to meet the emerging needs; (b) adopt a more holistic approach to human resource management for recruitment, utilization, improvement and retention of qualified staff; (c) examine opportunities for developing strategic partnerships with other educational organizations, e.g. agricultural universities, agribusiness enterprises and NGOs, to strengthen the Central Extension Resource Development Institute (CERDI) and make appropriate changes in its governance as well as organizational arrangements to give it greater autonomy in catering to multi-disciplinary and multi-dimensional training needs and, in time, to become a self-financing institution.

C. **High Value Agriculture**

28. Recent analytical information shows that within the food sector, the market for non-cereal commodities is growing rapidly. Fruits, vegetables, fisheries and livestock products are claiming a larger part of the incremental income, especially of people in urban areas. In addition, there is a growing export market for horticultural commodities and shrimps (fresh, processed, frozen) in Far East, Middle East, Europe and the United States. In response to the increasing demand, farmers are shifting land from cereals to spices, vegetables, potatoes, fruits and aquaculture. These developments have also created opportunities for value addition through improved post-harvest management and agro-processing of agricultural commodities into finished or semi-finished products both for the domestic and the export markets. However, growth of the high value commercial agriculture is being constrained by lack of locally adapted varieties and production technologies, poor post-harvest management practices (handling, grading, packaging, transport to market), inadequate market access and marketing arrangements, poor infrastructure (roads, cold storage, communication, power) and limited private sector investment in agro-processing. Food safety regulations of importing countries and high cost and limited availability of air cargo space are additional problems for increasing exports. Given the diverse nature of these constraints, many of which go beyond the scope of this
study, the focus has been to identify areas that can be directly addressed by the public technology system or through facilitation of investment by the private sector.

29. Finding solutions to technological constraints requiring medium to long-term research, e.g. to develop suitable new breeds or crop varieties, location specific fertilizer recommendations, aquaculture practices, safe pest and disease control systems, post-harvest management systems, should be the focus of the publicly funded research. The public research institutions can also play an important role in capacity building of producers, exporters and processors in various aspects related to the production, post-harvest handling, grading, packaging and marketing of high value commodities. The private sector has started to introduce imported new production and processing technologies through contract farming system. This role of the private sector to adapt new technologies to local conditions through short-term research and to develop forward linkages with markets and agro-processing is likely to grow in the future and should be facilitated by the public technology system. At the same time, judicious public-private partnerships can play an important role in developing suitable post-harvest technologies for value addition and in establishing reliable food quality and safety assurance system.

30. The facilitation role and provision of technical assistance to the private companies and NGOs entering the market to procure, process and export horticultural crops is being performed by the Horticulture Export Development Foundation (Hortex), which is a publicly funded autonomous agency specifically established by the MOA to promote increased cultivation, processing and export of horticultural crops. With appropriate strengthening and technical assistance, Hortex can play an important role in this area by promoting backward and forward linkages between different stakeholders, including research, extension, markets, farmers, the public sector, the private sector and NGOs. Although initially limited to horticultural crops, the mandate of Hortex has been broadened to include other agricultural commodities.

31. MOA and MOFL, along with Hortex, BARC, ARIs and extension services (DAE, DOF and DLS), should: (a) assess research and extension priorities and focus resources on activities that are likely to benefit small and marginal farmers from the expanding market for high value agricultural commodities; (b) develop an action plan to build skills of researchers, producers, exporters and processors to support the growth of high value agriculture; (c) develop a regulatory framework for an effective system of food quality and safety assurance, including sanitary and phyto-sanitary requirements of the export markets; (d) facilitate development of legal and regulatory framework to facilitate private investment in agro-processing; and (e) promote appropriate partnerships with the private sector to develop suitable system for the collection and distribution of market intelligence to help producers and entrepreneurs.

D. Implementation Strategy

32. An important element of the implementation strategy for the proposed agenda is to build consensus and ownership by the stakeholders. The key players, whose continued support would be crucial to manage the change process, include the Ministers and senior officials of MOA, MOFL and MOEF and heads of key institutions under the NARS; and heads of extension services (DAE, DOF and DLS).

33. The consultation process with stakeholders revealed that the politicians and the senior officials in the concerned ministries see the bridging of yield gap between what is possible and what is actually being achieved by farmers as the first priority for action under the change process. The technology system managers, scientists and extension staff, on the other hand, see the resolution of institutional and funding issues as priorities in addressing constraints to higher productivity.

34. In sequencing the reform agenda, it is recommended that highest priority be given to addressing the funding and institutional issues. It is concluded that the increased investment in the technology system can
be the driver for improved system efficiency. A dedicated endowment Trust Fund under BARF to finance research proposals through a competitive process would not only increase public investment in research but will also provide much needed sustainability and stability in funding. Greater and reliable availability of funds would enable the public institutions to address weaknesses in the management system and to improve human capital. As a result, NARS would be more effective in prioritizing research and directing resources to address farm-level constraints to higher agricultural productivity and bridging the yield gaps. Concurrent strengthening of the pluralistic institutional structure and decentralization of management to local institutions, involving farming communities, would make the extension services more relevant and responsive to the location specific needs of farmers.

35. Production of high value commodities, e.g. fruits, vegetables, shrimp, milk, meat and poultry, offers opportunities to diversify sources and improve income of small and marginal farmers. Therefore, the second set of priority for the reform agenda is to facilitate growth of high value agriculture. This would require increased allocation of resources both to solve problems constraining the productivity and quality of commodities being produced by farmers practicing commercial agriculture and to facilitate entry of others through knowledge and resource transfers. Support for expansion of contract farming through agribusiness enterprises would help to increase the area under horticultural crops (fruits and vegetables) as well as increase the production of milk and poultry products. This is likely to increase rural employment through increased demand for labor. In addition, facilitation of greater investment by the private sector in input supply distribution, post-harvest management systems and agro-processing would create more rural non-farm jobs.
Chapter 1: Introduction

1.1 The overarching goal of the Government of Bangladesh (GOB) by 2015 is to achieve a 50% reduction in the proportion of population living below the poverty line in 2000 (Millennium Development Goal -- MDG). In addition to maintaining a sound macro-economic framework, the Poverty Reduction Strategy Paper (PRSP), entitled “Unlocking the Potential - National Strategy for Accelerated Poverty Reduction” (GOB, 2005), highlights the need for higher growth in rural areas and development of agriculture and rural non-farm economic activities as one of the four priority areas for accelerating pro-poor economic growth. The other three priority areas included in the PRSP are: (i) small and medium manufacturing enterprises; (ii) rural electrification, roads, water supply and sanitation, and supporting rural infrastructure; and (iii) information and communication technologies.

A. Need to Increase Agricultural Productivity

1.2 Agriculture, which accounts for about 23% of GDP, plays a critical role in the overall economic development of Bangladesh. The rural non-farm sector, which is driven primarily by agriculture through the backward and forward linkages, accounts for another 33% of GDP. Over time, the share of production agriculture in GDP has declined whereas the share of rural non-farm sector has increased. About 75% of Bangladesh population lives in the rural areas and their main sources of livelihoods are agriculture and the rural non-farm sector. With almost 85 out of 100 poor people living in the rural areas, poverty in Bangladesh is primarily a rural phenomenon. Hence, improvement in agricultural sector performance and acceleration in growth are critical to reducing rural poverty.

1.3 It is estimated that the agricultural land is declining by around 1%/year and the land quality is deteriorating due to degradation, soil fertility problems (e.g. nutrient imbalance), soil erosion and soil salinity. In order to produce more food for the increasing population, growing at the rate of about 1.6%/year, and raw materials for the agro-industry, there is a need to increase agricultural growth through higher productivity, including increased yields, agricultural intensification and/or diversification and value addition. According to the PRSP, annual economic growth must be about 6-7%/year, if Bangladesh is to achieve its MDG goal of 50% reduction in poverty by 2015. From 1980-2000, GDP grew at 4.8%/year and agricultural GDP grew at 3.1%/year. However, in the last few years, annual agricultural growth has declined to below 2%/year. In order to achieve the GDP growth rate of 6-7%/year, agriculture must grow by at least 4%/year. This would be possible only through an increase in agricultural productivity (for crops, horticulture, livestock, fisheries and forestry) based on modern agricultural technology and a supply chain linking farmers with the consumers in the national as well as export markets.

B. Emerging Challenges for the Agricultural Technology System

1.4 Sustainable intensification and diversification of agriculture through technological change requires an efficient and productive agricultural technology system comprising of agricultural research (technology generation and development) and extension (technology dissemination). This needs to be supported by appropriate value addition and market linkages.

(a) Agricultural Research

1.5 The National Agricultural Research System (NARS), comprising of 10 Agricultural Research Institutes (ARIs) and the Bangladesh Agricultural Research Council (BARC), the coordinating body, was
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successful in increasing cereal yields over the last 30 years when production more than doubled. However, the system devoted limited resources to research on horticulture, fisheries and livestock sub-sectors and to research on post-harvest management and agro-processing needs. Furthermore, in more recent years, the research output has declined and average yields of crops, milk, meat and fish have remained low with a large gap between what research produces and what farmers want as well as between farmer yields and the research station yields. An important challenge facing the NARS, therefore, is to increase farm incomes through higher agricultural productivity from an intensively used and a declining land resource. Other challenges include: (i) increase in agricultural globalization of agriculture; (ii) need for sustainable intensification and diversification of agricultural production systems; (iii) alleviation of rural poverty; and (iv) deterioration of natural resource base, particularly land and water.

(b) Agricultural Extension

1.6 Since 1982, the Department of Agricultural Extension (DAE), under the Ministry of Agriculture (MOA), has played its part in transferring crop technologies that led to an increase in cereal yields. In addition, the Ministry of Fisheries and Livestock (MOFL), Ministry of Environment and Forests (MOEF), Cotton Development Board, Tea Board, Silk Foundation and Silk Board also maintain field staff and provide extension support to their clients. In early 1990s, DAE adopted a New Agricultural Extension Policy and commenced a group and demand-based extension system supported by decentralized participatory planning and demonstrations reflecting needs of the local communities. Although some progress has been made in pilot areas, the change process is still weak and, following closure of the externally supported projects, the service is facing funding crisis with inability to fully finance operational expenses and to build on past successes. This situation is not much different with the Department of Fisheries (DOF) and the Directorate of Livestock Services (DLS). In addition, inter-departmental coordination among DAE, DOF and DLS remains weak; staff skill development has not kept pace with demands of the participatory processes; and linkages with research need further strengthening. Transfer of appropriate technologies to farmers under “contract” with agro-processing enterprises is an emerging need offering opportunities for mutually beneficial public-private partnerships.

(c) Emerging Agricultural Policy

1.7 The Government of Bangladesh recognizes the critical role of science and technology in accelerating agricultural growth and has requested IDA assistance to strengthen the national agricultural technology generation and transfer systems. It has affirmed its commitment to reform and to an action program that would enable its research and extension services to play an important role in achieving the PRSP objectives for the agricultural sector. Support from IDA (and other development partners) would help the Government to develop a reform agenda responsive to emerging needs and changing roles of the public and the private sectors, necessary for pluralism in funding and execution of research and extension programs.

C. Objective, Scope and Strategy

(a) Objective

1.8 The main objective of this study is to make an assessment of the current status of the national agricultural research (technology generation) and extension (technology transfer) systems. Based on that assessment the study has made recommendations for reforming the agricultural technology system to make it more relevant and sustainable and, at the same time, to promote complementary involvement of the private sector, NGOs and the universities in research and extension activities. This has been done in the context of crops, horticulture, livestock and fisheries as well as high value commercial agriculture and the emerging challenges for agriculture in the global economy.
As a large body of information was already available from the past work, the initial focus of the study was to review available documents to identify the unfinished reform agenda which was still valid and needed implementation. The study paid special attention to understanding reasons for past failures and examined suitable options for reforming the national agricultural technology system in the future at a pace consistent with the ability of the country to internalize changes.

(b) Agricultural Research

The study examined the best options for supporting development of a pluralistic national agricultural research system. More specifically, the study identified the institutional and policy options that would:

(i) provide effective research coordination, including allocation of resources to agreed priorities, and build more effective linkages between the research community and policy making;
(ii) encourage greater involvement of the private sector;
(iii) integrate universities, as a part of the national research system;
(iv) promote strategic partnerships with international and regional research organizations;
(v) institutionalize separation of research funding from research execution;
(vi) help rationalize network of institutes and sub-stations;
and (vii) introduce more effective monitoring and evaluation of research.

The study also examined innovative institutional mechanisms for augmenting public funding of agricultural research and measures that would enhance effective utilization of available funds, including:

(i) need-based public-private partnerships to broaden the scope and coverage of research and attract additional resources;
(ii) competitive grants program (CGP) to enhance access to trained manpower and resources with organizations outside of agricultural institutes and to foster competition, efficiency and accountability;
and (iii) a peer review system for the ‘core’ research programs/projects to encourage multi-institutional partnerships, with greater accountability and timely action for modification or closure of unsuccessful research projects.

(c) Agricultural Extension

The study examined options to institutionalize changes that would:

(i) strengthen the decentralization and participatory processes that have shown promise in pilot areas;
(ii) expands service providers beyond public extension to include the private sector, NGOs and producers’ organizations in a variety of formal and informal partnerships, including contract farming, for technology transfer, knowledge management and market linkages;
and (iii) enhance inter-departmental/inter-institutional, and possibly international, coordination to emphasize farming systems approach and to respond to farmers’ concerns which go beyond technology needs to timely access to agricultural inputs and markets. Consideration was also given to opportunities for expanding the use of new information and communications technologies, including electronic mass media, for training, capacity building and information transfer to support diversified agricultural production systems. Finally, the study examined the actions needed to improve the training system to develop and improve quality of staff and to maintain their technical skills to support a decentralized farmer-centered extension system.

(d) Coverage

The study covered crops, horticulture, livestock and fisheries sub-sectors. The main inputs were the evaluation reports prepared during the previous Bank supported research and extension projects. Additional inputs came from consultations with key stakeholders, including the GOB’s *Actionable Agricultural Policy Briefs* and the *Poverty Reduction Strategy Paper (PRSP)*, private sector (input suppliers, agribusiness enterprises, agro-processors, and machinery manufacturers), NGOs, farmers and development partners. The study examined the current public funding of the agricultural research and extension services and processes of financial resource allocation within relevant ministries.
D. Consultations, Audience and Communication

(a) Stakeholder Consultations

1.14 The study involved extensive consultations with stakeholders in Bangladesh that included (i) three stakeholder workshops; (ii) visits to selected ARIs; (iii) field visits to different parts of the country; and (iv) discussions with the Local Consultative sub-Group (LCG) dealing with agriculture and rural development on issues related to PRSP, the Actionable Agricultural Policy Briefs (coordinated by FAO) and agricultural technology system. In addition, the study team organized one-on-one discussions with representatives of selected public sector agencies, private sector enterprises, NGOs, the universities, development partners and farmers on issues related to agricultural research, agricultural extension, high value agriculture, contract farming, agro-processing, agricultural exports and agricultural inputs.

1.15 To kick start the study, a one day Stakeholders Workshop was jointly organized by the Bangladesh Agricultural Research Council (BARC) and the World Bank in which over 50 experts participated. They were from the government agencies, research organizations and representatives of development partners, private sector, universities and NGOs. The objectives of the workshop were to: (a) encourage debate on the key challenges being faced by the national agricultural technology system; (b) sensitize participants about the need for change; and (c) share information on the emerging consensus on key elements of the new paradigm for strengthening the national agricultural technology system. This was followed by two further workshops with smaller groups of well informed experts with knowledge of the Bangladesh agricultural technology system as the main instrument for developing a consensus for reforming the national agricultural research and extension systems. Following a wide-ranging debate of issues it was clear that the key people are keen to promote reform and innovative interventions to strengthen the agricultural technology system.

(b) Audience and Follow-up

1.16 The main audiences for the report would be the GOB’s Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Environment and Forests; BARC and ARIs that collectively make up the NARS; Government departments dealing with agricultural extension such as the Department of Agricultural Extension (DAE), Directorate of Livestock Services (DLS) and the Department of Fisheries (DOF); Agricultural Universities; development partners; NGOs and the private sector involved in agricultural research, extension and high value agriculture. In addition, the study would form the basis for designing a national agricultural technology project (NATP) for possible financing by the World Bank and other development partners.

(c) Communication Strategy

1.17 The key elements of the communication strategy for disseminating the report and its recommendations include: (i) identification of champions for change; (ii) on-going dialogue with the stakeholders and policymakers; (iii) development of a shared vision and consensus for the agricultural technology system; (iv) formulation of dissemination of action plan for stakeholder workshops, presentations, focus group discussions, use of printed and electronic media to share information and obtain feedback; and (v) possibly a workshop to share findings and recommendations of the study with policymakers and other national and international stakeholders.
Chapter 2: Agricultural Performance and the Role of Agricultural Technology

2.1 This chapter focuses on three aspects of agricultural development and the role of agricultural technology. First, it provides a brief overview of the national and regional poverty profile in the rural areas. Second, it examines the performance and prospects of agricultural sector, in particular the need to increase agricultural productivity. Third, it highlights the role of agricultural technology in increasing productivity as an important contributor to agricultural growth and reduction of rural poverty.

A. Rural Poverty Profile

2.2 The latest poverty profile for Bangladesh is summarized in Table 2.1 and Figure 2.1. The results clearly indicate that (i) despite a reduction of about 1% per annum since 1992, the national poverty level remains very high since 50% of the population is still living below the upper poverty line; (ii) 85% of the total poor live in the rural areas; and (iii) with approximately 65-70 million poor, Bangladesh has the third largest number of poor people in the world. An increase in urban poverty since 1996 merely reflects migration of rural poor to the urban centers in search of jobs, i.e. transfer of rural poverty to the urban areas.

<table>
<thead>
<tr>
<th>Table 2.1</th>
<th>Trends in Poverty (headcount)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>Upper Poverty Line (%)</td>
</tr>
<tr>
<td>Urban</td>
<td>45</td>
</tr>
<tr>
<td>Rural</td>
<td>61</td>
</tr>
<tr>
<td>National</td>
<td>59</td>
</tr>
</tbody>
</table>


2.3 The spatial profile of rural poverty is summarized in Table 2.2. Clearly, there are large regional variations in the magnitude of rural poverty, ranging from 63% in the Northwest region (highest) to 37% in the Coastal areas (lowest). Furthermore, there are large variations in regional poverty trends over time. For example, in the last decade, rural poverty in the Eastern Hills, which includes the Chittagong Hill Tracts, has increased due to limited economic opportunities. There has been only a very small decline in rural poverty in the Meghna floodplains and the South Ganges floodplains due to low level of economic activity caused by frequent floods and related natural disasters. In contrast, over the same period, there has been a significant decline in rural poverty in the Northwest, the North Central and the Coastal regions.

2.4 Approximately, 73% of those who depend on farm wages in the agricultural sector are poor as compared to 49% of those who depend on non-farm wages in the rural non-farm (RNF) sector. This is primarily due to a slow rise (less than 1% per annum in real terms) and lower agricultural wages than in the RNF sector in Bangladesh. The situation is further compounded by the seasonal nature of employment in agriculture as compared to employment in the RNF sector.
B. Agricultural Sector Performance

(a) Role of agriculture

2.5 In terms of contribution to GDP (23%), employment (54%), exports (15%), food security and poverty reduction, agriculture (crops, livestock, fisheries and forestry) continues to play a significant role in the overall economic development of Bangladesh. Within production agriculture, the GDP shares of individual sub-sectors are about 13% for crops, 3% for livestock, 5% for fisheries and 2% for forestry. The rural non-farm (RNF) sector, which is driven primarily by agriculture through the backward and forward linkages, accounts for another 33% of the GDP. The RNF sector accounts for approximately 46% of rural employment and 50% of rural household income. Over time, the share of production agriculture in GDP has declined. The corresponding share of RNF sector has increased and it is likely to grow more rapidly in the future. Despite these changes, however, both agriculture and the rural non-farm sector are fundamental to any strategy designed to reduce rural poverty, increase rural employment, improve the quality of life of rural citizens and improve the development prospects for Bangladesh.

(b) Agricultural Growth Performance

2.6 The size of agricultural GDP, sub-sectoral shares in GDP and agricultural GDP, and the growth rates from 1982/83 to 2002/03 are summarized in Table 2.3. The overall share of production agriculture has declined from 32% in 1982/83 (this share was even higher in 1971 when the country became independent) to 23% in 2002/03. The agricultural sector has been gradually transforming over time as indicated by the sub-sectoral shares in agricultural GDP. The share of crop sector has declined from 65% in 1982/83 to 56% in 2002/03. Within the crop sector, while rice remains the dominant crop, the share of horticultural crops is gradually increasing. The share of fisheries sub-sector has increased from 15% in 1982/83 to almost 23% in 2002/03. However, the speed at which this transformation into high value commercial agriculture through diversification is taking place needs to be accelerated.

2.7 As shown in Table 2.3, the annual growth rate varies over time as well as across sub-sectors. Overall, agricultural GDP has been growing at a slower rate than the GDP. Among all the sub-sectors, fisheries has been growing at the fastest rate. Rapid growth in foodgrain production, largely in the last decade, has led to almost foodgrain self-sufficiency (mainly rice) at the national level. The growth rate for crop production (which also includes fruits, vegetables and other horticultural crops, and which also uses almost all of the agricultural land), however, has been the lowest as compared to the other sub-sectors.
## Table 2.3
Components, Shares and Growth in Agriculture GDP (Base: 1995-96 =100)

### A. Magnitude at Constant Producer Prices (Taka in Billions)

<table>
<thead>
<tr>
<th>Period</th>
<th>Crops and Horticulture</th>
<th>Livestock</th>
<th>Fisheries</th>
<th>Forestry</th>
<th>Agricultural GDP</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83</td>
<td>202.2</td>
<td>40.1</td>
<td>47.9</td>
<td>22.9</td>
<td>313.1</td>
<td>987.8</td>
</tr>
<tr>
<td>1987/88</td>
<td>215.5</td>
<td>44.5</td>
<td>53.1</td>
<td>24.8</td>
<td>337.8</td>
<td>1,181.6</td>
</tr>
<tr>
<td>1992/93</td>
<td>246.1</td>
<td>49.9</td>
<td>69.1</td>
<td>28.2</td>
<td>393.3</td>
<td>1,454.3</td>
</tr>
<tr>
<td>1997/98</td>
<td>259.9</td>
<td>56.4</td>
<td>100.8</td>
<td>33.6</td>
<td>450.7</td>
<td>1,843.9</td>
</tr>
<tr>
<td>2002/03</td>
<td>305.6</td>
<td>67.0</td>
<td>120.4</td>
<td>42.5</td>
<td>535.6</td>
<td>2,375.1</td>
</tr>
</tbody>
</table>

### B. Shares in Agricultural GDP (%)

<table>
<thead>
<tr>
<th>Period</th>
<th>Crops and Horticulture</th>
<th>Livestock</th>
<th>Fisheries</th>
<th>Forestry</th>
<th>Agricultural GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83</td>
<td>64.6</td>
<td>12.8</td>
<td>15.3</td>
<td>7.3</td>
<td>100</td>
</tr>
<tr>
<td>1987/88</td>
<td>63.8</td>
<td>13.2</td>
<td>15.7</td>
<td>7.3</td>
<td>100</td>
</tr>
<tr>
<td>1992/93</td>
<td>62.6</td>
<td>12.7</td>
<td>17.6</td>
<td>7.2</td>
<td>100</td>
</tr>
<tr>
<td>1997/98</td>
<td>57.7</td>
<td>12.5</td>
<td>22.4</td>
<td>7.5</td>
<td>100</td>
</tr>
<tr>
<td>2002/03</td>
<td>57.1</td>
<td>12.5</td>
<td>22.5</td>
<td>7.9</td>
<td>100</td>
</tr>
</tbody>
</table>

### C. Shares in GDP (%)

<table>
<thead>
<tr>
<th>Period</th>
<th>Crops and Horticulture</th>
<th>Livestock</th>
<th>Fisheries</th>
<th>Forestry</th>
<th>Agricultural GDP</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83</td>
<td>20.5</td>
<td>4.1</td>
<td>4.8</td>
<td>2.3</td>
<td>31.7</td>
<td>100</td>
</tr>
<tr>
<td>1987/88</td>
<td>18.2</td>
<td>3.8</td>
<td>4.5</td>
<td>2.1</td>
<td>28.6</td>
<td>100</td>
</tr>
<tr>
<td>1992/93</td>
<td>16.9</td>
<td>3.4</td>
<td>4.8</td>
<td>1.9</td>
<td>27.0</td>
<td>100</td>
</tr>
<tr>
<td>1997/98</td>
<td>14.1</td>
<td>3.1</td>
<td>5.5</td>
<td>1.8</td>
<td>24.4</td>
<td>100</td>
</tr>
<tr>
<td>2002/03</td>
<td>12.9</td>
<td>2.8</td>
<td>5.1</td>
<td>1.8</td>
<td>22.5</td>
<td>100</td>
</tr>
</tbody>
</table>

### D. Annual Growth Rates (%)

<table>
<thead>
<tr>
<th>Period</th>
<th>Crops and Horticulture</th>
<th>Livestock</th>
<th>Fisheries</th>
<th>Forestry</th>
<th>Agricultural GDP</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83-1987/88</td>
<td>1.3</td>
<td>2.2</td>
<td>2.2</td>
<td>1.7</td>
<td>1.6</td>
<td>3.9</td>
</tr>
<tr>
<td>1987/88-1992/93</td>
<td>2.8</td>
<td>2.4</td>
<td>6.0</td>
<td>2.7</td>
<td>3.3</td>
<td>4.6</td>
</tr>
<tr>
<td>1992/93-1997/98</td>
<td>1.1</td>
<td>2.6</td>
<td>9.2</td>
<td>3.9</td>
<td>2.9</td>
<td>5.4</td>
</tr>
<tr>
<td>1997/98-2002/03</td>
<td>3.5</td>
<td>3.8</td>
<td>3.9</td>
<td>5.3</td>
<td>3.8</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Source: Original Data from the Bangladesh Bureau of Statistics.

Note: The data for each year consists of a moving average of three consecutive years. For example, 1982/83 refers to the average of 1981/82, 1982/83 and 1983/84. The split year refers to the fiscal year in Bangladesh, 1st July to 30th June.
Improved agricultural performance has been due to (i) an increased use of improved agricultural technology (high yielding varieties, fertilizer and irrigation); (ii) reduced vulnerability and risk from natural disasters due to the construction of flood control and drainage infrastructure; (iii) implementation of agricultural reforms, including liberalization of the trade regime and deregulation of domestic input and output markets; and (iv) the promotion of the private sector development. The transition from subsistence farming to diversified commercial farming has begun but to accelerate and sustain the pace of change, it would be necessary to promote greater use of modern technologies (both production and post-harvest), increased investment (both public and private), rationalization of public expenditure, deepening of policy reforms and strengthening of rural institutions. The development of competitive and diversified agriculture in Bangladesh is essential to increase agricultural productivity and promote exports of agriculture products that would ultimately increase farm income and reduce rural poverty.

(c) Emerging Agricultural Challenges

Shrinking agricultural land. Agricultural land is an important natural resource. However, as shown in Table 2.4, cropped land is declining at the rate of about 1% per year. On an average, Bangladesh is losing good quality agricultural land by approximately 80,000 ha annually due to urbanization, building of new infrastructure such as roads and implementation of other development projects. This issue needs to be addressed by formulating and implementing a new national land use policy that stops and/or slows down the rate of decline in agricultural land. In addition, as shown in Table 2.5, the quality of agricultural land has also been deteriorating over time.

Increasing land fragmentation. As shown in Table 2.6, with 80% (in 1996) of households owning only 0.02 to 1.0 ha (marginal and small farmers), distribution of agricultural land in Bangladesh is highly inequitable. Furthermore, with a national average farm size of only 0.68 ha, the average farm size is also very small. The situation has deteriorated even further since 1996. Over time, the number of small farmers has been increasing due to land fragmentation whereas the number of medium and large farmers has been declining. Furthermore, the average farm size, which is very small to begin with, is declining even further. Clearly, there is scope for reducing rural poverty through land redistribution (particularly public khas land) and proper land administration. Approximately, 45% of rural households in Bangladesh are either landless or functionally landless (owning less than 0.02 ha).

While the issue of land policy and land administration is extremely important for reducing poverty (particularly rural poverty), it is also a politically very sensitive issue in Bangladesh. Overall, land is very scarce, land records are not very good, land administration is highly corrupt and land grab by the powerful elite is quite common. This is particularly true for khas land and water bodies. In other words, inappropriate land policy, lack of enforcement and weak administration are major barriers to accelerating sustainable growth in agriculture, rural non-farm sector, industry and services, and hence a constraint to reducing poverty.

Stagnating yields and large yield gaps. Rice is a dominant crop in Bangladesh and accounts for about 75% of the cropped area. The performance of rice yields in Bangladesh is summarized in Figure 2.2. There are substantial variations in yields across seasons, varieties and over time. While average yields have increased at a rapid rate in the 1980s and 1990s in response to the green revolution technology and an increase in rice area under boro season, in more recent years the yields appear to have stagnated. Furthermore, as reported in Table 2.7, there are large yield gaps for rice and wheat between the national average yields on farmers’ fields and yields on experiment stations. Same is true for horticulture, livestock, poultry and fisheries. In other words, there is substantial scope to bridge the yield gaps.
### Table 2.4
Decline in Agricultural Land

<table>
<thead>
<tr>
<th>Year/Change</th>
<th>Net Cropped Area</th>
<th>Net Cultivated Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982-1987</td>
<td>8.72 million ha</td>
<td>-</td>
</tr>
<tr>
<td>1995-2000</td>
<td>7.95 million ha</td>
<td>-</td>
</tr>
<tr>
<td>1984</td>
<td>-</td>
<td>8.15 million ha</td>
</tr>
<tr>
<td>1996</td>
<td>-</td>
<td>7.20 million ha</td>
</tr>
<tr>
<td>Annual change (ha)</td>
<td>-59 thousand ha</td>
<td>-79 thousand ha</td>
</tr>
<tr>
<td>Annual change (%)</td>
<td>-0.7</td>
<td>-1.0</td>
</tr>
<tr>
<td>Population growth (%)</td>
<td>1.6</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Source: Original data from the Bangladesh Bureau of Statistics

### Table 2.5
Degradation of Agricultural Land

<table>
<thead>
<tr>
<th>Causes</th>
<th>Affected Area (million ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soil erosion</td>
<td>1.70</td>
</tr>
<tr>
<td>2. Riverbank erosion</td>
<td>1.70</td>
</tr>
<tr>
<td>3. Soil fertility decline</td>
<td>8.00</td>
</tr>
<tr>
<td>4. Depletion of soil organic matter</td>
<td>7.50</td>
</tr>
<tr>
<td>5. Water logging</td>
<td>0.70</td>
</tr>
<tr>
<td>6. Soil salinity</td>
<td>0.84</td>
</tr>
<tr>
<td>7. Pan formation</td>
<td>2.82</td>
</tr>
<tr>
<td>8. Acidification</td>
<td>0.06</td>
</tr>
<tr>
<td>9. Deforestation</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Notes:
1. The affected land categories are not mutually exclusive.
2. Almost all of the 8 million ha land with decline in soil fertility is deficient in phosphorus, potassium and sulphur, particularly for growing HYV rice and upland crops.
3. Overall, agricultural land can be categorized as very good (2%), good (34%), moderate (39%), poor (16%) and very poor (9%).

### Table 2.6
Land Distribution and Farm Size

<table>
<thead>
<tr>
<th>Farm size (ha)</th>
<th>1983/84</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farm Households (million)</td>
<td>Area (million ha)</td>
</tr>
<tr>
<td>Small (0.02-1.00)</td>
<td>7.066 (70)</td>
<td>2.66 (29)</td>
</tr>
<tr>
<td>Medium (1.01-3.03)</td>
<td>2.493 (25)</td>
<td>4.14 (45)</td>
</tr>
<tr>
<td>Large (&gt;3.03)</td>
<td>0.496 (5)</td>
<td>2.38 (26)</td>
</tr>
<tr>
<td>Total</td>
<td>10.045 (100)</td>
<td>9.18 (100)</td>
</tr>
</tbody>
</table>

Notes:
1. Figures in parentheses refer to percentage of the total.
2. Original data from the Bangladesh Bureau of Statistics.
<table>
<thead>
<tr>
<th>Table 2.7</th>
<th>Estimated Crop Yield Gaps Between Experiment Stations and Farmers’ Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. National Average for Milled Rice</strong></td>
<td></td>
</tr>
<tr>
<td>Rice Type</td>
<td>National Average (mt/ha)</td>
</tr>
<tr>
<td>Aus</td>
<td>1.09</td>
</tr>
<tr>
<td>Aman</td>
<td>1.70</td>
</tr>
<tr>
<td>Boro</td>
<td>2.62</td>
</tr>
<tr>
<td>Total</td>
<td>1.86</td>
</tr>
<tr>
<td><strong>B. National Average for Paddy Rice</strong></td>
<td></td>
</tr>
<tr>
<td>Rice Variety</td>
<td>National Average (mt/ha)</td>
</tr>
<tr>
<td>Aus (BR14)</td>
<td>2.66</td>
</tr>
<tr>
<td>Aman (BR11)</td>
<td>3.21</td>
</tr>
<tr>
<td>Boro (BR3)</td>
<td>4.35</td>
</tr>
<tr>
<td><strong>C. National Average for Different Crops</strong></td>
<td></td>
</tr>
<tr>
<td>Crop</td>
<td>National Average (mt/ha)</td>
</tr>
<tr>
<td>Aus milled rice</td>
<td>2.34</td>
</tr>
<tr>
<td>Aman milled rice</td>
<td>2.68</td>
</tr>
<tr>
<td>Boro milled rice</td>
<td>3.22</td>
</tr>
<tr>
<td>Wheat</td>
<td>2.12</td>
</tr>
<tr>
<td>Onion</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Source: Compiled from various sources, including Bangladesh Rice Research Institute (BRRI), FAO and the Bangladesh Bureau of Statistics.

2.13 There is a substantial scope for increasing agricultural production through an increase in agricultural productivity i.e. an increase in total factor productivity, land productivity, animal productivity and pond productivity. The available evidence clearly indicates that the current crop, animal and pond yields are relatively low; there are substantial yield gaps in farm and experiment station yields; and the potential yields in Bangladesh are lower than the potential yields in other countries with similar agro-climatic conditions. The best and the most sustainable way to increase competitiveness of Bangladesh agriculture, in the regional and global context, is by increasing agricultural productivity. This would require dynamic and effective national agricultural research and extension systems in order to generate and transfer appropriate agricultural technology for use by farmers. In the absence of much needed reforms, the existing systems would not be able to meet these emerging challenges.

2.14 The available empirical evidence in Bangladesh indicates that agricultural technology has played an important role in increasing agricultural (particularly rice) productivity and rural non-farm activities. This has contributed to reduction in rural poverty through an increase in farm income, reduction in real rice prices (an important wage good for the landless rural and urban poor), an increase in rural employment and reduction in vulnerability for the poor. Reduction in real rice prices, while of benefit to the poor, also provided necessary incentives to farmers to diversify into high value crops. Increasing productivity in other crops, particularly maize, potatoes and vegetables, as well as in fisheries and livestock, has the potential to raise real incomes directly as the domestic market is expanding rapidly and there is some potential for exports.
2.15 **Limited diversification and low value addition.** There is also a substantial scope to increase agricultural production by reducing post-harvest losses, by increasing the shelf life of perishable commodities and by adding value through agro-processing of agricultural commodities into finished or semi-finished products, packaging in appropriate containers, proper storage and exports. The food processing industry in Bangladesh is at very early stages of development. The policy, institutional and infrastructure barriers to agribusiness, agro-processing and supply chain need to be removed in order to provide a “big push” to agriculture and rural development.

2.16 The main driving force for the development of horticulture crops, livestock, fisheries, food processing and the development of the RNF sector has been the expanding demand for these products which is caused mainly by urbanization and an increase in per capita income. As shown in Table 2.8, the income elasticity of demand for cereals is much lower as compared to the income elasticity of demand for non-cereal crops (mainly vegetables), fruits, fish, livestock products and the items produced in the industrial and service sectors. With appropriate incentives and institutional framework, these agricultural sub-sectors and the RNF sector are expected to grow in the future. The production and processing of these products is also labor intensive and, therefore, is likely to have a significant favorable impact for generating additional employment in the rural areas.

2.17 **Low and declining profitability.** Overall, agriculture in Bangladesh is experiencing relatively low and declining profitability. This is particularly true for rice which accounts for about 75% of the cropped area. The declining profitability for rice is due to two reasons. First, the rice prices in real terms have declined and continue to decline. Second, the input prices (seeds, fertilizer, chemicals, diesel, electricity and even labor during peak demand periods) in real terms have increased and continue to increase. In the early days of the green revolution, the declining profitability due to unfavorable price changes was compensated by an increase in productivity. However, the increase in productivity, particularly for rice, has now slowed down to a point that it is not adequate to compensate for unfavorable price changes. On the other hand, the high value commercial agriculture appears to be more profitable as long as market is assured.

2.18 **Declining budget for agriculture.** As shown in Table 2.9, the total public expenditure for agriculture as a share of total public expenditure for the country has declined over time. Same is true for the revenue expenditure and the development expenditure. Furthermore, the total public expenditure for agriculture as a share of agricultural GDP has also declined over time. This is partially due to the fact that the Government is gradually getting out of those activities that can not be considered “public good” activities. However, a large part of it is due to low priority given to agriculture, even to the “public good” activities, by the policy-makers. This is neither good for the poor nor for the nation as a whole. It would be very difficult to reduce rural poverty in a sustainable manner by neglecting the agricultural sector which is an important source of pro-poor growth and livelihood for the rural poor.

### Table 2.8

<table>
<thead>
<tr>
<th>Items</th>
<th>Income Elasticity</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td>0.65</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>Non-cereal crops</td>
<td>0.72</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>1.15</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>1.08</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Livestock products</td>
<td>1.50</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Manufactures</td>
<td>0.84</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Clothing</td>
<td>0.92</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Other industrial products</td>
<td>0.80</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>1.18</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>2.01</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>Health Care</td>
<td>1.13</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>1.70</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>Recreation</td>
<td>2.36</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>Other Services</td>
<td>1.46</td>
<td>0.97</td>
<td></td>
</tr>
<tr>
<td>Savings</td>
<td>2.13</td>
<td>1.77</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Hossain (2003), based on HIES (2000).*
Table 2.9
Trends in Public Expenditure for Agriculture

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Overall Economy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Expenditure/ GDP</td>
<td>0.134</td>
<td>0.141</td>
<td>0.150</td>
<td>0.155</td>
<td>0.144</td>
<td>0.143</td>
<td>0.145</td>
<td>0.151</td>
</tr>
<tr>
<td>Development Expenditure/ GDP</td>
<td>0.061</td>
<td>0.064</td>
<td>0.072</td>
<td>0.074</td>
<td>0.061</td>
<td>0.059</td>
<td>0.059</td>
<td>0.057</td>
</tr>
<tr>
<td>Revenue Expenditure/ GDP</td>
<td>0.072</td>
<td>0.076</td>
<td>0.078</td>
<td>0.081</td>
<td>0.083</td>
<td>0.084</td>
<td>0.086</td>
<td>0.094</td>
</tr>
<tr>
<td>Development Expenditure/ Total Expenditure</td>
<td>0.459</td>
<td>0.457</td>
<td>0.481</td>
<td>0.475</td>
<td>0.422</td>
<td>0.411</td>
<td>0.405</td>
<td>0.378</td>
</tr>
<tr>
<td>Revenue Expenditure/ Total Expenditure</td>
<td>0.541</td>
<td>0.543</td>
<td>0.519</td>
<td>0.525</td>
<td>0.578</td>
<td>0.589</td>
<td>0.595</td>
<td>0.622</td>
</tr>
<tr>
<td>Project Aid/ Development Expenditure</td>
<td>0.343</td>
<td>0.330</td>
<td>0.337</td>
<td>0.311</td>
<td>0.332</td>
<td>0.292</td>
<td>0.287</td>
<td>0.171</td>
</tr>
<tr>
<td>B. Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Expenditure (Agriculture)/ Total Expenditure (Country)</td>
<td>0.037</td>
<td>0.037</td>
<td>0.036</td>
<td>0.036</td>
<td>0.034</td>
<td>0.032</td>
<td>0.033</td>
<td>0.055</td>
</tr>
<tr>
<td>Development Expenditure (Agriculture)/ Development Expenditure (Country)</td>
<td>0.052</td>
<td>0.050</td>
<td>0.048</td>
<td>0.048</td>
<td>0.050</td>
<td>0.045</td>
<td>0.044</td>
<td>0.038</td>
</tr>
<tr>
<td>Revenue Expenditure (Agriculture)/ Revenue Expenditure (Country)</td>
<td>0.025</td>
<td>0.026</td>
<td>0.025</td>
<td>0.025</td>
<td>0.023</td>
<td>0.023</td>
<td>0.026</td>
<td>0.065</td>
</tr>
<tr>
<td>Total Expenditure (Agriculture)/ Agricultural GDP</td>
<td>0.020</td>
<td>0.021</td>
<td>0.022</td>
<td>0.024</td>
<td>0.023</td>
<td>0.022</td>
<td>0.024</td>
<td>0.043</td>
</tr>
<tr>
<td>Development Expenditure (Agriculture)/ Agricultural GDP</td>
<td>0.013</td>
<td>0.013</td>
<td>0.014</td>
<td>0.015</td>
<td>0.014</td>
<td>0.013</td>
<td>0.013</td>
<td>0.011</td>
</tr>
<tr>
<td>Revenue Expenditure (Agriculture)/ Agricultural GDP</td>
<td>0.007</td>
<td>0.008</td>
<td>0.008</td>
<td>0.009</td>
<td>0.009</td>
<td>0.009</td>
<td>0.011</td>
<td>0.032</td>
</tr>
</tbody>
</table>

Notes:
1. GDP and all expenditures are based on current prices
2. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91); and so on
3. Agriculture expenditure refers to expenditure by the following Ministries: Ministry of Agriculture, Ministry of Fisheries and Livestock, and Ministry of Environment and Forests
4. Agriculture GDP is the sum of crops, livestock, fisheries and forestry
5. 2004/05 GDP estimates are provisional
6. There has been a substantial increase in the revenue expenditure for agriculture during 2004/05. This increase is attributed to (i) allocations for new development programs, including agricultural subsidy, agricultural assistance program and flood rehabilitation; and (ii) an increase in the existing institutional, administration and service expenditures.

Source: Bangladesh Bureau of Statistics (BBS), Ministry of Finance, Annual Budget Brief, Ministry of Planning

(d) Likely Source of Growth

2.19 According to the draft PRSP, GDP must grow at 6-7% per year from 2000 to 2015 if Bangladesh is to achieve the poverty MDG. This growth must also be pro-poor and equitable. In order to achieve 6-7% per year GDP growth, the average agricultural growth must be at least 4.0% per year and the average RNF sector growth must be at least 8.0% per year. Given the historical growth performance record, it would be a real challenge to achieve and sustain these high growth rates. Furthermore, accelerating growth, without adequate social and environmental safeguards, would have serious consequences for natural resource management, i.e. land, water, fisheries, forestry and biodiversity. Even though the historical record is not very good, there is a critical need and a substantial scope to improve natural resource management.

2.20 In general, the sources of growth in agricultural production are likely to be land expansion by bringing new land under cultivation, an increase in cropping intensity through multiple cropping, diversification into high value crops and other sub-sectors such as livestock and fisheries, enhanced productivity growth in terms of yield/ha, yield/animal or bird and yield/unit of fisheries pond, and value addition through agro-processing. However, Bangladesh now has no potential for expanding land under cultivation and only a limited for increasing the cropping intensity, as potential sources of agricultural growth in the future.

2.21 Clearly, the main sources of future agricultural growth in Bangladesh are going to be diversification into high value commodities (horticulture, livestock and fisheries); increase in agricultural productivity; and
value addition through proper post-harvest management and agro-processing. In order to bridge large yield gaps and to increase the potential yields even further, there is a need for dynamic, efficient and responsive agricultural research and extension systems as well as input delivery systems that exploit the synergies of public and private partnerships. The generation, transfer and use of agricultural technology, that is appropriate for conditions in Bangladesh, is fundamental to acceleration of pro-poor agricultural growth.

C. Role of Agricultural Technology

2.22 The strategic role of agricultural technology (research and extension) derives from the critical importance of agriculture in the overall economy. Overall, investment in agricultural research and extension (a) yields high economic returns; (b) improves competitiveness of agriculture; (c) provides food security; and (d) reduces poverty. In order to achieve these goals, adequate public investment in agricultural research and extension is extremely important and should be given a very high priority.

(a) Yields High Economic Returns

2.23 No matter which measure of return is selected or which analytical method is applied, an extensive literature in agricultural economics convincingly demonstrates that investment in agricultural research and extension yields high payoffs. Evenson and Westphal (1995) summarized 156 studies of estimated real rates of return to agricultural research and extension (Table 2.10). For public sector agricultural research, average returns were 48 percent for developed countries and 80 percent for developing countries. For the United States, Huffman and Evenson (1993) show that returns are very high but differ significantly between applied and more basic or pre-technology research, between research and extension, and between the public and private sector (Table 2.11).

2.24 The rates of return to investment in agricultural research are generally very high. However, the magnitude of the rates of return varies from one crop to another, from one livestock product to another, from crop sector to livestock sector or aggregate agricultural production, from one country to another, and from developed to developing countries (Table 2.12). The rate of return to investment in research varies from 22 to 42 percent for potatoes in Peru to 191 percent for maize in South America. The nature of agricultural technology, the level of agricultural productivity and appropriateness of agricultural policies greatly influence payoffs to investment in agricultural research. Careful and informed research management and public investment are essential and must take place within a set of constraints defined by a country's resource endowments and economic policies.

2.25 Positive and high rates of return means that the stream of societal benefits from research outweigh the costs over a planning horizon of several years. The costs of these investments are repaid because the economy grows as a consequence of the reduced food and fiber costs that benefit both consumers and producers, the reallocation of physical and human capital into higher and better uses, and increased economic activity, including trade. But as with any investment, there is frequently a lag between expenditure and return. For agriculture, the lag may be 10-20 years. Even allowing for the long lag, however, the expected return on investment in agricultural research and extension is positive and high.

---

1 There is vast amount of published literature dealing with different aspects of agricultural research and development or, more broadly, with the generation and dissemination of agricultural technology. Few selected examples are Alston and Pardey (1996); Alston, Norton and Pardey (1995); Anderson (1994);Binswanger and Ruttan (1978); Byerlee and Alex (1998); Evenson and Pray (1991); Hayami and Ruttan (1995); Pardey, Roseboom and Anderson (1991); Pinstrup-Anderson (1982); Purcell and Anderson (1997); Ruttan (1981); Ruttan and Pray (1987); Tabor (1995); and the World Bank (1981, 1983, 1996).
Table 2.10
Summary of empirical Studies with estimated Rates of Return to R&D

<table>
<thead>
<tr>
<th>Activity/Regions</th>
<th>Numbers of Studies</th>
<th>Studies with Range of Estimates for Rates of Return (%)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-24</td>
<td>25-49</td>
</tr>
<tr>
<td>Public Sector Agricultural Research a/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>10</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Latin America</td>
<td>36</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Asia</td>
<td>35</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>All developing countries</td>
<td>85</td>
<td>23</td>
<td>45</td>
</tr>
<tr>
<td>All developed countries</td>
<td>71</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td>Private Sector Industrial Research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing countries</td>
<td>5</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Developed countries</td>
<td>35</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Public Sector Agricultural Extension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing countries</td>
<td>17</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Developed countries</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

a/ Includes international agricultural research centers

Table 2.11
Internal Rates of Return to Research, Extension and Education in the U.S.

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Internal Rates of Return a/ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public research</td>
<td>41</td>
</tr>
<tr>
<td>Pretechnology</td>
<td>74</td>
</tr>
<tr>
<td>Private R&amp;D</td>
<td>46</td>
</tr>
<tr>
<td>Public extension</td>
<td>20</td>
</tr>
<tr>
<td>Farmers’ schooling</td>
<td>40</td>
</tr>
</tbody>
</table>

a/ Refers to both crop and livestock sector aggregates, 1950-82
Source: Adapted from Huffman and Evenson (1993)

Table 2.12
Rate of Return to Agricultural Research in Developing Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Study</th>
<th>Commodity</th>
<th>Rate of Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>Ruvalcaba (1986)</td>
<td>Maize</td>
<td>78-91</td>
</tr>
<tr>
<td>South America</td>
<td>Evenson (1989)</td>
<td>Maize</td>
<td>191</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Pardey (1993)</td>
<td>Rice</td>
<td>60-5</td>
</tr>
<tr>
<td>India</td>
<td>Evenson (1990)</td>
<td>Rice</td>
<td>65</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Nagy (1983)</td>
<td>Wheat</td>
<td>58</td>
</tr>
<tr>
<td>Brazil</td>
<td>Ayers (1985)</td>
<td>Soya beans</td>
<td>46-69</td>
</tr>
<tr>
<td>Philippines</td>
<td>Librero (1987)</td>
<td>Sugarcane</td>
<td>51-71</td>
</tr>
<tr>
<td>Peru</td>
<td>Norton 91987</td>
<td>Potatoes</td>
<td>22-42</td>
</tr>
<tr>
<td>Senegal</td>
<td>Schwartz (1989)</td>
<td>Cowpeas</td>
<td>60-80</td>
</tr>
</tbody>
</table>

Source: Bonte-Friedheim, Tabor and Rosenboom (1994)
2.26 Researches at IFPRI measured and compared the impact of alternative public investments on agricultural growth and poverty reduction. Higher the impact per unit of investment, better the ranking across alternative public investments. The empirical results for India and China are summarized in Table 2.13. These empirical results clearly demonstrate that return to public investment in agricultural research and development has the largest impact on agricultural growth in both India and China; and second largest impact on poverty reduction in both India and China.

<table>
<thead>
<tr>
<th>Public Investment</th>
<th>India</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agricultural Growth</td>
<td>Poverty Reduction</td>
</tr>
<tr>
<td>Agriculture R&amp;D</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Roads</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Irrigation</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Education</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Electricity</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Health</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Telephone</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Sources: Fan, Hazell and Thorat (2000) for India; and Fan, Zhang and Zhang (2002) for China

(b) Improves Competitiveness of Agriculture

2.27 Public support for agricultural research can also be an important part of a nation’s strategy to increase the competitiveness of its agricultural sector, whether through directed public investment or public action to foster private research. Operationally increased competitiveness means that the agricultural sector is better able to sell products abroad or to produce substitutes for products being imported. Increased competitiveness is desirable because it results in improved standards of living for the given nation or region. Research attempts to ease constraints that are largely the consequence of resource endowments (Thirtle and Ruttan, 1987). Agricultural research and technological development create competitive advantage by improving the ability of the agricultural sector to create value for domestic and international customers. The consequences of technological and managerial innovations fostered by agricultural research are sustained high rates of return and increasing market share.

(c) Improves Food Security

2.28 There is a global and national perspective to agricultural research that is particularly important. In a study, McCalla (1994) juxtaposes plausible growth rates in world population and income against historical growth rates in agricultural productivity. What emerges is a simple disquieting fact: agricultural productivity must continue to increase worldwide at or above historical rates if future food demands are to be met without potentially dire human consequences. McCalla makes a second and equally ominous observation: in most countries throughout the world, developing and industrial, national priorities are shifting away from agriculture and from agricultural research. This myopic perspective further diminishes the world’s collective ability to achieve the needed increases in agricultural productivity in manner that can be sustained into the future. From the national perspective, food security is extremely important to Bangladesh because of large population, land scarcity, vulnerability due to frequent natural disasters and high levels of poverty. Agricultural research and extension plays an important role in improving productivity and increasing standards of living for rural as well as urban people.
(d) Reduces Poverty

2.29 The link between improved agricultural technology and poverty reduction is clear and strong. Improved agricultural technology results in increased productivity in agriculture, reduced cost per unit of agricultural output and/or sustainable use of natural resources. Increased agricultural productivity accelerates pro-poor growth in agriculture (in Bangladesh, as has been discussed earlier, land is shrinking and increase in productivity is the only source of agricultural growth). An increase in productivity can also (and in Bangladesh it has) result in declining real price of foodgrains, an important wage good. Clearly, growth in agriculture is pro-poor and hence results in poverty reduction in the rural areas. In countries like Bangladesh, where 85% of the poor are rural poor, the impact of improved agricultural technology and hence productivity could be substantial on reduction in rural poverty.
Chapter 3: Agricultural Technology System: Agricultural Research

3.1 The purpose of this chapter is to examine the status and performance of the national agricultural research system. More specifically, it deals with (i) the institutions involved in agricultural research; (ii) public expenditure on agricultural research; (iii) performance of public agricultural research institutions; and (iv) barriers to better agricultural research. This analysis provides a basis for formulating recommendations to reform the national agricultural research system to meet the emerging needs of Bangladesh agriculture.

A. Institutions involved in Agricultural Research

3.2 The National Agricultural Research System (NARS), as currently constituted in Bangladesh (Figure 3.1), includes an apex body, the Bangladesh Agricultural Research Council (BARC), and ten Agricultural Research Institutes (ARIs). The relatively new Bangladesh Sericulture Research and Training Institute is not yet fully integrated with the NARS. The Agricultural University and agricultural faculties of regular Universities, NGOs and the private sector, who also undertake some agricultural research, are not integrated with NARS. Table 3.1 provides an overview of the NARS. Key features of the NARS partners are briefly summarized below.

(a) Bangladesh Agriculture Research Council (BARC)

3.3 BARC was established under an Act of GOB in 1973 to coordinate research undertaken by ARIs and other organizations in the country. Since then the BARC Act has been amended three times, the latest being the BARC Act 1996. Under the revised Act, BARC was given wider responsibilities of human resource development, planning, priority setting, coordination, monitoring, reviewing and evaluation of the research programs of ARIs.

3.4 The organizational structure of BARC consists of the Governing Body (GB), the Executive Council (EC) and the Secretariat (Figure 3.2). Chairman of GB is the Minister of Agriculture, with Ministers of Fisheries and Livestock, and Environment and Forests as Co-Chairs. It has 28 other members representing different stakeholders, including the government, universities, senior scientists, NGOs, the private sector and farmers. Executive Chairman, BARC, is a member and the Member-Director of Administration and Finance, BARC, acts as the Secretary of GB. Despite past efforts to diversify membership of the GB, 11 members out of 28 are still government officials. A 20 member EC consists of Executive Chairman and Member-Directors of BARC, Director-general and Directors of ARIs. Executive Chairman of BARC is the Chairman of EC. EC is responsible to GB and helps to implement its decision and assists in various policy matters related to BARC. The Secretariat of BARC is headed by the Executive Chairman. It has seven divisions, each headed by the Member-Director. Total staff strength of BARC is 216, of which 42 are technical staff.

(b) The Agricultural Research Institutes (ARIs)

3.5 The NARS system is composed of 10 ARIs linked to the Ministries of Agriculture (6), Fisheries and Livestock (2), Environment and Forests (1), and Commerce (1). All institutes now operate under Acts/Ordinances that give them limited autonomy. The exceptions are BFRI, which is a government department under the Ministry of Environment and Forests and Soil Resources Development Institute which operates as a department of MOA.
Figure 3.1: Current Institutional Arrangement of the National Agricultural Research System

Legend

- GOB: Government of Bangladesh
- MOA: Ministry of Agriculture
- MOFL: Ministry of Fisheries and Livestock
- MOEF: Ministry of Environment and Forests
- MOC: Ministry of Commerce
- BARC: Bangladesh Agricultural Research Council
- BARI: Bangladesh Agricultural Research Institute
- BRRI: Bangladesh Rice Research Institute
- BINA: Bangladesh Institute of Nuclear Agriculture
- BJRI: Bangladesh Jute Research Institute
- BLRI: Bangladesh Livestock Research Institute
- BFRI: Bangladesh Forest Research Institute
- BTRI: Bangladesh Tea Research Institute
- FRI: Fisheries Research Institute
- SRDI: Soil Resources Development Institute
- BSRI: Bangladesh Sugarcane Research Institute
<table>
<thead>
<tr>
<th>Institute</th>
<th>Year Established</th>
<th>Ministry</th>
<th>Areas of Responsibilities</th>
<th>Number of Divisions and other Units</th>
<th>Current Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bangladesh Agricultural Research Council (BARC)</td>
<td>1973</td>
<td>Agriculture</td>
<td>Coordination, prioritization and monitoring of agricultural research</td>
<td>7 divisions, 5 units</td>
<td>228</td>
</tr>
<tr>
<td>2. Bangladesh Rice Research Institute (BRRI)</td>
<td>1970</td>
<td>Agriculture</td>
<td>Research on rice</td>
<td>19 divisions, 10 admin divisions, 9 research stations</td>
<td>605</td>
</tr>
<tr>
<td>3. Bangladesh Agricultural Research Institute (BARI)</td>
<td>1976</td>
<td>Agriculture</td>
<td>Research on cereals (other than rice), pulses, oilseeds, vegetables, tubers and horticultural crops</td>
<td>15 divisions, 12 research centers, 24 sub-stations, 80 multiple trial sites</td>
<td>2186</td>
</tr>
<tr>
<td>4. Bangladesh Jute Research Institute (BJRI)</td>
<td>1951</td>
<td>Agriculture</td>
<td>Research on jute production and utilization</td>
<td>17 divisions, 4 regional stations, 5 sub-stations</td>
<td>451</td>
</tr>
<tr>
<td>5. Bangladesh Sugarcane Research Institute (BSRI)</td>
<td>1973</td>
<td>Agriculture</td>
<td>Research on sugarcane</td>
<td>10 divisions, 8 units, 2 regional stations</td>
<td>253</td>
</tr>
<tr>
<td>6. Bangladesh Institutes of Nuclear Agriculture (BINA)</td>
<td>1984</td>
<td>Agriculture</td>
<td>Application of nuclear techniques in agriculture</td>
<td>8 divisions, 9 units, 4 sections, 5 sub-stations</td>
<td>312</td>
</tr>
<tr>
<td>7. Soil Resources Development Institute (SRDI)</td>
<td>1983</td>
<td>Agriculture</td>
<td>Soil survey, soil classification and characterization</td>
<td>5 divisions, 4 regional offices, 20 district offices, 5 soil laboratories</td>
<td>427</td>
</tr>
<tr>
<td>8. Bangladesh Tea Research Institute (BTRI)</td>
<td>1958</td>
<td>Commerce</td>
<td>Research on tea</td>
<td>9 divisions, 5 departments, 2 sub-stations</td>
<td>242</td>
</tr>
<tr>
<td>10. Fisheries Research Institute (FRI)</td>
<td>1984</td>
<td>Fisheries and Livestock</td>
<td>Freshwater, brackish water, aquaculture, and marine fisheries research</td>
<td>6 divisions, 4 research stations, 2 sub-stations</td>
<td>219</td>
</tr>
<tr>
<td>11. Bangladesh Forest Research Institute (BFRI)</td>
<td>1955</td>
<td>Environment and Forests</td>
<td>Research on forestry and agro-forestry</td>
<td>19 divisions, 21 research stations/ sub-stations</td>
<td>809</td>
</tr>
</tbody>
</table>

Notes:
1. Some of these institutions (e.g., Bangladesh Sugarcane Research Institute) existed as research stations prior to their establishment.
2. Bangladesh Sericulture Research and Training Institute (BSRTI) is part of the Ministry of Textiles and Jute. The staff includes 13 (16) scientists and 57 (107) support staff.
3. The numbers in parenthesis refer to the total number of sanctioned positions but some of these positions remain vacant.
4. The category of "scientists", in some cases, may also include senior staff dealing with administration and finance.
Figure 3.2: Organogram for the Bangladesh Agricultural Research Council

Legend:
A&F = Administration & Finance; AERS = Agricultural Economics & Rural Sociology;
AIC = Agricultural Information Centre; HRD = Human Resources Development;
NRM = Natural Resources Management; P&E = Planning & Monitoring;
TTMU = Technology Transfer & Monitoring Unit; SS = Support Service.
3.6 In 1996, changes were made in the governance structure which led to independent Acts/Ordinances for institutes linked to MOA, identified as Schedule A institutes in the BARC Act 1996 and in Acts/Ordinances. These are: BRRI, BARI, BJRI, BINA and BSRI. The Governing Boards of these institutes were changed to Management Boards. Membership of the Boards also changed with a reduction in the number of government officials and an increase in representation from other stakeholders like NGOs, farmers and the private sector. This change, however, did not apply to institutes in Schedule B, which included: BLRI, FRI, BFRI, BTRI and SRDI. These institutes either retained their Governing Boards (FRI, BLRI, BTRI) under an independent Act/Ordinance or retained direct linkage with Ministries – MOA in the case of SRDI and MOEF in the case of BFRI. Each institute has separate facilities, including stations and sub-stations, staff, programs and budget. Each of the institute in the NARS has a specific mandate and conducts a wide range of applied and adaptive research. Although, it would appear that there is some overlap between mandates of some of the MOA institutes, e.g. BARI and BINA. More information on the current status of NARS is given in Annex 1.

(c) Agricultural Universities

3.7 Bangladesh now has three agricultural universities under the Ministry of Education. These are: Bangladesh Agricultural University (BAU) and, more recently established, Bangabandhu Sheikh Mujibur Rahman Agricultural University and Sher-e-Bangla Agricultural University. BAU is a well established University with a large campus at Mymensingh and has undertaken research on a variety of topics, including development of new crop varieties, land use, cropping systems, nutrient and water management, pest control etc. Under ARMP, BAU scientists participated in Contract Research Grant Scheme and were awarded some contracts related to crop research. However, as universities are not involved in planning or implementation of research programs of NARS, impact of BAU’s work is not known. Furthermore, due to a decline in funding, the focus in more recent years has been largely on teaching.

(d) Bangladesh Rural Advancement Committee (BRAC)

3.8 BRAC, an NGO, has been engaged in rural development activities since the early 1970s. Under its employment and income generation program, BRAC has identified six sub-sectors of agriculture (poultry, livestock, fisheries, social forestry, vegetable production and crop diversification and sericulture) in which a large number of rural poor, especially women, can be helped. As part of its integrated approach to provision of services to the poor, BRAC considers provision of technologies as an important element. Although the focus of technological interventions in most of these programs is on extension, BRAC also supports some adaptive research to develop location specific recommendations. Examples include: bull station to improve cattle breed through artificial insemination; tissue culture laboratories to produce disease free planting material, selection of crop varieties for seed production,

(e) The Private Sector

3.9 The private sector input supply (seed, fertiliser and crop protection) companies undertake some development work to test efficacy of their products under Bangladesh conditions in support of their marketing operations. However, with the possible exception of the seed industry, opportunities for large private investment in agricultural research and development are limited, in the short to medium-term. This is largely due to small market size, frequent natural disasters adding to business risks and Government regulations, including weak intellectual property rights.
B. Public Expenditure on Agricultural Research

3.10 This section outlines the role of the public sector in financing the national agricultural research system in Bangladesh. The two main sources of financing agricultural research are the revenue expenditure and the annual development expenditure, as part of the Annual Development Program (ADP). Project aid (credit and grants), from the bilateral and multilateral development partners, accounts for part of the development expenditure. The role of the World Bank in financing agricultural research in Bangladesh is summarized in Annex 2. Overall, the analysis clearly indicates that agricultural research has received low priority from policymakers in terms of budgetary resource allocation at the national level. The analysis that follows examines the size, composition and effectiveness of public expenditure in agricultural research.

(a) Public Sector Dominates Agricultural Research

3.11 The share of agricultural research funding by the private sector and NGOs, while gradually increasing, remains very small. Similarly, the role of agricultural universities in financing agricultural research is very limited. Most of the agricultural research resources (such as research laboratories, experimental facilities, research stations and scientists) are in the public sector ARIs.

(b) Public Expenditure on Agricultural Research is Low and Declining

3.12 The public expenditure (revenue, development and total) on agricultural research in Bangladesh from 1997/98 to 2004/05 is summarized in Table 3.2. Total expenditure on agricultural research has declined from about 14 percent of total expenditure on agriculture in 1997/98 to about 5 percent in 2004/05. Substantial decline was during 2002/03. However, there was a small increase in budget in 2003/04 and 2004/05 over the previous years.

3.13 The share of total expenditure on agricultural research is not only very small but has declined from 0.29 percent of agricultural GDP in 1997/98 to 0.22 percent in 2004/05 (the decline is even more dramatic from 0.34 percent in 1999/00 to 0.20 percent in 2002/03). Agricultural research expenditure is about 0.62 percent of agricultural GDP in developing countries as a group and 2.80 percent in developed countries as a group (Pardy, Alston and Piggott, 2005). The appropriate level of funding for research is related to the stage of development and it is not essential to assign arbitrary targets. However, given the importance of the agricultural sector to the overall economic growth of developing countries, it is essential for the public investment in research to increase consistently and sustainably in relation to the growth of the agricultural sector. In this context, a level of 2 percent of agricultural GDP has often been mentioned as a desirable target for the developing countries (World Bank, 2002). Increased investment in agricultural research is particularly important for Bangladesh, since agricultural land is shrinking, where the most likely source of agriculture growth is the technology-driven increase in agricultural productivity.

3.14 It is important to note that, unlike agricultural research, the total expenditure on agricultural extension is not only larger than research but it has also been increasing. By international standards, the expenditure on agricultural extension remains low but it is three to five times larger than the corresponding expenditure on agricultural research, as shown in Table 3.3 (also see Figure 3.3). Clearly, agricultural research is not getting the priority it deserves in the share of public investment to accelerate agricultural growth.

(c) Revenue Budget Finances Primarily Salaries

3.15 Table 3.4 highlights the composition of revenue expenditure on agricultural research. Over 90% of the revenue expenditure is allocated to finance salaries, allowances, operational costs and some investment costs. Less than five percent of the revenue budget is actually used to finance activities, materials and chemicals that are needed to undertake agricultural research. This is not the most efficient way to use highly
skilled agricultural researchers and scientists. In addition, very limited resources are allocated to finance human resource development through capacity building and training.

<table>
<thead>
<tr>
<th>Year</th>
<th>Agricultural GDP</th>
<th>Expenditure on Agriculture</th>
<th>Expenditure on Agricultural Research</th>
<th>Research/ Agriculture (Development)</th>
<th>Research/ Agriculture (Revenue)</th>
<th>Research/ Agricultural GDP (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Development</td>
<td>Revenue</td>
<td>Total</td>
<td>Development</td>
<td>Revenue</td>
<td>Total</td>
</tr>
<tr>
<td>1997/98</td>
<td>490101</td>
<td>6580</td>
<td>5660 1001</td>
<td>927.93</td>
<td>501.31</td>
<td>1429.24</td>
</tr>
<tr>
<td>1998/99</td>
<td>554755</td>
<td>7040</td>
<td>4110 11450</td>
<td>1287.97</td>
<td>543.16</td>
<td>1831.13</td>
</tr>
<tr>
<td>1999/00</td>
<td>583661</td>
<td>8240</td>
<td>4680 12920</td>
<td>1412.71</td>
<td>576.40</td>
<td>1989.11</td>
</tr>
<tr>
<td>2000/01</td>
<td>590372</td>
<td>8920</td>
<td>5110 14030</td>
<td>1351.01</td>
<td>586.23</td>
<td>1937.23</td>
</tr>
<tr>
<td>2001/02</td>
<td>599004</td>
<td>8250</td>
<td>5230 15480</td>
<td>1137.94</td>
<td>599.83</td>
<td>1737.77</td>
</tr>
<tr>
<td>2002/03</td>
<td>630569</td>
<td>7930</td>
<td>5870 13000</td>
<td>653.04</td>
<td>626.21</td>
<td>1279.25</td>
</tr>
<tr>
<td>2003/04</td>
<td>672025</td>
<td>8670</td>
<td>7450 16120</td>
<td>542.35</td>
<td>845.54</td>
<td>1387.89</td>
</tr>
<tr>
<td>2004/05</td>
<td>708772</td>
<td>8090</td>
<td>22440 30530</td>
<td>501.74</td>
<td>1044.49</td>
<td>1546.23</td>
</tr>
</tbody>
</table>

Notes:
1. Agriculture GDP is the sum of crops, livestock, fisheries and forestry.
2. GDP and all expenditures are based on current prices.
3. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91) and as on.
4. Agriculture expenditure refers to expenditure by the following ministries: Ministry of Agriculture, Ministry of Fisheries and Livestock, and Ministry of Environment and Forests.
5. There has been a substantial increase in the revenue expenditure for agriculture during 2004/05. This increase is attributed to (i) allocations for new developing programs, including agricultural subsidy, agricultural assistance program and flood rehabilitation; and (ii) an increase in the existing institutional, administration and service expenditures.
6. Expenditure on agricultural research refers to expenditure on NARS and the Bangladesh Sericulture Research and Training Institute (BSRTI).
7. 2004/05 GDP estimates are provisional.

(d) Development Budget Dominates Operational Costs of Agricultural Research

3.16 As reported in Table 3.4, development expenditure (while varies from one year to another) accounted for one-half to two-thirds of total expenditure on agricultural research, including human resource development activities. With the completion of IDA-funded agricultural research project in 2001, the share of development expenditure declined significantly. This raises a fundamental issue of sustainability of agricultural research activities initiated as part of the externally funded research projects. This is particularly serious since about 40% from 1992/93 to 2004/05 (which varies from 14% in 2004/05 to 51% in 1999/00) of development expenditure on agricultural research is financed through project aid, either as credit or grant. However, as shown in Table 3.5, the total expenditure on agricultural research as well as the share of project aid has declined substantially in the last few years.

(e) Release of Funds is Generally not Timely

3.17 Agriculture is a seasonal activity and the release of funds, as part of the budget cycle, does not always match the critical needs of agricultural research for funds. Furthermore, generally the release of funds is erratic in terms of time of release or the amount of funds released. Finally, the process of getting funds released (even after the commitment is made) is very time consuming and bureaucratic. Such delays in the release of funds seriously constrain agricultural research.

(f) Food Crops Dominate Agricultural Research Expenditure

3.18 Food crops, primarily rice, account for the largest share of agricultural research expenditure. This was desirable and important when Bangladesh was striving to achieve self-sufficiency in rice production.
Now that rice self-sufficiency (in normal years) has been achieved and the demand for fruits, vegetables, fish and animal products is increasing (faster than demand for rice) due to urbanization and growth in per capita income, there is a need to allocate more budgetary resources to accelerate and expand research related to other commodities (fruits, vegetables, fisheries and livestock).

### Table 3.3
Expenditure on Agricultural Research and Extension as Share of Agricultural GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>Research (R)</th>
<th>Extension (E)</th>
<th>Total (R+E)</th>
<th>Share of Research in Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997/98</td>
<td>0.29</td>
<td>0.83</td>
<td>1.12</td>
<td>25.95</td>
</tr>
<tr>
<td>1998/99</td>
<td>0.33</td>
<td>0.89</td>
<td>1.22</td>
<td>27.03</td>
</tr>
<tr>
<td>1999/00</td>
<td>0.34</td>
<td>0.98</td>
<td>1.32</td>
<td>25.89</td>
</tr>
<tr>
<td>2000/01</td>
<td>0.33</td>
<td>1.08</td>
<td>1.41</td>
<td>23.34</td>
</tr>
<tr>
<td>2001/02</td>
<td>0.29</td>
<td>1.04</td>
<td>1.33</td>
<td>21.79</td>
</tr>
<tr>
<td>2002/03</td>
<td>0.20</td>
<td>1.03</td>
<td>1.23</td>
<td>16.43</td>
</tr>
<tr>
<td>2003/04</td>
<td>0.21</td>
<td>1.05</td>
<td>1.26</td>
<td>16.39</td>
</tr>
<tr>
<td>2004/05</td>
<td>0.22</td>
<td>1.03</td>
<td>1.25</td>
<td>17.52</td>
</tr>
</tbody>
</table>
### Table 3.4
### Composition of Expenditure on Agricultural Research

<table>
<thead>
<tr>
<th>Year</th>
<th>Salary &amp; Allowances</th>
<th>Operational Costs</th>
<th>Research</th>
<th>Other Costs</th>
<th>Total</th>
<th>Salary &amp; Allowances</th>
<th>Operational Costs</th>
<th>Research</th>
<th>Other Costs</th>
<th>Total</th>
<th>Salary &amp; Allowances</th>
<th>Operational Costs</th>
<th>Research</th>
<th>Other Costs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992/93</td>
<td>204.31</td>
<td>27.24</td>
<td>13.87</td>
<td>6.14</td>
<td>251.56</td>
<td>142.52</td>
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<td>124.73</td>
<td>141.01</td>
<td>464.51</td>
<td>1077.08</td>
</tr>
<tr>
<td>1993/94</td>
<td>302.60</td>
<td>36.47</td>
<td>23.73</td>
<td>4.58</td>
<td>367.38</td>
<td>85.64</td>
<td>75.99</td>
<td>65.86</td>
<td>385.20</td>
<td>612.69</td>
<td>388.24</td>
<td>112.46</td>
<td>89.59</td>
<td>397.88</td>
<td>980.07</td>
</tr>
<tr>
<td>1994/95</td>
<td>358.51</td>
<td>46.80</td>
<td>15.51</td>
<td>4.83</td>
<td>425.65</td>
<td>88.84</td>
<td>78.23</td>
<td>141.03</td>
<td>424.71</td>
<td>732.81</td>
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<td>125.03</td>
<td>156.54</td>
<td>429.55</td>
<td>1158.46</td>
</tr>
<tr>
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<td>391.86</td>
<td>58.45</td>
<td>16.26</td>
<td>14.28</td>
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<td>70.93</td>
<td>117.16</td>
<td>287.96</td>
<td>548.95</td>
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<td>129.38</td>
<td>133.42</td>
<td>302.24</td>
<td>1029.80</td>
</tr>
<tr>
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<td>18.98</td>
<td>11.25</td>
<td>481.40</td>
<td>87.72</td>
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<td>141.17</td>
<td>166.92</td>
<td>384.66</td>
<td>1176.26</td>
</tr>
<tr>
<td>1997/98</td>
<td>427.74</td>
<td>47.93</td>
<td>19.73</td>
<td>5.91</td>
<td>501.31</td>
<td>101.67</td>
<td>158.93</td>
<td>208.04</td>
<td>459.30</td>
<td>927.95</td>
<td>529.41</td>
<td>206.86</td>
<td>227.77</td>
<td>465.21</td>
<td>1429.24</td>
</tr>
<tr>
<td>1998/99</td>
<td>459.31</td>
<td>56.80</td>
<td>21.16</td>
<td>5.89</td>
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<td>132.58</td>
<td>232.21</td>
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<td>679.70</td>
<td>1287.97</td>
<td>591.89</td>
<td>289.01</td>
<td>264.65</td>
<td>685.59</td>
<td>1831.13</td>
</tr>
<tr>
<td>1999/00</td>
<td>487.94</td>
<td>57.04</td>
<td>24.79</td>
<td>6.64</td>
<td>576.40</td>
<td>117.03</td>
<td>199.71</td>
<td>325.04</td>
<td>779.03</td>
<td>1412.71</td>
<td>604.97</td>
<td>256.75</td>
<td>349.83</td>
<td>777.56</td>
<td>1989.11</td>
</tr>
<tr>
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<td>57.03</td>
<td>29.65</td>
<td>7.81</td>
<td>586.23</td>
<td>105.94</td>
<td>194.03</td>
<td>326.60</td>
<td>724.44</td>
<td>1351.01</td>
<td>597.67</td>
<td>251.06</td>
<td>356.25</td>
<td>732.25</td>
<td>1937.23</td>
</tr>
<tr>
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<td>504.43</td>
<td>58.37</td>
<td>30.78</td>
<td>6.25</td>
<td>599.83</td>
<td>106.41</td>
<td>132.60</td>
<td>249.69</td>
<td>649.24</td>
<td>1137.94</td>
<td>610.84</td>
<td>190.97</td>
<td>280.48</td>
<td>655.48</td>
<td>1737.77</td>
</tr>
<tr>
<td>2002/03</td>
<td>524.80</td>
<td>64.60</td>
<td>31.65</td>
<td>5.17</td>
<td>626.21</td>
<td>62.11</td>
<td>127.02</td>
<td>207.22</td>
<td>256.68</td>
<td>653.04</td>
<td>586.92</td>
<td>191.62</td>
<td>238.87</td>
<td>261.84</td>
<td>1279.25</td>
</tr>
<tr>
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<td>118.62</td>
<td>92.25</td>
<td>80.05</td>
<td>845.54</td>
<td>55.39</td>
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<td>194.99</td>
<td>283.52</td>
<td>299.37</td>
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<td>706.46</td>
<td>232.16</td>
<td>282.21</td>
<td>325.40</td>
<td>1546.25</td>
</tr>
</tbody>
</table>

Notes:
1. All expenditure estimates are based on current prices.
2. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91) and so on.
3. Total Expenditure on agricultural research refers to expenditure on NARS that includes BARC, BRRI, BARI, BJRI, BSRI, BINA, SRDI, BTRI, BFRI, BTRI, and BSRTI.
4. Definitions of expenditure categories are as follows:
   - **Salary & Allowances**: Consists of salary as per government rules and regulations and allowances for payment for house rent, medical, festival bonus, travel, provident fund, pension, laundry, and dearness allowance.
   - **Operational Costs**: Travel expenses, taxis, post and telephone, electricity, and gas, newspaper and periodicals, stationary, Income tax, Group insurance, legal cost, leverage, and miscellaneous.
   - **Research**: Expenditure related to purchase of materials, equipment, labour costs, and inputs required for conducting research.
   - **Other Costs**: Other costs include cost incurred for the lease of land, building construction, equipment purchase, and other investment costs.

Source: Bangladesh Agricultural Research Council (BARC), Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural Research Institute (BARI), Bangladesh Jute Research Institute (BJRI), Bangladesh Sugarcane Research Institute (BSRI), Bangladesh Institute of Nuclear Agriculture (BINA), Soil Resources Development Institute (SRDI), Bangladesh Tea Research Institute (BTRI), Bangladesh Livestock Research Institute (BLRI), Fisheries Research Institute (FRI), Bangladesh Forest Research Institute (BFRI), Bangladesh Sericulture Research and Training Institute (BSRTI).
### Table 3.5

**Share of Project Aid in Development Expenditure for Agricultural Research**

<table>
<thead>
<tr>
<th>Year</th>
<th>GOB Development Expenditure</th>
<th>Project Aid</th>
<th>Total Development Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Million Taka</td>
<td>Share (%)</td>
<td>Million Taka</td>
</tr>
<tr>
<td>1992/93</td>
<td>541.55</td>
<td>65.60</td>
<td>283.97</td>
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<td>53.72</td>
<td>283.56</td>
</tr>
<tr>
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<td>72.33</td>
<td>202.79</td>
</tr>
<tr>
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<td>68.68</td>
<td>171.91</td>
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<tr>
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<td>74.99</td>
<td>173.78</td>
</tr>
<tr>
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<td>51.65</td>
<td>622.68</td>
</tr>
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<td>48.65</td>
<td>725.44</td>
</tr>
<tr>
<td>2000/01</td>
<td>680.37</td>
<td>50.28</td>
<td>672.85</td>
</tr>
<tr>
<td>2001/02</td>
<td>643.99</td>
<td>56.59</td>
<td>493.98</td>
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<tr>
<td>2002/03</td>
<td>511.82</td>
<td>68.44</td>
<td>236.01</td>
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<tr>
<td>2003/04</td>
<td>476.34</td>
<td>84.71</td>
<td>86.00</td>
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<tr>
<td>2004/05</td>
<td>449.74</td>
<td>85.71</td>
<td>75.00</td>
</tr>
</tbody>
</table>

**Notes:**
1. All expenditure estimates are based on current prices
2. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91); and so on
3. Total Expenditure on agricultural research refers to expenditure on NARS that includes BARC, BRRI, BARI, BJRI, BSRI, BINA, SRDI, BTRI, BLRI, FRI, BFRI and BSRTI

Source: Bangladesh Agricultural Research Council (BARC), Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural Research Institute (BARI), Bangladesh Jute Research Institute (BJRI), Bangladesh Sugarcane Research Institute (BSRI), Bangladesh Institute of Nuclear Agriculture (BINA), Soil Resources Development Institute (SRDI), Bangladesh Tea Research Institute (BTRI), Bangladesh Livestock Research Institute (BLRI), Fisheries Research Institute (FRI), Bangladesh Forest Research Institute (BFRI), Bangladesh Sericulture Research and Training Institute (BSRTI)

### (g) Consequences of Agricultural Research Funding Policy are Devastating

3.19 The inadequate and inappropriate funding of agricultural research in Bangladesh has three consequences. First, quality research output that is relevant and useful to solve the agricultural problems faced by the farmers is limited. Second, in the last 10 years, approximately 400 experienced agricultural researchers/scientists have left the national agricultural research system (about 20% of scientists) for better opportunities elsewhere. Third, the research infrastructure created through development expenditure is gradually deteriorating due to lack of proper maintenance. As a result, quality of the research output is declining and its contribution remains far below the potential and the national requirements for the 21st century to increase agricultural productivity and reduce rural poverty.
C. Performance of the Public Agricultural Research Institutions

3.20 During the 1970s and 80s, with external assistance from agencies like the WB, USAID, Australia, Japan, ARIs expanded rapidly and a number of stations and sub-stations were constructed to cover different agro-ecological situations. The 1980s also saw establishment of new institutes, including BINA, SRDI, BLRI, and FRRI. By 1984, the current network of institutes was in place, although further expansion/improvement of facilities at some of the crop institutes was supported under ARMP during late 1990s. Best examples of this growth are BARI and BRRI. BARI has 6 Regional Research Stations, 24 Sub-stations, 12 Farming Systems Research sites and 83 Multi-location Test sites. Such an extensive network is difficult to manage and demands considerable human and financial resources for productive use. While considerable investment has been made in establishing this infrastructure, institutes have faced difficulties in posting experienced scientists to these stations as many of them are in isolated locations with limited facilities, e.g. medical and educational. In addition, declining funding of NARS has meant that most of these facilities are under utilized, poorly maintained and in need of rationalization.

(a) Crop Research

3.21 Historically, crop research institutes, especially those dealing with food crops (BRRI and BARI), have received the largest share of public investment. Jute, as an important export crop in the past, also received significant investment. The main focus of research in both BARI and BRRI has been to develop high yielding varieties. In this work, they received considerable assistance from international centers under the Consultative Group on International Agricultural Research (CGIAR). BARI has worked closely with the International Center for Wheat and Maize Improvement–CIMMYT (Wheat, Maize and Barley), the International Crops Research Institute for Semi-Arid Tropic–ICRISAT (Groundnut, Chickpea) and the International Center for Potato–CIP (Potato). As a result, BARI was successful in releasing several varieties of Wheat, Maize, Barley, Groundnut, Chickpea and Potato. BRRI’s record in releasing new varieties of rice, which benefited from close collaboration with the International Rice Research Institute (IRRI) right from its inception, has been equally good. There are now over 22 varieties released by BRRI whose seeds are in considerable demand by farmers and are part of the regular seed production program. As a result, significant successes were achieved by the crop research in increasing cereal yields when production almost doubled from 10.26 million ton in 1972-73 to 19.56 million ton in 1992-93 and increased further to 26.76 million ton in 2000-01. The major contribution to higher productivity were the green revolution technologies incorporating the use of improved rice and wheat varieties, irrigation and fertilizers as well as from the expansion of area under irrigated ‘boro’ (dry season) rice.

3.22 The record of these institutes in development of crop management recommendations, e.g. water, nutrient and pest management has not been as impressive. For example, BARI scientists have developed fertilizer use recommendations for a range of crops, including maize, wheat, millet, barley, groundnut, sunflower, linseed, soybean, cabbage, cauliflower, broccoli, tomato and onion, for some agro-ecological zones of the country. While this represents culmination of a considerable amount of research, the field impact is minimal for a number of reasons. First, many of the recommendations have been developed based on work undertaken on research stations and has not been validated to provide location specificity. Second, many of the recommendations are for minor crops of interest to a small number of farmers.

(b) Horticulture

3.23 At present, the technology needs of farmers entering high value agriculture (HVA) is largely being met by the private sector. As compared to cereals, especially rice, other commodities have received little attention from ARIs. Limited research on fruits and vegetables is undertaken at the Horticulture Research Center (HRC) of BARI. It has released some varieties of different crops, including papaya, guava, leaf vegetables and tomatoes. However, impact of these varieties has been limited, partly due to lack of seed availability and greater reliability of imported seeds of vegetables. BARI’s work on pest and disease control
suffers from limited validation on farmer’s fields and systematic approach to dissemination. Neither the public extension service of DAE has skills or resources to help farmers cultivating horticultural crops nor has BARI made serious efforts to establish linkages with the private sector to disseminate its technologies. BARI also undertakes limited work on processing of fruits and vegetables through its Post-harvest Technology Division. However, it has limited resources and capacity to undertake significant research on post-harvest management issues of concern to growers and processors.

3.24 Slow but steady expansion of area under horticultural crops is accelerating growth of HVA. This is identifying needs for new high yielding varieties of fruits and vegetables suited to local conditions with pest and disease resistance/tolerance, improved nutritional content, product quality and safety, which require attention from BARI. As there is limited capacity in the private sector to produce the breeder/basic seed of horticultural crops, the public institutions would need to bridge the gap in the foreseeable future, with support from the private sector for further multiplication, marketing and distribution of seed of the selected varieties. Another important area for public sector research is the development of integrated pest management (IPM) practices. Pests are a serious threat to cost effective cultivation of horticultural crops. Most common method of pest control at present is the use of pesticides. Pesticide use requires close monitoring to avoid overuse by farmers. In addition, due to geological reasons, fruits and vegetables production in Bangladesh also requires monitoring for contamination from heavy metals, i.e. arsenic, lead and cadmium. These contaminants in fresh fruits and vegetables are serious issues, especially for export markets, and regular monitoring needs to be part of any food quality and safety assurance scheme. To reduce large post-harvest losses, estimated to be over 30%, there is a need for research on low-cost techniques for cleaning, packing, storage and transportation. The research system needs to reassess its priorities and allocate resources to emerging problems faced by farmers in diversifying production systems to include fruits and vegetables.

(c) Fisheries

3.25 Compared to crops, fisheries research has received limited support from GOB in the past. However, due to increasing demand for fish and importance of fisheries as an economic activity for a large rural population (fulltime employment for 12 million and part-time employment for another 11 million), GOB decided to establish the Bangladesh Fisheries Research Institute (FRI) to carry out research on all aspects of fisheries and to reverse a declining trend in production in inland capture fisheries. FRI inherited existing fish research facilities (four research facilities and one fish seed multiplication farm) of the Department of Fisheries (DOF). The establishment of FRI has resulted in some increase in public investment in fisheries research. However, compared to investment in crop research, this is quite small.

3.26 Four research stations of FRI have undertaken on-station applied research on a number of technologies on freshwater, brackish water and coastal aquaculture, including riverine and reservoir fisheries with emphasis on Hilsa fisheries. In addition, FRI has also been involved in a number of externally aided projects. However, greatest attention has been given to aquaculture and aquaculture-related issues. Research topics have included breeding and genetics, feed and nutrition, integrated fish farming, disease and health management and socio-economic aspects of aquaculture. Cost-effective technologies on integrated fish farming adapted/tested under local conditions included: polyculture farming, rice-fish farming, improved carp nursery, Thai sarapunti farming, Tilapia farming, poultry-fish farming. It is not clear, however, to what extent these technologies have been adopted by farmers. There are serious gaps in socio-economic research. The institute lacks appropriately trained manpower, facilities and resources to address more complex and demanding work involving integrated stock assessment, environmental protection, conservation in both inland water and marine fisheries resources and constraints to aquaculture.

3.27 Under the World Bank-financed Forth Fisheries Project, the plan was for DOF to expand support for environmentally and socially appropriate small-holder shrimp production in selected areas. However, due to long delays in establishing ownership and lease-free status of land areas, limited progress has been made in
promoting improved production systems. The main source of new technologies at present seems to be the private sector and the USAID-funded Agro-based Industries and Technology Development Project (ATDP), which has introduced a number of new methods of growing shrimps in Bangladesh. Although, most shrimp farmers are still using traditional technologies, there seems to be some interest amongst progressive growers with resources to try out the new methods.

(d) Livestock

3.28 Bangladesh Livestock Research Institute (BLRI), a multidisciplinary research institute, is responsible for livestock research to increase production. BLRI is organized into six research divisions and one administrative division dealing with training and planning. The six research divisions include: (i) animal production; (ii) poultry production; (iii) animal health; (iv) system research; (v) socio-economics; and (vi) goat and sheep production. BLRI also has two regional research stations. More recently, BLRI has created two new divisions dealing with (i) biotechnology and (ii) planning, training and technology demonstration, which takes over some of the functions previously assigned to the administration division. Since its inception in 1984, BLRI has initiated research on a number of aspects, including work to improve livestock feed availability by selecting high yielding grass species and multi-purpose cash crops, breed improvement of suitable dairy beef cattle, improvement of black Bengal goat through selective breeding and vaccine production for the control of important diseases. Research on conservation of native poultry and to improve yield is also undertaken. Only limited veterinary research is undertaken by the animal health division. Neither this division nor the Central Diagnostic Investigation Laboratory (CDIL), a MOFL entity, is adequately prepared to address new challenges, including the avian flu (bird flu).

3.29 Like fisheries, livestock research has also suffered from inadequate investment. In general, the research programs have been very ambitious which do not relate to changing circumstances, available scientific manpower and financial resources for full development and dissemination of results. As a result, impact, in terms of productivity gains, has been limited, despite high potential benefits of some of the technology packages developed, especially for the poor, e.g. forage work, black Bengal goat rearing and calf raising model.

(e) Research Management

3.30 One of the recurrent concerns in research management in Bangladesh in recent years has been the weak leadership, which has manifested in several different ways. Many institutes have suffered from frequent changes and long gaps in the appointment of senior managers, especially Director Generals, e.g. BRRI, BLRI, BARI. As a result, institutes have not been managed properly and scientists have not received appropriate guidance and support in conducting research.

3.31 Over-ambitious work plans without due attention to available resources and needs of farmers appear to be a common feature of research programs being pursued by most of the ARIs. Internal review processes and the oversight provided by BARC is clearly inadequate to prioritize research and reduce the overall scope and coverage of programs to fit available resources. The situation is further compounded by commodity focus of work which lacks systems perspective. Furthermore, due to funding constraints a lot of work is undertaken on research stations without further validation on farmer’s fields. As a result, a significant proportion of research findings are of limited value in addressing farm-level constraints faced by farmers. Useful research findings, when available, are not disseminated effectively due to weak linkages with farmers and extension.

(f) Human Resource Development

3.32 Funding crisis is affecting the skill-base of scientists due to limited opportunities for further studies and training. Poor working conditions, low salaries and limited scope for career progression means that
scientists have little incentive for hard work and innovation. Overall human resource development is also a concern in relation to the use of new sciences such as biotechnology, bioinformatics and ICT. While the crop research institutes, especially BRRI and BARI, have maintained good collaboration with IRRI, CIMMYT, CIP and ICRISAT, linkages of other institutes with international organizations are weak. Regional collaboration with other research organizations in South Asia has not been actively sought.

(g) Emerging Challenges

3.33 In more recent years, the research output has declined and average yields of crops, milk, meat and fish have remained low with a large gap between what research produces and what farmers want as well as between farmer yields and the research station yields. In order to support development of high value commercial agriculture with new technologies and to increase farm incomes through higher agricultural productivity from a declining land resource, the system needs to broaden the research agenda beyond a focus on improvement of cereal crops to support all the sub-sectors (such as crops, horticulture, fisheries, livestock and forestry) and pay greater attention to issues related to natural resource management. What was once a productive agricultural research system now appears to be in decline and is finding it difficult to respond to current development challenges.

D. Barriers to Better Agricultural Research

(a) Funding Issues

3.34 Inadequate and unstable funding. Research investment in Bangladesh is quite low compared to other countries. The system’s three average investment in agricultural research has declined from 0.32% in 1997/00 to around 0.21% of agricultural GDP in 2002/05 which is very low by international standards (which averages around 2.8% for all developed countries and 0.62% for all developing countries). Funding has also been unstable, largely due to heavy dependence on external funds, especially to finance operational costs of research programs. When external funding ceases, very little is left for operations and maintenance leading to low productivity and dilapidation of facilities. In addition, erratic releases of funds by GOB further compounds the financial problem for the agricultural research institutes.

3.35 Limited private sector financing of research. In general, returns to private investment in agricultural research in Bangladesh are low due to the preponderance of small and marginal farmers with limited resources to adopt input intensive technologies, which limits the market size for products from the private companies. In addition, frequent occurrence of natural disasters enhances business risks. Despite these limitations, however, policy changes, e.g. liberalization of input markets, have increased business opportunities and environment for private investment in agro-processing, seed industry, fertilizer distribution, farm implements and crop protection chemicals. There is, however, a need to further improve the rural investment climate in order to promote financing of agricultural research by the private sector.

(b) Issues Related to Weak Research Management

3.36 Inefficient allocation of available resources. While the need for prioritization of research to achieve greater efficiency in resource allocation has been recognized and some progress was made under ARMP, the agenda is still largely set by individual commodity-driven institutes. There is no consensus on priority constraints and, as a result, no long-term vision for agricultural research to guide resource allocation between competing demands. This makes it difficult to know if the resources are being allocated to activities with potential for highest pay-offs. National priorities in agricultural research should be set for the system as a whole.
3.37  **Inadequate capacity in social sciences.** Inadequate attention to develop capacity in social sciences remains a system-wide problem to support policy analysis work, undertake socio-economic research and to provide input from social sciences in the planning and implementation of biological and natural resource management research. As a result, there is limited understanding of challenges and opportunities for the research system in changing circumstances for agriculture, including trade regime of the country and globalization of agriculture. There is a lack of understanding about the cost of slow pace of reform to the national economy. Enhanced capacity to undertake socio-economic and policy research would help to prioritize the reform agenda and in building a consensus for change.

3.38  **Deteriorating research quality, innovation and accountability.** Shortage of funds, inappropriate allocation of available resources, weak linkages with farmers and extension service, and inadequate attention to human resource development have all contributed to a declining quality and relevance of research. To reverse this trend, a number of different actions are needed, including innovative ways for financing priority research such as the establishment of a competitive grants program (CGP).

3.39  **Dominance of commodity-based research.** Due to commodity orientation of the main ARIs and weak inter-institutional collaboration, commodity-based research dominates the current research agenda and there is limited capacity to undertake multi-disciplinary systems-based research. As a result, the farming systems problems faced by farmers who grow multiple crops, along with livestock, fisheries and forestry are not really addressed.

3.40  **Weak research-extension-farmer linkages.** Inadequate exchange of information between scientists and extension workers (public and private) continues to be a problem despite some progress through the Farming Systems Research Programs financed under the ARMP. Scientists are not required to define uptake pathways for research findings to enhance client orientation and to strengthen linkages with extension, NGOs, agribusiness companies and farmers. There is limited capacity and inclination to undertake farmer participatory research. This means that even useful research recommendations do not always reach farmers or are not adopted. The gap between potential and actual farm yields is high and, in the absence of an effective feedback mechanism, scientists continue to undertake research of limited value to farmers.

3.41  **Limited access to new science.** Advances in bio-sciences have increased complexity in research requiring inputs from new sciences, e.g. biotechnology, information and communication technology. Due to funding constraints and weak international linkages, scientists have limited access and skills to fully benefit from new sciences. At the same time, access to new scientific tools and techniques is further limited by a rapid growth in the private sector research protected by intellectual property rights.

(c)  **Institutional Issues**

3.42  **Weak apex body.** The apex body BARC is linked to MOA but has mandate to coordinate research programs of 10 different institutes responding to four different Ministries, including MOA, MOFL, MOEF and MOC (Figure 3.1). Although the BARC Act 1996 mandates it to coordinate research, ARIs prepare their own independent budgets and funds flow directly to them from parent Ministries with BARC having little say in resource allocation. This limits BARC’s ability to coordinate research, which is made even more difficult by its declining technical skill base. The institutes either have their own governing bodies or respond to Ministries concerned, which further limit BARC’s ability to influence decisions taken by them.

3.43  **Weak governance with limited autonomy.** BARC and ARIs have been granted some autonomy\(^2\) under the 1996 Act but depend on the parent Ministries and through them on the Ministry of Finance and

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\(^2\) Full autonomy, in the context of this report, denotes ability of the governing board of an institution to appoint, transfer and promote staff up to certain seniority level without having to seek government approval and to have its own service and financial rules (which are different from the civil service rules).
the Ministry of Establishment, for decisions on matters related to finance and appointment of senior personnel. Neither BARC nor ARIs have effective financial and human resource management systems in place nor have the autonomy to set Service Rules and Business Rules, as per need of the research system. For example, when BARC Governing Body, which is dominated by government officials (with the participation of three ministers and six secretaries), agrees, in principles, on the need for a new regulation and asks BARC management to draft such a regulation, this proposal must then be submitted through the various levels of the relevant Ministries, where it may be blocked or passed after a long delay. Past attempts at obtaining government approval for an integrated national agricultural service for BARC and institutes under MOA (Schedule A institutes) and financial regulations for BARC/ARIs failed due to objections from the Ministry of Finance and Ministry of Establishment. This was because the proposed rules and regulations were significantly different from the prevailing civil service rules.

3.44 **Overlapping mandates and deteriorating large infrastructure.** Over time, the ARIs have grown organically, mostly supported by donors, resulting in a large network of stations and sub-stations, with some locations having several facilities belonging to different institutes. Shortage of funds means that many of these stations are now poorly maintained and underutilized.

3.45 **Inadequate scientific incentives and eroding human resource base.** The ARIs are finding it difficult to motivate and retain scientific staff. The civil service rules applied to the research system do not reward outstanding scientific work or sanction bad performance. ARIs have limited influence in the appointments at senior levels, promotion and compensation. While some progress has been made in addressing these issues under the IDA-funded ARMP, overall incentive environment is still poor and more productive scientists are leaving the system. Urgent action is needed to improve incentives for scientists and to stop continuing erosion in the human capital.

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3 Under the 1996 Act for NARS, Schedule A institutions include BARI, BRRI, BJRI, BINA, BSRI and BARC. They are all attached to MOA and have their own governing boards. The Schedule B institutes are SRDI controlled by MOA; FRI and BLRI linked to MOFL with their own governing boards; BFRI controlled by MOEF; and BTRI linked to MOC but responding to Tea Board. A recently established new institute is Bangladesh Sericulture Research and Training Institute (BSRTI), which is controlled by the Ministry of Textiles and Jute but is not yet a member of the NARS system comprising of the older 10 Schedule A and B institutions.
Chapter 4: Agricultural Technology System: Agricultural Extension

4.1 The purpose of this chapter is to examine the status and performance of the national agricultural extension system. More specifically, it deals with (i) institutions involved in agricultural extension; (ii) public expenditure on agricultural extension; (iii) performance of the public agricultural extension institutions; and (iv) barriers to better agricultural extension. This analysis provides a basis for formulating recommendations to reform the national agricultural extension system.

A. Institutions Involved in Agricultural Extension

4.2 Although in recent years there has been an increase in the range of extension service providers (ESPs), the public institutions remain the dominant ESPs. The new entrants to the field includes non-governmental organizations, the private sector agribusiness enterprises and grass-root institutions, e.g. Self-Help and micro-credit Groups involving the farming communities. A brief overview of the current situation is given here.

(a) Government (public) Institutions

4.3 The public institutions have traditionally been the main source of advice to farmers. In the past, they have largely worked with male farmers with medium to large holdings and provided extension support on a one-to-one basis to transfer technologies. In more recent years, however, attempts have been made to reach a larger number of small to medium farmers, including women, using a group approach.

4.4 Department of Agricultural Extension (DAE): DAE was created in 1982 as an important institutional reform by merging six commodity oriented extension programs/departments to provide unified service to farmers. It is the largest government ESP. The organizational structure of DAE is given in Figure 4.1. DAE comprises of eight wings with a mandate to provide technical support to field staff, extension service to farmers throughout the country, training to equip extension staff with needed skills, planning and evaluation of extension activities and administration and personnel management. DAE employs some 24,000 staff with a field force of about 10,280 Block Supervisors (BSs; recently re-designated as Sub-Assistant Agricultural Officers) (DAE 2002). Majority of BSs are based at the Union level from where they visit farmers in their villages. BSs report to Upazilla Agricultural Officers (UAOs) who are supported by a group of Subject Matter Specialists at each of the 467 Upazillas (old name Thana). Technical and administrative support for UAOs is provided by the districts offices, who in turn report to the Field Services Wing of DAE through the regional offices (DAE 1999). DAE concentrates on providing crop advice (primarily for food grain crops). Although DAE is mandated to provide national coverage, medium and large farmers, who operate about 60% of land but only represent about 22% of farmers, seem to be the main beneficiaries of extension support.

4 According to DAE’s Second Strategic Plan (2002-2006), the current establishment at Block Supervisor (now called Sub-Assistant Agricultural Officer) level is 12,640 with 2,360 vacancies. The intended ratio of 1 BS to 1000 farmers is now close to 1:2000 due to reduction in staff numbers and an increase in the number of farmers, largely due to land fragmentation.
Figure 4.1: Organizational Structure of the Department of Agricultural Extension

Director General

- Water Management & Agricultural Engineering Wing
- Field Services Wing
- Food Crops Wing
- Cash Crops Wing
- Plant Protection Wing
- Planning & Evaluation Wing
- Training Wing
- Administration and Personnel Wing

- Regions
- Horticulture Centres
- Quarantine Stations
- CERDI
- ATIs

- Districts
- Unions
- Block

The Management Committee Comprises of the Director General and the Wing Heads

Legend:
CERDI: Central Extension Resource Development Institute
ATI: Agriculture Training Institute
4.5 **Department of Fisheries (DOF):** The Department of Fisheries is part of MOFL. Its wings focus their work on 4 systems, including pond, open water, marine and brackish water fisheries. The Department also has wings for planning, monitoring and evaluation, and administration and finance. It employs a total of about 5000 staff; of those about 1000 are professionals, 2000 sub-professionals and 2000 support staff. Approximately, 500 positions are now vacant. Unlike DAE, DOF does not have staff at the Union level. Its focus of extension support is Upazilla, from where the DOF staff (Upazilla Fisheries Officer, Assistant Fisheries Officer, and Fisheries Assistant) performs all fishery-related activities, including aquaculture, extension, training, conservation and enforcement. The role of district and divisional staff has traditionally been to supervise and manage the field staff. In view of the growth potential of aquaculture, in recent years, a lot of attention has gone to supporting this sub-sector with a focus on pond aquaculture of both fish and shrimp.

4.6 **Directorate of Livestock Services (DLS):** The Directorate of Livestock Services is also part of MOFL. It is divided into 4 divisions (administration and animal health; production; extension; research, training and evaluation). Other establishments of DLS include a Central Disease Investigation Laboratory (CDIL), 7 Field Disease Investigation Laboratories (FDIL) and 64 District Veterinary Hospitals. DLS also has 35 poultry farms, 4 duck farms, 7 cattle breeding and/or dairy farms and one buffalo breeding farm. In addition, DLS structure includes a Principal (in the rank of Director) who overseas running of Officers’ Training Institute. The Director General is the executive head followed by the Directors, Deputy Directors, Unit Heads and other staff. DLS employs about 8428 staff, with a complement of about 1500 technical staff and 3500 sub-technical staff. Like DOF, DLS also does not have staff at the Union level. The focal point of department’s extension activities are the Upazillas (464 offices with 11 staff in each office, including clerk and peon). The Upazilla office is headed by Upazilla Livestock Officer (ULO). He is assisted by one Veterinary Surgeon, mainly responsible for treatment of diseases of birds (poultry) and animals and artificial insemination of cows. The ULO is assisted by a few other sub-technical staff (veterinary field assistant, artificial insemination livestock assistant, compounder, and dresser). Administrative and technical support from the district office is provided by the District Livestock Officer, supported by the Head Assistant.

(b) **Non-Government Organizations (NGOs)**

4.7 The initial involvement of NGOs to provide advice to farmer groups was from those allied to micro-credit groups for income generating activities. This involvement has now grown substantially and some large NGOs are playing an important role as ESPs, e.g. BRAC, Proshika and Caritas. Starting with a focus on services towards women and small farm operators, BRAC now has a broad-based extension program involving 500 agriculturists and 10,000 agricultural extension workers in 64 districts of Bangladesh. BRAC’s agricultural extension activities are grouped under two components. One deals with vegetable cultivation and the other with crop diversification (rice, wheat, maize, potato, onion and sunflower cultivation). In this program, a total of 113756 village organizations formed by BRAC are involved and 500,000 small and medium farm families are receiving regular advice as well as other support services in crop, livestock, poultry, sericulture and fisheries activities. BRAC’s vegetable production program now involves over 150,000 farmers cultivating nearly 23,000 hectare through contract farming for the export markets (BRAC, 2003 and 2004). Many other NGOs also operate specialist services such as poultry business, seed production and social forestry. Unlike the big NGOs, the overall experience of working with small NGOs in the country shows that, while motivated to work with small and marginal farmers, women and isolated farming communities, they require considerable financial support and capacity building before becoming effective ESPs (ASSP and ASIRP 2003).

(c) **Agribusiness Enterprises**

4.8 The private organizations have started to feature only recently as ESPs and are largely composed of input supply companies producing and/or marketing seed, irrigation/farm equipment, fertilizers, pesticides,
Revitalizing the Agricultural Technology System in Bangladesh

hatcheries, feed and veterinary products. Extension advice is usually tied with product sale. These organizations, with some exceptions, e.g. pesticide companies, provide minimal after sale support.

4.9 More recently, some of the agribusiness enterprises have started to invest in processing of agricultural commodities for the domestic as well as the export markets. To ensure regular supply of quality raw materials for these enterprises they have entered into ‘contract farming’ arrangements (see Chapter 5 for more information on contract farming) for the production of seeds, oil crops, fruits and vegetable. The contracts generally include provision of extension services and assured markets for produce of the participating farmers. This represents an important development not only for growth of the high value commercial agriculture in the country but also for the private extension service with opportunity for others to enter this field. In the long-run, greater involvement of the agribusiness enterprises in extension would not only add to the diversity of institutions involved but also have an impact on the role, approach and scope of the extension service provided by the public institutions i.e. by DAE, DOF and DLS.

4.10 A semi-autonomous publicly funded agency, which has played a useful catalytic role in facilitating increased cultivation and processing of horticultural crops (vegetables, fruits and flowers), primarily for the export market, is Horticulture Export Development Foundation, in short Hortex. It was established by GOB in 1993, with assistance from the World Bank, for the development, promotion and marketing of high value horticultural crops. Its mandate now covers other areas of agribusiness as well. Hortex has provided technical assistance and training to both NGOs and private companies to enter export markets. Hortex also helped partner organizations, particularly BRAC, to enter contract farming system for the production of export quality horticultural crops. It helped in the selection of appropriate varieties and to establish linkages with potential buyers in Europe and elsewhere. More information on the Hortex activities is given in Annex 3. Annex 5 discusses case studies where contract farming has been used to produce and market value-added products, including vegetables, seeds and high value variety of aromatic rice.

(d) Farmers and Farmer Organizations

4.11 In the past, farmers have generated and informally shared information amongst themselves with little or no outside involvement or recognition. However, in more recent years some of the externally funded projects (e.g., DANIDA supported a project to strengthen plant protection services, IFAD supported Agriculture Intensification and Diversification project) have sought to use participatory approaches and have involved farmers and their grass-root organizations, e.g. Farmers Field Schools, micro-credit groups, in extension activities and to encourage farmer to farmer dissemination of information. In Bangladesh, promotion of farmers’ organizations, especially in planning, implementation and monitoring of extension agenda, is a neglected area which needs greater attention from all ESPs, including the extension departments of the respective ministries.

(e) Extension Services Providers and the Local Government

4.12 As a part of its decentralization program, the government has initiated a renewed program to strengthen Union Parishad (UP) through transfer of limited resources to make them functional. Taking advantage of this development, DAE has proposed that extension activities should be supported at the ward level by posting 2-3 BSs (now called Sub-Assistant Agricultural Officers) in each UP area to work closely with local government and farmers in planning and implementation of ‘one-stop’ extension service covering all the disciplines. This proposal is still being debated within the government. To implement this approach, at least to the crop sector extension, DAE has recruited a large number of BSs to fill vacant positions. While the use of Union as the focal point for extension support could be an effective way for involving both farmers and

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5 Under the local government system, Union Parishad (UP) is the lowest administrative unit and directly linked with the people. One UP is composed of 9 wards and each ward member would be head of one Gram Sarkar. In total there are 4488 UPS having 40392 Gram Sarkars.
their elected representatives in the extension service delivery process, complete reliance on the public extension service, which is already suffering from a number of constraints, including funding, would add to its sustainability problems. A more cost-effective alternative in the long-run would be to prepare farming communities themselves to take more responsibility for some of the extension activities.

B. Public Expenditure on Agricultural Extension

4.13 This section outlines the role of the public sector in financing the extension service in Bangladesh. Total public sector financing consists of revenue expenditure and development expenditure which is part of the annual development program. Project aid (credit and grants), from the bilateral and multilateral development partners, accounts for a large share of development expenditure. The role of the World Bank in financing agricultural extension in Bangladesh is summarized in Annex 2. Overall, the analysis indicates that agricultural extension receives relatively larger share of the budget than agricultural research. The following discussion examines the size, composition and effectiveness of public expenditure in agricultural extension.

(a) Public Expenditure Dominates Agricultural Extension

4.14 The share of funding for agricultural extension by the private sector and NGOs, while gradually increasing, remains very small. Most of the agricultural extension resources (physical infrastructure and staff) remain in the public sector which accounts for most of agricultural extension in the country. Contract farming, which is promoted by the public sector (such as BADC), the private enterprises (such as PRAN) and NGOs (such as BRAC), is slowly increasing and the coverage is small at this time. Contract farming involves agricultural extension as one of the important components of the contract.

(b) Public Expenditure on Agricultural Extension is Low

4.15 The public expenditure (revenue, development and total) on agricultural extension in Bangladesh from 1997/98 to 2004/05 is summarized in Table 4.1. Unlike agricultural research, the total expenditure on agricultural extension has increased from about 41% of total expenditure on agriculture in 1997/98 to about 47% in 2002/03 and then declined in 2004/05. However, the relative shares of revenue and development expenditures have changed over time since the relative contribution of revenue expenditure has declined from 71% in 1997/98 to 19% in 2004/05 whereas the relative contribution of development expenditure has increased from 23% to 38% for the corresponding years.

4.16 Unlike agricultural research, the share of total expenditure on agricultural extension has increased from 0.83% of agricultural GDP in 1997/98 to 1.05% in 2003/04 and then declined to 1.03% in 2004/05. However, given the importance of agriculture with over 12 million farming families, there is a need to increase the total expenditure on agricultural extension. As discussed below, since the public extension service allocates a large proportion of available budget to finance salaries, any increase in budget must be allocated to support agricultural extension and the operational costs of agricultural extension.

(c) Revenue Budget Finances Primarily Salaries

4.17 The composition of revenue expenditure on agricultural extension (for DAE, DOF and DLS) is reported in Table 4.2. Almost 95% of the revenue expenditure is used to finance salaries. The remaining 5% is used to finance operational costs. Thus, staff is paid salaries but not used to actually deliver adequate agricultural extension services to farmers. Furthermore, very limited resources are allocated to finance human resource development (for both the extension agents and the farmers) through capacity building and training.
## Table 4.1
Public Expenditure on Agricultural Extension

<table>
<thead>
<tr>
<th>Year</th>
<th>Agricultural GDP</th>
<th>Expenditure on Agriculture</th>
<th>Expenditure on Agricultural Extension</th>
<th>Extension/Agriculture (Development)</th>
<th>Extension/Agriculture (Revenue)</th>
<th>Extension/Agriculture (Total)</th>
<th>Extension/Agricultural GDP (Total)</th>
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<tr>
<td></td>
<td></td>
<td>Development</td>
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<td>Development</td>
<td>Revenue</td>
<td>Total</td>
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### Notes:

1. Agriculture GDP is the sum of crops, livestock, fisheries and forestry.
2. GDP and all expenditures are based on current prices.
3. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91); and so on.
4. Agriculture expenditure refers to expenditure by the following ministries: Ministry of Agriculture, Ministry of Fisheries and Livestock, and Ministry of Environment and Forests.
5. There has been a substantial increase in the revenue expenditure for agriculture during 2004/05. This increase is attributed to (i) allocations for new development programs, including agricultural subsidy, agricultural assistance program and flood rehabilitation; and (ii) an increase in the existing institutional, administration and service expenditures.
6. Expenditure on agricultural extension refers to expenditures by Department of Agricultural Extension (DAE), Department of Fisheries (DOF), and Directorate of Livestock Services (DLS).
7. 2004/05 GDP estimates are provisional.

Source: Bangladesh Bureau of Statistics (BBS), Ministry of Finance, DAE, DOF, DLS, Annual Budget Brief.
<table>
<thead>
<tr>
<th>Year</th>
<th>Salary &amp; Allowances</th>
<th>Operational Costs</th>
<th>Extension</th>
<th>Other Costs</th>
<th>Total</th>
<th>Salary &amp; Allowances</th>
<th>Operational Costs</th>
<th>Extension</th>
<th>Other Costs</th>
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</tr>
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</table>

Notes:
1. All expenditure estimates are based on current prices.
2. Year refers to a period from July 1, 1990 to June 30, 1991 (FY91) and so on.
3. Total Expenditure on agricultural extension refers to expenditures on Department of Agriculture Extension (DAE), Department of Fisheries (DOF), and Directorate of Livestock Services (DLS).
4. Definitions of expenditure categories are as follows:
   - **Salary & Allowances**: Consists of salary as per government rules and regulations and allowances for payment for house rent, medical, festival bonus, provident fund, pension, laundry, gratuity, and dearness allowance.
   - **Operational Costs**: Travel expenses, tax, post and telegraph, telephone, municipal tax, electricity and gas, newspaper and periodicals, stationary, income tax, group insurance, legal cost, hireage, labour cost, medical cost, house maintenance, transport maintenance, feed and lubricants, office furniture, building maintenance and allocation, house and miscellaneous.
   - **Extension**: Expenditure related to purchase of materials, equipments, labour cost as inputs required for carrying out extension work.
   - **Other Costs**: Other cost includes cost incurred for the purchase of land, building construction, equipment purchase, and other investment and Source: Department of Agricultural Extension (DAE), Department of Fisheries (DOF), Directorate of Livestock Services (DLS).
(d) Development Expenditure Dominates Provision of Agricultural Extension Service

4.18 Unlike agricultural research, the share of development expenditure in total expenditure on agricultural extension is lower but has increased substantially over time. As reported in Table 4.2, the share of development expenditure varies from about 25% to almost 50% of the total expenditure on agricultural extension. It is interesting to note that all of the extension-related operational expenditure is funded from the development budget. However, as shown in Table 4.3, the major source of funding (over 60% in most cases) for development expenditure for DAE and DOF is project aid. The share of project aid for DLS has been much lower. This raises the fundamental issue of sustainability of agricultural extension activities initiated as part of projects funded by credits or grants by the development partners. Another important implication for such a funding policy is that the agricultural extension staff, who should be delivering agricultural services to the farmers, remains busy in implementing area/discipline specific projects. In other words, the staff is unable to fulfill the main mandate of providing extension services to farmers.

(e) Release of Funds is Generally not Timely

4.19 Like agricultural research, the release of funds for agricultural extension is often neither timely nor adequate. The process of getting funds released is very long, time-consuming and bureaucratic. Agriculture is very seasonal activity. Untimely and inadequate release of funds contribute to poor service delivery to farmers. It is not uncommon to find the extension agents spending most of their time in the offices rather than with farmers in the villages and on farms.

(f) Food Crops Dominate Agricultural Extension Expenditure

4.20 Rice crop accounts for about 75% of the cropped area in Bangladesh. Partly because of the large area and partly due to the concerns for achieving rice self-sufficiency (rice being the staple food crop), the agricultural extension was and still remains focused on the rice crop. However, the demand for agricultural products is changing in response to increased per capita income and urbanization. The existing agricultural extension needs to address the emerging challenges faced by farmers in response to changing domestic economic conditions as well as the regional and global situation, partly in response to the less restrictive trade regime as part of WTO. In order to meet these emerging challenges and the changing requirements, there is a need to allocate more budgetary resources to agricultural extension related to horticulture crops, livestock, poultry, fisheries, aquaculture, food processing, marketing and market information.

(g) Impact of Agricultural Extension can be Improved by Changing Funding Policy

4.21 The inadequate and inappropriate funding policy for agricultural extension does not have the impact on agriculture or farmers that is commensurate with the resources used or national needs. The agricultural extension agents are not responding to the current needs of farmers which are not confined to rice production technologies. Due to heavy dependence on the development expenditure, the overall system is not sustainable. As a result, the overall contribution and impact of agricultural extension remains low and below the potential as well as below the national requirements.

C. Performance of the Public Agricultural Extension Institutions

(a) Extension Policies and Strategies of the Line Departments

4.22 National Agricultural Extension Policy (NAEP) and Strategic Plan of the Department of Agriculture Extension (DAE) of MOA. In 1996, MOA adopted a new policy to improve the effectiveness, efficiency and targeting of extension services (MOA, 1996). The key features of this policy included:
<table>
<thead>
<tr>
<th>Year</th>
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<th></th>
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<th>DLS</th>
<th></th>
<th></th>
<th>DOF</th>
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<tr>
<td></td>
<td>Development Expenditure (Million Taka)</td>
<td>Government (%)</td>
<td>Project Aid (%)</td>
<td>Development Expenditure (Million Taka)</td>
<td>Government (%)</td>
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Notes:
1. All expenditure estimates are based on current prices.
2. Year refers to a period from July 1, 1990 to June 30, 1992 (FY91); and so on.
3. Development Expenditure is reported separately for Department of Agriculture Extension (DAE), Department of Fisheries (DOF) and Directorate of Livestock Service (DLS).

Source: DAE, DLS, DOF, Planning Commission.
Revitalizing the Agricultural Technology System in Bangladesh

- Extension support to all categories of farmers;
- Efficient extension services;
- Decentralization;
- Demand-led extension services;
- Working with groups;
- Strengthened research-extension links;
- Training of extension personnel;
- Adoption of appropriate extension methodology;
- Integrated extension support to farmers;
- Coordinated extension activities; and
- Integrated environmental support.

4.23 Adoption of NAEP represented a major shift in the mandate of DAE and its implementation required DAE to:

- Expand the client-base;
- Change from a centralized extension service to a decentralized pluralistic extension system;
- Integrate different elements, including ESPs and needs related to different sub-sectors;
- Encourage partnerships between all the stakeholders based on comparative advantage; and
- Move from a top-down operational mode to a participatory demand-led approach.

4.24 Since the adoption of NAEP, DAE has produced two Strategic Plans to implement the key policy changes (DAE 1997 and 2002). The first plan covered the period from 1999 to 2002 and the second from 2002 to 2006, respectively. According to DAE, the plan is designed not only to implement the NAEP but also to support the entire policy framework of GOB, including National Agricultural Policy, National Rural Development Policy, and National Policy for Economic Growth, Poverty Reduction and Social Policy.

4.25 The second plan, launched in March 2003, is focusing on the following five areas:

- Increased agricultural productivity;
- Provision of pro-poor services;
- Strengthening of partnerships and links with local government;
- Development of DAE as an effective institution for providing quality services; and
- Developing performance measurement.

4.26 Although attempts have been made to adopt the NAEP principles under the two plans, the change process is still incomplete and is hampered by lack of full commitment to the change process and operational funds to support its day-to-day activities. Concurrent involvement of DAE in the implementation of several donor-funded area and/or discipline specific development projects with different objectives and extension approaches adds to complexity of implementing a common (the NAEP) approach at the national level and makes the change process more fragile.

4.27 National Fisheries Policy and Aquaculture Extension and Training Strategy (AETS) of DOF, MOFL. The traditional role of DOF has been to control and protect the fisheries resource. However, the recent National Fisheries Policy required a fundamental change from regulation and control to participation and cooperation with local communities, the private sector and NGOs, as well as provision of extension support. While there is need for extension support in all areas of the fisheries sector (open water fisheries, closed water aquaculture, coastal aquaculture and marine fisheries), the discussion below is focused on closed water aquaculture because of its increasing importance and availability of a free-standing extension
Agricultural Technology System: Agricultural Extension

and training strategy. AETS is one of a number of sub-strategies developed under the National Fisheries Policy.

4.28 The World Bank/DFID assisted Fourth Fisheries Project (FFP) included a Freshwater Aquaculture Extension and Training component with an objective to increase sustainable fish production in Bangladesh, primarily by increasing productivity through improved pond management. To overcome past weaknesses of the extension service of DOF in this field, the project assisted with the development of a national AETS. The preparation of AETS involved wide stakeholder consultation. This process identified the need for a change from the current project-based approach to a program-based approach of planning and budgeting to improve coordination and enable adoption of a common overall goal for the extension service - from top-down approach to people-centered decentralized approach - to enhance relevance; and development of a pluralistic institutional structure, where the role of DOF, in addition to being one of the service providers, would also be to encourage, coordinate and monitor other service providers, including NGOs, the private sector and local communities. To respond to these challenges, the strategy emphasizes increased participation of all primary stakeholders at every stage of the extension cycle (design, planning and implementation). It pays special attention to poverty and gender issues by emphasizing approaches and messages that are more appropriate to their circumstances.

4.29 Implementation of AETS has led to a number of changes in the extension approach adopted by DOF. The key changes include: reliance on decentralized planning and implementation at the Upazilla level; use of a balanced approach between facilitation, technology transfer and advice with help from a variety of agencies and partners; and village based group approach to extension delivery with direct involvement of fisherman and women in planning and implementation of extension activities. The new approach also required organizational changes within the DOF to allow decentralization and better coordination of activities (education, research, extension, input supplies, marketing, legal support, policy and planning) to improve the relevance, quality and coverage of service delivery. AETS preparation process has led to increased awareness of relationship between aquaculture practices and biodiversity as well as environmental issues. To ensure that relevant skills and capacity to support AETS concepts and approaches are available, DOF is implementing a systematic strategy for human resource development both for staff and its partners. A participatory monitoring and evaluation system has also been established to track output and outcomes.

4.30 The Livestock Extension Strategy. Even though the potential for livestock development, particularly for small scale dairy and poultry is high, there is no comprehensive livestock development policy or a separate national livestock extension policy to enhance productivity/production and develop collaboration with the private sector. To accelerate future growth of the livestock sub-sector, a recently completed policy report (MOFL and FAO, 2005) has emphasized that GOB should give:

- Greater thrust to improving small scale poultry farming and smallholder dairy;
- Develop goat, buffalo and duck, which has the potential in selected areas;
- Explore all alternatives for improved nutrition and veterinary care in the animal agriculture;
- Initiate institutional reform of DLS by clearly defining its public good functions;
- Enact and enforce laws and regulations for quality control of drugs, vaccines, feeds, breeding materials and hides and skins;
- Provide support for accelerating privatization of veterinary services of private good nature;
- Complete and approve the draft animal breeding policy;
- Establish mechanized slaughterhouse, with Static Flaying Frame in all municipal areas and strict enforcement of the Slaughter Act; and
- Pay greater attention to human resource development both in the public and the private sectors, including issues related to WTO agreements.

(b) Performance in terms of Outputs and Impact

4.31 **DAE, MOA.** With IDA assistance, Bangladesh introduced the modified T&V system in the 1970s and 1980s. Despite initial successes, the system proved to be too rigid, high-cost and highly staff-intensive which GOB was unable to sustain. Furthermore, in later years it promoted messages which were not relevant to local needs. An important change of direction for extension started in the 1990s when, under an IDA supported project (the Agricultural Support Services Project--ASSP), DAE adopted the revised extension approach (REA) to implement the NAEP under the first Strategic Plan for period 1999-2002 (DAE 1999).

4.32 The progress under the first Strategic Plan was assessed to be unsatisfactory (DAE 2002). The key weaknesses included:

- Lack of full commitment and ownership by the senior managers leading to weak support to make the ‘cultural’ move towards a partnership approach and reluctance to address key issues such as reorganization of DAE and staff incentive and work environment;
- Partial adoption of the decentralized extension planning and implementation along with weak coordination among extension providers as well as with other stakeholders;
- Partnerships were driven by funding sources which collapsed as soon as the source of funding (the project) ended;
- Extension work largely involved existing groups formed under different projects with varying objectives without attention to capacity building and formation of new groups to share responsibilities for planning and implementation of extension activities;
- DAE’s concurrent involvement in the implementation of a large number of development projects with differing objectives and approaches; and
- Inadequate M&E of extension activities.

4.33 The second Strategic Plan (2002 to 2006), which started in March 2003, was formulated keeping the above shortcomings in mind. Commencement of the second plan coincided with the completion of the Bank/DFID supported ASIRP. The second Strategic Plan highlights many actions needed to improve effectiveness of DAE. However, ending of the Bank/DFID project at a time when the change process was still incomplete and needed continued support, has weakened commitment to the NAEP driven change agenda in DAE. Additionally, due to a serious shortage of operational funds, the implementation of ideas pilot tested under previous projects has virtually stalled.

4.34 **DOF, MOFL.** DOF has successfully implemented a village based group learning approach under the FFP where extension support is being provided in collaboration with NGOs, fry traders, DAE and other interested parties such as school teachers. Over the life of the project it is intended to cover 8000 villages. Under the AETS, the project is also promoting a ‘local extension agent for fisheries’ (LEAF) approach. The agent is selected by the group members of the fisheries village and trained under the project to provide support to other members under supervision of the department’s Upazilla Fisheries Officer (UFO). A recent
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4.35 Although good progress has been made, a review of various FFP reports and discussion with staff involved in supervising the project has pointed to three areas of concern. The first relates to the relationship with the private sector. One of the report highlights concerns expressed by the village group members about the availability of fingerlings of the required species, size and quality due to weak linkages with the private sector. The second relates to linkage with research. Discussions with FRI suggest that the institute is not involved in supporting the technical work of the FFP and, in general, feels linkages with DOF are weak. The third relates to the post-project sustainability of the new extension approach, including that of the LEAF concept. This is due to potential funding constraints as there is no provision in the revenue budget to continue support for activities which are currently being financed through the development (project) budget.

4.36 **DLS, MOFL.** Extension activities of DLS aim at:

- Prevention, control and treatment of diseases;
- Artificial Insemination (AI) of cattle for genetic improvement and increased production;
- Fodder production and nutrition development for livestock;
- Distribution of inputs like chick pullets, heifer and concentrate feed, fodder seeds for increased production;
- Training of farmers and entrepreneurs;
- Dissemination sustainable technologies; and
- Creation of employment and income through livestock and poultry rearing.

4.37 The above list suggests that DLS would like to support fairly broad areas of activities through its extension service. In practice, however, main focus appears to be on providing AI services and distribution of subsidized inputs. The department has very little operational budget to disseminate sustainable technologies or to train farmers to improve productivity of livestock or poultry. In the meantime, the private sector, especially in the poultry sub-sector, has grown rapidly with only limited involvement of DLS. Technological change in the livestock sector through efforts of the public extension has been limited. The main drivers of growth in the livestock sector, e.g. the poultry and dairy, seem to be the technologies introduced and investment made by the private sector and supporting policy changes introduced by the government. There is a need for DLS to develop a new national livestock extension policy that takes into account the changing circumstances (especially the increasingly important role being played by the private sector) and that gives greater attention to the needs of the poor and the landless. For example, through its own efforts and/or by forging strategic partnerships, it can improve productivity of small ruminants and backyard poultry and help to promote a vertically integrated production system involving species such as Bengal goat, native to Bangladesh, involving systems for stall feeding, meat processing, packaging and marketing, and improvements in quality of raw hide. Its other important role would be to perform the regulatory functions, disease prevention (including diagnostics and surveillance of infectious diseases that have implications for the livestock sector and public health, e.g., avian flu), especially as Bangladesh Animal Diseases Act, 2005 and Bangladesh Animal and Animal Product Quarantine Act, 2005 have now been

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promulgated. DLS can also be proactive in facilitating a greater role for extension services by the private sector and NGOs to farmers practicing animal agriculture.

(c) Research-Extension-Farmer Linkages

4.38 One of the major objectives of all the line departments providing extension service is to increase agricultural productivity. For example, the second Strategic Extension Plan prepared by DAE identifies a number of interventions to achieve this objective, including crop diversification, appropriate land use, soil quality improvement, sustainable agriculture and environment, and commercialization. Success in all these areas would depend on availability of appropriate technologies and their adaptation to local situations. This would require the extension service to work closely with ARIs and, in some cases, with the private sector to ensure that these problems receive sufficient attention from scientists and locally adapted research findings are made available to farmers, in close collaboration with the extension service. Unfortunately, despite past efforts these linkages remain weak with no assurance of regular flow of needed technologies. Relevance of the research and extension agenda, funding issues, skill gaps, institutional constraints have all contributed to the continuing weak research-extension-farmer linkages.

(d) Level of Coordination

4.39 There is an increasing diversity in institutions involved in providing extension services and the government policy (through NAEP and AEP) encourages development of partnerships between different extension service providers. However, outside of externally financed projects (e.g. the World Bank), there are few examples of working relationships where a set of activities have been planned and implemented through mutual sharing of resources, knowledge and experience between the public and the private organizations. Similarly, to promote coordination between the extension activities of different line departments a number of committees have been established at different levels (Union, Upazilla, District, Region, National) and discussions have taken place at various levels in the government to move towards an integrated approach to extension covering crops, livestock, fisheries and agro-forestry. Despite these efforts, however, the inter-departmental coordination remains weak.

4.40 More recently, DAE has proposed an integrated ‘one-stop’ service approach at the Union level through Block Supervisors (now called Sub-Assistant Agricultural Officers) working closely with local governments (DAE 2002). This proposal is still to be accepted by other line departments (e.g. DOF and DLS) and the government. It appears, therefore, that despite the policy declarations, there is lack of understanding between the line departments and clarity in appropriate public-private role in an emerging pluralistic institutional structure of extension service providers. As a result, DAE, as it has a large field force, feels it has the best claim to be the main service provider rather than assuming a leadership role in developing inter-institutional coordination and monitoring mechanisms for extension activities of all ESPs. Other factors contributing to the weak coordination of extension activities include: a project and area/discipline based approach to extension with differing objectives and approaches supported by donor funding and lack of operational funds in regular (revenue) budgets of the line departments.

4.41 A positive aspect of the current situation seem to be the growing recognition by all the line departments that an integrated and decentralized extension approach involving all the stakeholders would be needed to effectively respond to varying needs of all categories of farmers. In addition, the project-based approach would need to be replaced by a program-based approach to ensure greater coordination between the national extension service and the extension needs of different projects.

(e) Staff Development and Training

4.42 A Ten Year Review of Human Resource Interventions (ASSP and ASIRP 2003), undertaken by the ASIRP Technical Assistance team, showed that the outcome of training programs (supported under ASSP...
and ASIRP) aimed at human resource development (HRD) has been mixed. The discussion below draws on findings of this review. To address the needs of NAEP a ‘cascade’ approach was used until 1999 which proved ineffective further down the structure of DAE and, as a result, few Block Supervisors are fully conversant with location specific needs and technologies needed to respond to these needs. The survey also found that in view of the focus of these projects on testing of new extension methodologies, higher percentages of Block Supervisors had adequate understanding of different extension approaches as compared to technologies needed to respond to varied needs of farmers. NAEP and REA (revised extension approach also provided a basis for examining staff performance and led to testing of some human resource management (HRM) aspects such as a work programming scheme and staff appreciation events. There is now recognition that staff development involves more than just training. At the same time, to maintain effectiveness of extension service technical training of field staff can not be neglected. Up-to-date technical knowledge to respond to changing needs of farmers is an essential skill for field staff regardless of what extension methodology is adopted and applies to staff of all agencies (i.e. DAE, DOF and DLS) providing extension service to farmers.

4.43 The 2002 revised training policy requires DAE to train the Block Supervisors so that they are able to assist farmers effectively and to promote partnerships amongst different extension service providers. The policy also requires farmer training needs to be assessed by the field staff and training arranged accordingly. In practice, however, this policy does not function due to lack of funds for routine training activities. All training activities for both farmers and staff are driven by projects financed by development partners. As a result, training wing does not have a significant role in planning of DAE training activities but plays a useful role in coordinating training being financed under different projects. This enables the Training Wing to keep DAE managers informed about available trained human resources and other HRM interventions consistent with NAEP/REA principles. However, as indicated above, these recommendations are only implemented if funded by a development project.

4.44 In DAE, there is no human resource planning for recruitment, utilization, improvement and retention of staff. The strategy adopted to move away from the T&V system and the entry of other ESPs has not resulted in a basic re-assessment of the role of DAE in extension and the number of staff needed to operate the service under the new policy. For example, there is no clarity on the number of Block Supervisors required to run a group-based approach with or without partnerships with other service providers at Upazilla/Union levels. The Annual Confidential Report (ACR) system provides no feedback to staff and does little to improve performance. There is no formal recognition for good performance or sanction for bad performance. Introduction of an open system of performance evaluation that requires a manager and his staff to jointly review performance and to agree on an individual performance improvement plan would be a significant advance over the current system. Salaries in DAE are low. Promotion is based on seniority not performance with limited prospects for promotion in the case of field staff. There is much competition for senior posts. In a hierarchical centralized structure with top-down management, this results in poor leadership and lack of continuity. On the other hand, UAOs and Block Supervisors complain of stagnating in their posts for 20 years or more with little or no opportunity for promotion.

4.45 In DOF, a lot of work is in progress within the framework of an overall HRD strategy under the World Bank assisted FFP, which emphasizes need-based training. However, the future sustainability of these activities after the project is completed is doubtful. In contrast, very little HRD work is taking place in DLS due to funding constraints and lack of an overall HRD strategy and low priority given to HRD needs.

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7 The ‘cascade’ approach used under the project until 1999 involved training of senior staff using the core modules. They in turn trained the middle level staff, who then proceeded to train junior level staff.
(f) Role of DAE’s Training Institutions

4.46 **Agriculture Training Institutes (ATIs).** Eleven ATIs were originally built to provide: (i) basic training to BSs; and (ii) short courses for both field staff and farmers. Salaries of the core staff of ATIs is funded by DAE with the Technical Education Board providing additional funding. DAE’s Training Wing maintains coordination responsibility for ATIs. The freeze on recruitment and lack of funds has meant that ATIs have not been training BSs on a regular basis. Short training courses for field staff are only undertaken when a project has funded this activity. Therefore, under current situation, ATIs are making little contributions towards achieving the NAEP objectives. Most of them are now conducting Agriculture Diploma courses which are not directly linked to the provision of extension service to farmers by the line departments.

4.47 **Central Extension Resources Development Institute (CERDI).** It was established as the apex training institute focusing on training of DAE officers. The end of the project review report on ASIRP concluded that CERDI has not played a significant role in the development of training and extension capability for some years (Gill et al 2003). However, as indicated in the second Strategic Plan, DAE wishes to strengthen CERDI so that it can play a much more pivotal role in assessing training needs, design courses, produce training materials, train trainers and implement participatory training programs. As DAE is unable to provide needed funds and enabling environment to upgrade CERDI, these objectives can only be met through stable funding and strategic partnerships with other training/educational institutions, e.g. agricultural universities, successful NGOs and management institutes.

D. Barriers to Better Agricultural Extension

(a) Funding Issues

4.48 **Lack of focus on cost-effectiveness of the extension service.** Amongst GOB departments with a significant field presence, DAE (crop extension) invests the largest amounts of public funds on extension. By comparison, extension expenditure of the Department of Fisheries (DOF) and the Directorate of Livestock Services (DLS) was much smaller. The total DAE expenditure is higher than the total research expenditure of all the research institutes, the private sector and NGOs combined together. Of the total DAE budget, only about 15% was allocated to operational costs of the extension. The remainder was used to finance salaries of about 24000 staff (of which 16724 are field staff). This leaves the public crop extension system with a chronic shortage of operating funds limiting contacts with farmers and affecting both the quality and quantity of service. The situation in DLS appears to be worse with little or no operational funds. DOF is functioning due to allocations from FFP through the development budget. The funding has also been unstable due to heavy dependence on contributions from the externally aided projects to the development funds, especially for operational work. As it is difficult to demonstrate a direct relationship between extension inputs and impact on farm productivity, it has not been possible to generate greater budgetary support from the government.

4.49 **Lack of focus on diversification of funding and financial sustainability.** The line departments have not made serious attempts to reduce costs by sharing responsibility for service delivery with other service providers, including growers, input supply (seeds, pesticides and fertilizers) companies, agro-processing enterprises and NGOs. The emergence of contract farming is potentially an important development for transfer of some costs of the extension support to the private sector. However, the rate and level of future increases in the private sector funding would depend on the increases in demand for inputs, growth of contract farming and GOB’s policy on the public/private role in extension.
(b) Management Issues

4.50 **Declining relevance of the public extension service.** The ‘one size fits all’ approach adopted by the extension service without targeting, market/client segmentation and categorization often means that the recommendations are not relevant to solve the immediate problems of farmers. In addition, lack of location-specific technologies has in some cases resulted in inappropriate recommendations. The performance of extension workers is generally evaluated based on achievements of physical targets (quantity) rather than impact (quality). In such a situation, accountability to farmers is neither demanded nor is measured in terms of farmer responses even though they would be the best judge of the quality of the service. Since farmers are poorly organized and not empowered, they are unable to bring about a change in the current situation.

4.51 **Inadequate focus on mainstreaming innovations.** Over the years, DAE has implemented a number of development projects which have tested different extension approaches to improve efficiency and impact. While the lessons learnt from these pilot experiments are reflected in the second Strategic Plan prepared by DAE, not enough attention has been given to mainstreaming of successful elements of different pilots. Same is true for extension innovations related to livestock and fisheries.

4.52 **Limited technical support from the national Agricultural Research Institutes (ARIs).** Despite past attempts to strengthen linkages between research and extension, there does not appear to be a significant improvement in the situation. Outside of the externally supported projects, there is little input from ARIs in the extension delivery process. As discussed earlier, due to a number of constraints faced by ARIs, they are unable to generate a steady stream of relevant technologies or to provide an effective technical back-up to the extension service. Inadequacy of operational funds available to both the research and extension services, makes it difficult for both services to finance joint field operations.

(c) Institutional Issues

4.53 **Lack of commitment to strengthen decentralization and institutional pluralism.** The NAEP principles respond well to the changing environment for extension, including, decentralization of public services to local level institutions, entry of new service providers, promotion of partnerships with NGOs and the private sector, liberalization of trade regime and privatization. However, its implementation is being impeded by the weak commitment to change, including lack of clarity in the public-private role in extension.

4.54 **Weak organizational efficiency of the line departments involved in extension.** The line departments (DAE, DLS, and DOF) have been slow in responding to the changed environment for extension. As a result, a move from a hierarchical centralized structure with top-down management to a decentralized and participatory mode of operation has not been fully achieved. The positioning of field staff does not correspond with needs of the poorer districts, which limits its ability to provide service to the poor small and marginal farmers. In addition, involvement in implementing a number of projects with differing objectives introduces inconsistency in strategy and methodology. Past attempts at coordination between projects have made limited progress. Similarly, it has not been possible to bring about greater collaboration between different departments of GOB to deliver an integrated extension service.

4.55 **Inadequate institutional support related to inputs, credit and marketing.** Timely availability of quality seed in adequate quantities at a reasonable price is a major constraint. Despite market deregulation the same problems apply to availability of fertilizers. Imbalanced use of nutrients has, in many locations, led to over application of nitrogen and under use of other primary nutrients (potash and phosphorus). Emerging micro-nutrient deficiencies, especially of sulfur and zinc, in intensive rice-based systems, are not receiving adequate attention. Access to institutional credit, especially by the small and marginal farmers as well as by the micro, small and medium enterprises (‘the missing middle’) continues to be a major problem. Agricultural marketing is a weak aspect of the Bangladesh agriculture. The markets have poor infrastructure, a highly
fragmented chain and, in some situations, control of movement of goods by syndicates limiting profitable marketing opportunities for many farmers.

4.56 *Slow growth of Contract Farming.* Contract farming of cereals, fruits, vegetables, oilseeds, crop seeds, poultry and other commodities is an emerging new area for the private sector driven commercial agriculture. Although a number of companies (both public and private as well as NGOs) are now involved in this development, future growth depends on removal of constraints related to government regulations, institutional linkages, infrastructure, access to markets and availability of appropriate technologies.

4.57 *Limited coverage and reach.* The coverage, as measured by direct contact between DAE field staff and farmers, has remained at around 10% of farmer population. The number of clients entitled to service is large, some in geographically difficult-to-reach dispersed communities and with differing needs. In practice, therefore, extension staff can only establish direct contact with a few farmers. Field workers have tended to visit mostly the large and more resource endowed farmers in easily accessible areas. The poor and women farmers, although better served than in the past, still feel neglected. They neither receive regular visits from public extension staff nor benefit from the farmer-to-farmer diffusion of technology from farmers receiving direct service (larger farmers) from DAE, DOF or DLS.

4.58 *Eroding skills and motivation of the public extension service staff.* Past efforts have largely been focused on training of staff but the impact on skill development has been mixed. In recent past, the training programs, largely linked to objectives of the externally aided projects, have given considerable attention to developing skills in different extension methodologies involving participatory approaches. Although these training programs were judged to be successful, in practice, utilization of participatory skills has been variable. It has been particularly difficult to maintain technical skills of field staff, both due to lack of focus on technical training as well as weaknesses of the training institutes. Limited opportunities for career progression, especially for the front-line field staff, and a weak incentive structure, including limited support for mobility, have been identified as important de-motivating factors for improved effectiveness of the service. There is a need to move away from a narrow focus on training to a more holistic human resource management approach to enhance staff skills and motivation.
Chapter 5: Innovations in the Agricultural Technology System

5.1 The purpose of this chapter is to examine recent international experiences in reforming agricultural technology systems and their relevance for Bangladesh. The areas examined include (i) agricultural research; (ii) agricultural extension; (iii) contract farming; and (iv) producers’ organizations. These innovations or “best practices” will be part of the agenda for reforming the agricultural technology system in Bangladesh.

A. Agricultural Research

5.2 Investment in agricultural technology system can be a major source of pro-poor agricultural growth and provide significant benefits in terms of increased farmer income, lower food prices and increased employment in rural areas (Fan et al 2002). However, to realize these impacts, agricultural research resources must be targeted at the most important problems taking into account the changing environment for research. Another condition is that the technology system must be sufficiently strong to utilize additional resources in a cost-effective manner to develop and disseminate appropriate technologies. Unfortunately, due to lack of institutional innovations in organization and management of the national agricultural research system and inadequate funding by governments, these conditions have not always been met in many countries, including Bangladesh, thus compromising ability of the national systems to generate research impacts mentioned above. At the same time, other organizations, especially the private sector in response to a growing market for inputs and added value in agricultural products, are making increasing investments in the technology development and dissemination, which has changed the makeup of the national research system in some developing countries, e.g. Chile, Malaysia and Thailand. This process, however, has only recently commenced in Bangladesh. Therefore, the challenge in strengthening of national agricultural research systems in the future is to develop institutional approaches that encourage participation and funding of research by all players, contributing to the technology/knowledge pool based on their comparative advantages.

5.3 A review undertaken by Byerlee and Alex (1999) of funding, institutional, organizational and management issues in strengthening of NARS and of good practices in the reform process in the World Bank financed projects summarized the key elements of a new NARS paradigm as follows:

- Separation of research funding from research execution. Funding and execution of research requires distinct skills and inputs. Research funding and the setting of broad priorities for research is a policy issue, while research execution by alternative suppliers is an efficiency issue.

- Recognition of the pluralistic institutional structure of NARS. Increasingly, the definition of NARS includes universities, the private sector, farmer organizations, and nongovernmental organizations (NGOs). This allows additional scientific skills to be tapped and matched with national needs, thus increasing research efficiency.

- Sharper focus of public funding for research on public goods and diversification of funding support for public research institutes. There is a strong case for public-sector funding of basic and strategic research (long-term research with uncertain payoffs and high spillovers), research on problems of small-farm agriculture (high transactions costs for farmers to organize their own research), and research on natural resource management (positive environmental externalities).

- Recognition of the complementary roles of public and private sector research and development (R&D). There are potential efficiency gains from private-public sector collaboration in
both the funding and execution of research due to the complementary skills and resources in each sector.

- **Increased flexibility and institutional autonomy in public research institutions combined with increased accountability improves effectiveness of NARS.** Granting of greater autonomy along with accountability promotes results-oriented institutions, characterized by business-oriented management of human, financial, and physical resources.

- **Increased involvement of stakeholders.** Involvement of the clients of the research system, especially farmers, in research governance, priority setting, execution, financing, and evaluation improves responsiveness of NARS to their needs. The institutional models for achieving this include full or partial funding of research by farmers and other clients, involvement of farmers and farmers’ organizations in governance of research institutes/systems, and various types of contractual relationships with clients in executing research.

- **New models for technology transfer that move beyond the traditional research-extension chain improve effectiveness.** Involvement of farmers, NGOs, and the private sector in a variety of formal and informal partnerships, and information dissemination and feedback mechanisms improves relevance and effectiveness of research and extension services.

5.4 During late 1970s through to early 90s, the NARS in Bangladesh has considerably expanded both in size and complexity, often with the help of external funding. Attempts to reform the system in Bangladesh during the late 90s, including greater autonomy for the NARS, met with limited success, mainly due to lack of commitment in the concerned ministries of the government for promoting and sustaining institutional reforms. Strong political commitment and a desire to change from the scientific community, coupled with demand side pressure from stakeholders plays a critical role in building a strong and productive research system. This was the case in Malaysia, Chile, Brazil and Uruguay. Experiences of these countries have also shown that building of strong public institutions takes time when commitment to the change process must be sustained, which was missing in the case of Bangladesh. The way forward for Bangladesh, therefore, is to draw lessons from its own past experience, especially under the Bank financed ARMP, and to build consensus for the introduction of key elements of the new NARS paradigm discussed above which are relevant for Bangladesh.

### B. Agricultural Extension

5.5 Declining public funding of agricultural extension in many countries is curtailing the scope and coverage of the public extension service. Under these circumstances the response has been to encourage participation by the private agribusiness enterprises, including input suppliers and purchasers of agricultural products; information/media companies; NGOs; and producer groups/organizations. The roles of these groups in the provision of extension service can vary depending on the national situation. A recent international workshop (World Bank 2002) reviewed the different approaches for revitalizing extension services and concluded that innovations must emerge from an analysis of success and failures of existing extension programs. However, this is not easy as shown by a recent review by Anderson and Feder (2004). These reviewers found that impact of extension programs on agricultural outputs, the welfare of rural communities and environmental sustainability is difficult to assess due to attribution problems as many factors affect performance of agriculture in complex ways.

5.6 Despite the attribution problems, however, outcome of the workshop sited above and the common framework for agricultural extension proposed by the Neuchatel group (Neuchatel Group, 1999) have
highlighted the following principles as the basis for reforming a declining or ineffective agricultural extension service:

- **A sound agricultural policy is essential to provide enabling environment.** An extension program is more likely to succeed if the necessary conditions for growth in agriculture and related industries are in place.

- **Focus of extension should be on “facilitation” and not solely on “technology transfer”.** Extension is often narrowly defined as a vehicle for technology transfer. Instead it should be seen as a means of promoting two way flow of information between scientists/extension workers and farmers, collected using participatory approaches. The knowledge gained through this process provides a sound basis for diagnosing problems and for disseminating proven improvements/solutions to technical problems and information on markets, credit and consumer demand. Thus, a good extension service facilitates flow of complimentary information from different sources and builds capacity of farmers to absorb this information and arrive at solutions that are appropriate to their needs. To play the facilitation role, the extension service requires high caliber human resource with good grounding in technical information, understanding of market opportunities and an ability to marry know-how with people skills.

- **Producers are not simply beneficiaries of agricultural extension but are the key stakeholder and sponsors.** Extension activities are more effective when farmers are directly involved in the identification, implementation and monitoring of the extension agenda. When farmers fund or purchase training service, the impact is significantly better than when they are recipient of a program entirely designed and funded by someone else. For farmers to exercise their right as the stakeholder and sponsor requires empowerment and promotion of strong producer organizations that are able to share responsibilities at all stages in the extension delivery cycle.

- **Increasing involvement of farmers in market economy requires new relationship between farmers and the private sector.** The move from subsistence farming to high value commercial farming is consumer-driven rather than producer-driven. Because input suppliers and produce buyers have better feel for emerging consumer demand, closer linkages between farmers and the private sector are essential. Extension service can play an important role in facilitating a balanced relationship between producers and the private sector and provide unbiased market and technical information to enable producers to benefit by responding to emerging market demands.

- **New perspectives needed in supporting private extension service providers with public funds.** Public funding of extension is essential but that does not mean that only the public institutions should provide extension service. Government may contract out some or all of the implementation to NGOs, farmers’ organizations or specialized consultants. However, to contract out services, the government institutions must develop capacity to monitor and evaluate activities they finance matching these with the country’s financial resources.

- **Pluralistic and decentralized institutions of extension service providers require effective coordination.** Extension systems should be able to respond to local situations and to changing needs. Decentralizing decision making and service provision can strengthen pluralistic institutional structure of the extension service providers and improve producers choices in terms of methods, quality and cost, but the multiplicity of actors makes national coordination and consultation an essential task for the lead public agencies. However, care should be taken to avoid coordination role becoming central control by another name.
5.7 Some of the principles highlighted above, e.g. decentralization, participatory approaches, have already been pilot tested in Bangladesh. However, lessons learnt from these experiences have not been fully internalized due to lack of sustained commitment from the government to reform the system and interrupted funding. Based on lessons learnt from the past experience, the challenge for the government is to build a national agricultural extension system that is decentralized, pluralistic, efficient, financially sustainable and places much greater emphasis on farmers participation in the management of extension services.

C. Contract Farming

5.8 The major constraints faced by small farmers in benefiting from high value agriculture include: inadequate research and extension support, lack of own resources and access to credit, timely availability of quality inputs (seeds, fertilizers, and crop protection products), access to market services at assured prices and maintenance of product quality/standardization. Contract farming addresses many of these problems and has become an increasingly popular means of product supply in many developing countries, where the land tenure rules or political realities are not conducive to large-scale farming, especially by large corporations.

5.9 Contract farming is an operational arrangement that allows firms to participate in and exert control over the production process without owning or operating the farms: leaving production responsibilities with growers who own or lease the land. After studying different contract farming practices, Minot (1986) classified the options into the following three, mutually non-exclusive, categories:

(a) **Market specification contracts** are pre-harvest agreements that bind the firm and grower to a particular set of conditions governing the sale of the crop. These conditions often specify price, quality and timing.

(b) **Resource providing contracts** require the processor to supply crop inputs, extension and, in some cases, credit, in exchange for a marketing agreement.

(c) **Production management contracts** bind the farmer to follow a particular production method or input use pattern, usually in exchange for a marketing agreement or resource provision. This may also include provision of resources.

5.10 Contracts vary a great deal in detail and complexity but are important mechanism for clarifying issues related to:

- **Marketing**: How much of the product would be purchased, when, and at what price for what quality?

- **Inputs and technical assistance**: How would inputs and technical assistance be delivered, how much, and at what price and quantity?

- **Credit**: Will the grower receive credit in cash or kind? How much would he receive, at what interest rate? What would be the collateral?

- **Production management**: What technological procedures must the grower follow? How would the grower be monitored?

- **Delivery and grading**: Who would transport the harvest to the processor and how would quality be graded?
5.11 International experience shows that, while contractual agreements benefit small farmers, under certain conditions there can be problems related to:

- **Credit.** Contracting solves the problem of operating capital, as either the contractor provides the money and/or inputs or the contract itself facilitates a bank loan to the producers. However, short-term production contracts, which are common in fruit and vegetable production, do not solve the problem of investment capital. Only, less common, longer term contracts or joint ventures can provide investment capital for small producers. In most situations small producers require government support to access investment credit.

- **Technology Development.** Although the private organizations involved in contract farming can be effective in technology validation/adaptation work requiring short-term research. However, they generally do not support long-term research to solve more complex technical problems, e.g. soil-borne disease, development of new varieties, salinity, erosion, and pest resistance. An effective national research system is essential to address such problems. For example, exports of fruits and vegetables from Mexico under the North American Free Trade Agreement (NAFTA) in early years suffered due to weaknesses of the national research system to increase yields or to control important pest problems which made the produce less competitive with the United States (Cook et al 1991).

- **Technology Transfer.** Due to limited extension support provided by the government agencies to producers of high value commodities, the role of contractor as provider of technology and knowledge can be very important, especially in teaching farmers how to grow (new) crops, develop systems of production appropriate to local conditions, introduce new varieties, and advice on management of pest and disease problems. Experience from many countries seem to suggest that producers who need extension support are better off contracting with a firm that is itself a producer - or has the resources and commitment to act like one - rather than dealing with firms that are mainly marketing intermediaries. Another issue could be the appropriateness of technologies being transferred. Input intensive farming practices used by large farmers may not be appropriate for small farmers, given the risk considerations, access to family labor, and capital constraints. Similarly, ecological damage due to repeated intensive cultivation of crops with inappropriate management of applied inputs can result in environmental damage. In many situations, therefore, local adaptation and validation of recommended technologies may be necessary. This role can either be played by the public research and extension services through public-private partnerships or by strong producers’ organizations (POs), where available, working with the public institutions and the private companies entering into contractual arrangements.

- **Marketing.** Markets are relatively small in many specialized agricultural products. In other commodities, e.g. fresh fruits and vegetables, they are also highly risky. Contracts with established firms that have secure access to markets can greatly lower risks of participation by small farmers. However, international experience highlights the importance of avoiding speculative intermediaries who are unwilling or unable to absorb market shocks (low prices or changes in demand). Marketing barriers are probably the most significant obstacles to smallholder participation in high value agriculture. International experience demonstrates that dealing with large companies can help in meeting quality standards demanded in export markets (Jaffee 1991).

5.12 In times of high market demand and high prices, farmers have incentive to break contracts by selling produce to competitor or directly in the local market. Breaking of contract by the purchaser has also been a problem when supply exceeds demand and the prevailing market prices are considerably lower than agreed in the contract. It is best for these types of problems to be resolved through mutual understandings and safeguards built in contracts.
5.13 In Bangladesh, the private sector/NGOs-driven contract farming incorporating technical, credit and marketing support for high value agriculture is currently a small and nascent activity. However, it can be an important contributor to future agricultural growth, especially due to shortage of good agricultural land which is declining further, and availability of a large pool of small and marginal farmers willing to diversify production systems to augment family income. However, to realize the full potential of contract farming and to avoid problems experienced in other countries, the government would need to ensure that: existing laws do not constrain agri-business and contract farming development; the necessary infrastructure is in place and farmers are protected from an exploitative relationship with the agribusiness enterprises. The public research and extension services can play an important role in meeting the technology needs of producers and in empowering farming communities by fostering and strengthening producers’ organizations. More information on experiences with contract farming in Bangladesh is given in Annex 5.

D. Producers’ Organizations

5.14 To make the research and extension services more responsive to their clients, international experience has highlighted the need for empowerment and greater participation by farming communities through their own organizations in planning, implementation and monitoring of the research and extension agenda (Rondot and Collion 2001). Summarizing findings of a workshop they highlighted the following aspects related to POs.

5.15 **What constitutes a PO?** POs are a membership organization created by farmers or related groups to provide services to members with objectives that may include: better management of or access to natural resources or assets; improved access to services, credit and markets; participation in the decision making process. POs can start as informal groups and as they gain experience and build capacity to be self-reliant; they can be federated at local, sub-regional, regional and national levels. POs can assume several functions, including advocacy, policy, economic, technical, financial and social needs.

5.16 **What is the rationale for formation and/or strengthening of POs?** Reasons for supporting (formation and strengthening) POs can vary depending on the objectives. These could be to: advocate economic and social regulations; influence rural development policy; compensate for public or private institutional failure; push forward technical, economic or institutional changes. Support to POs is an investment in social capital development, which empowers members to better themselves socially as well as economically and increase return on other types of investments, thus reducing poverty. They can help to align activities of the agricultural services (research, extension, and agricultural and rural advisory services) with a demand-led agenda so that members are able to express their priority needs to the service providers. The central challenge for many POs is the building of balanced technical, economic and political partnerships. It is a slow and time consuming ‘learning by doing’ process adapting to local needs. It is hard to reduce this process to simple procedures or ‘best practices’, but, if done right, strong POs have the power to modify relationships with the government service providers, the civil society and development partners.

5.17 **What are the actions needed to strengthen POs?** Experience shows that there is no universal approach to strengthening of POs. It needs to be tailored to suit local conditions and to the specific needs of producers. A support program should embody the principle of empowerment and follow certain principles based on lessons learnt from national and international experience. The key lessons include:

- Develop a need-based agenda which involves PO leaders and members;
- Strengthen technical capabilities and provide back-up support for maintaining and updating skills/knowledge, if possible, through resources controlled by producers with emphasis on ‘learning by doing’;
• Develop human (members and leaders) and financial resources; role of a leader is vital for the growth and survival of PO, and therefore, needs specific type of training;

• Provide financial support in the beginning and develop capacity to mobilize sufficient internal financial resources through savings and/or income generating activities;

• Establish linkages that provide access to and create capacity to utilize strategic information; and

• Ensure sustained government support which is essential for POs to grow and mature.

5.18 What has been the experience of PO partnerships with research and extension institutions?
In several African and Latin American countries, early reforms influenced by improved participation by producers in the research and extension institutions, have included:

• Greater focus on production systems research to improve relevance;

• Better identification of needs based on participatory diagnostic methods;

• Decentralization of research and extension institutions; and

• Establishment of consultative forums between research, extension and POs.

5.19 The next level of reforms that have allowed producers to be involved in managing research and extension institution and formulating their program of work has been achieved when representatives of POs and other non-officials are in majority on the executive councils/boards of the publicly funded research and extension institutions. This allows them to ensure that the work programs being supported meet needs of their members and that this approach becomes the ‘normal’ way of doing business. Examples where POs have had significant influence on the functioning of the research and extension services include Senegal, Cote d'Ivoire, Togo and Uruguay.

5.20 Another approach for reforming the public research and extension systems has been to establish research and/or extension fund with independent and transparent management which allows producers to ‘buy’ research and extension services from public institutions, NGOs or POs. Examples include Mali, Venezuela, Colombia and Guinea.

5.21 Lessons learnt from experiences of different countries show that: government support and favorable policy environment are essential for improved institutional responsiveness to growers. In Bangladesh, growers remain unorganized and lack voice to influence functioning of the research and extension institutions. As a result, public institutions often do not work for the benefit of all producers. To change the current situation, greater resources and sustained commitment is needed to develop and strengthen POs drawing on the international experience.
Chapter 6: Reforming the Agricultural Technology System

6.1 Key constraints that need to be addressed by the reform agenda relate to funding, system management and institutional issues. These influence all the barriers to better research and extension discussed in Chapters 3 and 4, respectively.

A. Needed Reforms for Agricultural Research

6.2 Experience of the Agricultural Research Management Project (ARMP). Some of the issues discussed below have been the subject of intense debate during implementation of ARMP (1995-2001). Annex 6 summarizes past recommendations, reforms discussed with GOB, changes made under the 1996 Act for NARS, and their current status. The focus of the institutional reforms under ARMP was on bridging the gaps left by BARC Act 1996. These included: (a) limited autonomy of the BARC Governing Body, especially in the formulation of service and business rules for the system; (b) restriction on BARC to receive funds for the system directly from the Ministry of Finance and ability of ARIs to receive funds directly from parent Ministries which limits the ability of BARC to prioritize and coordinate research; (c) lack of explicit provision for direct involvement of Universities, NGOs, CBOs and the private sector as important constituents of the NARS which inhibits development of a strong pluralistic institutional structure of NARS. The progress, however, was disappointing and at the end of the project many of the changes sought were left unfinished. One of the major reasons for limited progress was lack of consensus amongst the key stakeholders. Other contributing factors highlighted by a review of available project documents and discussions with the stakeholders in Bangladesh are summarized below.

6.3 Weak project design. Even though the September 1991 Identification Mission of ARMP correctly identified the key areas for institutional reform, the OED’s project performance report (World Bank 2003) concluded that the final project design failed to address some important issues related to governance and autonomy of NARS, including the weak position of BARC opposite the ARIs, lack of a unitary system for management decisions, including budgetary allocations, the system’s autonomy and inefficiency resulting from an excessive number of institutes and sub-stations. It was only during the mid-term review of ARMP that a clearly laid out action plan, that took into account the weaknesses of the 1996 Act, was presented to GOB.

6.4 Limited ownership of the reform agenda. Even at the highest levels in MOA, MOFL and MOEF, there was limited ownership and commitment to address the reform agenda agreed with the World Bank, including that proposed at the mid-term review.

6.5 Problems created by GOB’s budgeting and fund flow arrangements. Project–based provision of funds through development budget is a serious impediment to institutional development and sustainability of reforms due to erratic and uncertain funding, especially for the operational budget. For example, funding for BARC (staff salaries and operational budget) came under the development budget with no guarantee of continued employment after the end of the project funding. As a result, BARC was unable to recruit and retain suitably qualified and trained senior staff. This meant that BARC neither had the legal sanction nor could exercise intellectual authority over ARIs on issues relating to resource allocation to redirect research. The situation has changed somewhat in that some staff positions have now been moved to the revenue budget, but the key posts still remain vacant.

6.6 Experience of the Poverty Elimination through Rice Research Assistance Project (PETRA). The support provided and political commitment generated in rice research by ARMP contributed to financing of PETRA by DFID (DFID 2004). Although the project was a grant to Bangladesh, funds for the project
implementation were channeled through IRRI, which allowed it to bypass many of the institutional constraints faced when funds are channeled through the government machinery. The project completion report of the PETRA project concluded that it made significant contributions in technology development for improvement of productivity of rice and rice-based systems, capacity building for demand-led rice research, development of uptake methods and pathways. In addition, PETRA also supported policy dialogue on a number of topics related to rice research, as well as some broader issues such as poverty and agriculture and research and extension. It also successfully pilot tested a model for competitive allocation of funds to support discrete research activities. However, the fund flow mechanism (through IRRI) adopted by PETRA reduced sustainability of its achievements due to lack of continued funding by GOB for most of its activities. In addition, the project made limited contribution towards institutional development of the research system as a whole.

6.7 The priorities for the reform agenda outlined below draw on the implementation experience of ARMP and PETRA as well as on the international experience highlighted in the previous chapters, particularly in Chapter 5.

(a) Research Funding

6.8 **Increased public investment in research.** A study of growth and distribution of rural income in Bangladesh (Hossain et al 2000) has shown that the adoption of new varieties produced through past public investment in rice research and extension as well as expansion of irrigation have increased farmer income, reduced rice prices for consumers and created more employment opportunities in the rural non-farm sector. This example of positive outcomes from Bangladesh makes a compelling case for increased public investment in agricultural research. In the short-term, this would help to bridge the current yield gap and, in the medium to long-term, help to generate new technologies to support sustainable intensification and diversification of the production systems into high value agriculture.

**Recommendation 1:**

In view of its high impact on agricultural growth and poverty reduction vis-à-vis other public investments, GOB should increase public funding for agricultural research from its current level of around 0.2% of AGDP to about 2% in phases. The immediate increase should be to 0.6% of AGDP, which is the average for all developing countries.

6.9 **Ensuring stability and sustainability of the public funding of research.** Reduced reliance on externally aided projects and amalgamation of funds provided under the development budget with the revenue budget would help to reduce the problem of instability in funding of research. At the same time, to avoid problems caused by erratic releases of funds, GOB should consider establishing an imprest account for each ARI by providing a permanent advance equivalent to 12 month’s estimated operational expenses of research programs (excluding salaries) to ensure continuity of work.

**Recommendation 2:**

To ensure sustainable and stable funding for NARS, GOB should: (i) provide funding through an amalgamated development and revenue budget; and (ii) establish an imprest account for each ARI by providing a permanent advance equivalent to 12 month’s estimated operational expenses of research programs (excluding salaries).

6.10 **Introduction of Competitive Grants Program (CGP).** Commencement of a CGP would provide an additional mechanism for funding priority agricultural research across different sub-sectors. This mechanism is now increasingly used by many countries to finance and manage agricultural research. Under this system, research providers are selected on a competitive basis after calls for proposals and peer review of proposals submitted prior to allocation of funds. Potential benefits of such an approach included:

- Expansion of agricultural research service providers from a predominant reliance on the public sector ARIs to include other agencies, e.g. NGOs, Universities, the private sector;
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- Improved research quality, innovation and accountability;
- Funding of proposals with time-bound outcomes;
- Stability of funding through diversification of sources of funding, including the private sector, farmer's organizations, NGOs and external donors;
- Redirecting of research towards demand-driven high priority areas; and
- Encouragement to multi-disciplinary and multi-institutional partnerships.

6.11 Pilot testing of a contract research program under ARMP and of the CGP approach under PETRA in Bangladesh gave promising results. An independent study funded by DFID through the Working Group in Bangladesh on Agricultural Research Initiative, (DFID, 2003) recommended establishment of an independent body to finance research and extension activities through a competitive process. Accordingly, it is proposed that GOB should commence a CGP based on international 'best practices' (see Annex 7). To ensure independence as well as transparency in the review process, a dedicated agency would be needed to manage the CGP. Three possible options for organizational arrangement to manage a CGP are discussed under the proposed institutional reforms. The CGP would be open to all the public and private institutions in the country with capacity to undertake agricultural research, including the private sector. It would finance research in priority areas (consistent with NARS priorities and the PRSP) in food crops, livestock and fisheries research.

6.12 To ensure sustainability and stability of funding for the CGP, an endowment Trust Fund would need to be created to generate an income stream of sufficient size to finance CGP research and a portion of the operational costs of the agency established to manage the CGP. External assistance would be required to establish the Trust Fund of a size commensurate with needs of the priority research programs to be financed through the competitive process.

**Recommendation 3:**

GOB should:

a. Establish an independent agency to manage the competitive grants program to finance time-bound peer reviewed research proposals on priority topics invited from all eligible research institutions; and

b. Establish a dedicated Trust Fund with sufficient potential earnings to ensure sustainable funding for the CGP.

6.13 **Diversification of sources of funding for research.** In recent years, the agribusiness interests in Bangladesh have commenced financing contract farming for cultivation of selected cereals, oil crops, fruits, vegetables, seed production and even commercial poultry production and are identifying technology gaps related to suitable varieties, cultivation practices and post-harvest management systems for specific crops, sub-sectors and locations. In view of this, it is now timely to examine opportunities for augmenting research funding from new sources, especially the private sector. Possible mechanisms could include: (i) need-based public-private partnerships that broaden the scope and coverage of research, e.g. in biotechnology, post-harvest management systems, information and communication technology; and (b) research contracts to generate technologies for high value commercial agriculture.

**Recommendation 4:**

NARS should examine opportunities for augmenting research funding from the private sector to address specific problems through: (a) need-based public-private partnerships; and (b) time-bound contract research for the private sectors.

(b) Research Management

6.14 The research management issues are (a) prioritization of research to improve efficiency of resource allocation; (b) capacity for economic and sector work, including policy analysis and socio-economic research;
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(c) need for a change from commodity focus to a systems based eco-regional research; and (d) access to new sciences such as biotechnology.

6.15 **Prioritization of research.** Under ARMP, Strategic Plan for the national agricultural research system and master plans for individual agricultural research institutes were prepared to focus research on priority constraints impeding agricultural growth. However, since the closure of ARMP this subject has received inadequate attention. While the plans prepared under ARMP provided valuable information and progress was made in improving research relevance, broad agreement on priority constraints does not yet exist. This is largely due to the fact that these plans have not been subjected to uniform priority setting methodology and developed further to combine indicated priorities for each sub-sector into an overarching plan for the agricultural sector. This could be done by using either the ex-ante economic analysis or a simplified scoring method which could be applied by all institutes to prioritize research and to allocate resources accordingly to improve system efficiency. These models have been applied in many countries and much literature is available on the subject. Once plans for all the institutes have been revised and adopted, it would be possible to assess expected pay-offs to research and BARC would be able to develop a vision for the national agricultural research system highlighting the changing priorities.

**Recommendation 5:**
BARC, jointly with ARIs, should:

a. Update and re-evaluate existing plans to prioritize research programs using a common methodology taking into account government policies and outcome of PRSP; and,

b. Update the research strategy and prepare an action plan for allocation of resources in the context of revised priorities.

6.16 **Need for enhanced capacity in social sciences.** In general, there is limited capacity in the national system in social sciences. As a result, little economic and sector work and policy analysis is undertaken on issues of direct relevance to NARS. In view of increasing importance of the economic and policy analysis inputs to the overall effectiveness of the agricultural research system, it is important that steps are taken to strengthen this capacity. Since it has been difficult in the past to find and retain suitably qualified staff in social sciences, option to establish strategic partnerships with other centers with this expertise, including Agricultural Universities, should be considered.

**Recommendation 6:**
BARC and ARIs should review options, including strategic partnerships with other institutions with expertise in social sciences, and develop an action plan to strengthen capacity in economic and sector work, including policy analysis and socio-economic research in the NARS.

6.17 **Support for participatory eco-regional on-farm production systems research.** To respond to location specific needs of farmers under different agro-ecological conditions there is a need to mainstream participatory planning, implementation and monitoring of on-farm production systems research. This requires multi-disciplinary and multi-institutional systems-based eco-regional approach. As this is not the normal ‘business’ approach in ARIs, which are organized along the commodity or disciplinary lines, there is a need to develop capacity to better target research on farmer’s needs and integrate research across disciplines, including social sciences, drawing scientists from different institutions. This approach would also be of value in strengthening research-extension-farmer linkages by involving extension personnel in the participatory

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8 For example in India, under the National Agricultural Technology Project (NATP), funded by the World Bank, the country was divided into five broad eco-regions covering and, coastal, hill and mountain, irrigated and rainfed areas. These were further delineated in the fourteen production systems. Systems-based research programs/projects for each of the production system were identified using participatory methodologies and implemented by multi-disciplinary multi-institutional teams. Each time-bound research proposal was financed by following a peer review process and was subjected to close monitoring.
need assessment and prioritization process. Since CGP could be an appropriate mechanism for financing this type of research, funding for eco-regional research may be integrated with this program.

**Recommendation 7:**
BARC should establish an inter-institutional team of experts to develop an institutional framework and operational modalities for commencing eco-regional on-farm research as an integral part of the planning, budgeting and approval process of research to be financed under the CGP.

### 6.18 Access to New Sciences
Resolution of many problems related to biotic and abiotic constraints to higher productivity requires application of tools and techniques of new sciences such as biotechnology. However, a recent joint study undertaken by GOB, UNDP and FAO concluded that there are serious institutional, regulatory and investment constraints in realizing this potential. These weaknesses are now being addressed through an independent biotechnology project being financed by UNDP. In view of this, NARS should develop close linkages with this project to enhance the role of biotechnology in agricultural research and examine other actions needed to improve access and enhance capacity of NARS to utilize new sciences. The United States Government is also financing agricultural research related to biotechnology.

**Recommendation 8:**
BARC to constitute a committee of eminent scientists to develop an action plan to enhance access to and capacity to utilize biotechnology and other new sciences, including bioinformatics and information and communication technology in agricultural research.

### (c) Institutional Development

6.19 To implement the institutional reform program related to autonomy and governance of NARS agreed with IDA under ARMP, GOB passed a new Act for the NARS in May 1996. However, this Act failed to provide full autonomy to BARC and ARIs needed for more efficient operations and to establish a unitary agricultural research system with unified service rules and regulations. More recently, in an ECNEC meeting held on 10 September 2003, issues related to strengthening of NARS were discussed once again and it was agreed, in principle, that steps should be taken to develop a unified service for agricultural research institutions, including BARC. Therefore, the proposed institutional reform agenda for BARC and ARIs addresses issues related to the governance of NARS, including mandate of BARC, ensuring good leadership, rationalization of mandates of the research institutes; and a strategy for human resource development.

6.20 Governance of NARS and mandate of the apex body. In view of the gaps left by the 1996 Act in providing autonomy and flexibility in governance of the NARS and strengthening of BARC's mandate (Annex 1), the Bank with help from BARC, organized several consultation workshops in 2004 and 2005 with the key stakeholders in Bangladesh where different mechanisms for achieving greater autonomy and flexibility in governance of NARS and the role of BARC were considered. Other important issues discussed during these consultations included the need to promote pluralistic institutional structure, sustainability of funding and promotion of results-oriented and client-responsive institutional culture. Following consideration of a number of different approaches, three options (Option A, Option B and Option C) have been highlighted for further discussions with the government. These options are briefly summarized below. Detailed information is included in Annex 8.

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Option A (Figure A 8.1)

6.21 Establishment of the Bangladesh Agricultural Research Foundation (BARF). Under this option, BARC would be restructured into an autonomous agency under the Companies Act as a ‘not-for-profit’ Association to be known as the Bangladesh Agricultural Research Foundation (BARF). The BARC Act 1996, currently in force, would be abolished in due course, but is not a prerequisite for the establishment of BARF. The mandate of BARF would focus on: prioritization, resource allocation and monitoring and evaluation of all agricultural research undertaken by the NARS partners. It would have capacity for development of agricultural technology policy and socio-economic research. It would maintain an oversight on the skill needs of NARS and help with human resource development, including liaison with national, regional and international agricultural research organizations/institutes.

6.22 In addition, BARF would have the responsibility for managing the CGP with full independence and transparency. Funds for CGP would come from an income stream generated by a dedicated endowment Trust Fund. Funding provided to TF would be held in a ‘basket’ of hard currencies to hedge against depreciation and would be managed by an independent professional fund manager. Trustees of TF would be appointed in consultation with GOB. Many countries, especially in the industrialized world, e.g. USA, Sweden, use endowment funds as an attractive and efficient mechanism to finance research. This mechanism provides sustainable institutional development and stable funding to plan and execute research.

6.23 To strengthen the coordination function of BARF, it is recommended that GOB should allocate the research budget to ARIs following review and appraisal of annual work plans by BARF. This would cover strategic issues of public goods nature requiring medium to long-term research.

6.24 Governance. The organizational structure of BARF would have a Governing Board (GB), an Executive Council (EC) and a Secretariat. Establishment of BARF would provide its GB full autonomy and authority needed to guide and strengthen NARS and to prepare its own laws and by-laws, e.g. to develop uniform service rules for the NARS, including selection and promotion criterion for scientific and administrative staff, review of mandates and organizational structure of ARIs. The GB would have representation from all the stakeholders (government, ARIs, Universities, NGOs, the private sector and farmers), with a majority composed of non-officials. EC, with its membership largely drawn from the agricultural research community, would be responsible for implementing decisions taken by the GB and link BARF to all ARIs and maintain the integrity of the NARS.

6.25 The Secretariat would manage the day-to-day business of the Foundation. The mandate of BARC Secretariat under this option would require a thorough review of the size, composition and qualifications of the staff. In particular, it would need to strengthen its capacity in social sciences for policy as well as socio-economic work and to analyze and evaluate existing and/or new research programs/proposals for their relative priority in the context of the overall national research strategy and available resources. All technical and general establishment positions needed for BARF would be assigned from BARC and funded by GOB under the revenue budget.

Option B (Figure A 8.2)

6.26 Under this option GOB/MOA/MOFL/MOEF would need to amend the BARC Act 1996 and other Ordinances/Acts governing individual institutes to give greater autonomy to BARC as the apex body of NARS. Reforms sought in the governance, mandate, and funding of BARC would be similar to that described above under Option A. The key difference, however, would be in separation of the CGP governance and management under a new body, the Bangladesh Agricultural Research Foundation (BARF), with its own Governing Board (GB).
6.27 As in Option A, under this option also the Governing Board (GB) of ‘new’ BARC would be an autonomous body with authority to formulate service and business rules and other functions in relation to the NARS described under Option A. Its membership would be amended to have increased representation of non-government members. Composition and role of the EC would be unchanged. However, the EC would have an additional function of liaising with the BARF management in ensuring that the overall national research priorities are reflected in the projects financed under the CGP.

6.28 The ‘new’ BARC Secretariat would be smaller in size and its mandate would be revised to give greater focus to its role in research coordination, prioritization, and allocation of resources to agreed priorities and monitoring and evaluation of all research. To strengthen its research coordination function, the NARS research budget (excluding salaries) would be allocated based on its recommendations to finance strategic public goods research on agreed priorities. The capacity of its Secretariat to help ARIs to develop annual work plans and to undertake socio-economic and policy analysis on issues of importance to agricultural sector/research would be strengthened.

6.29 The main function of the newly established Bangladesh Agriculture Research Foundation (BARF) under this option would be to manage the CGP. As a Foundation it would have its own Governing Board (GB), operating independently of the BARC GB to ensure autonomy and transparency in running of the CGP. The GB would have representation from GOB, BARC, the private sector, NGOs and the scientific community. This would ensure accountability both to the government as well as to other stakeholders. BARF would be incorporated under the Companies Act, 1913 (as amended by Companies Act, 1994) as a not-for-profit association. In practice, therefore, it would operate like other independent foundations in Bangladesh e.g. the Palli Karma-Sahayak Foundation (PKSF). The key management positions of BARF would be filled through open competition. However, some of the positions needed to administer the CGP would be transferred from the BARC Secretariat. Experience of many countries that have adopted CGPs, e.g. Brazil, Ecuador, Chile, shows that independent governance, typically involving an apex council or a board with strong private sector and non-governmental participation, is critical to integrity of a CGP. At the same time, sound management structure and efficient day-to-day operation of the program requires a Secretariat with financial management powers and an appropriate level of technical expertise.

6.30 Funding for the CGP would come from an income stream generated by an endowment Trust Fund (TF) to be established by GOB and its development partners, which may also receive funds from other sources, including the private sector. Other arrangements for the management of the Trust Fund would be similar to those described under Option A.

Option C (Figure A 8.3)

6.31 As in Option B, under this option also the Government would need to amend the BARC Act 1996 and other Ordinances/Acts governing individual institutes to give greater autonomy to BARC as the apex body of NARS. As with other options, the membership of the GB would be reviewed to ensure increased representation of non-government members and have greater autonomy and authority to formulate uniform service and business rules for the ARIs and BARC. The role of EC would be similar to that described under Option B. Similarly, the restructured Secretariat would focus on the main functions of the ‘new’ BARC related to research coordination, prioritization, allocation of resources to agreed priorities and M&E of research. Its capacity to undertake policy analysis on issues of importance to agricultural research would be strengthened. It would help ARIs in planning of annual research work plans. As under Option B, the NARS research budget (excluding salaries) would be allocated based on recommendations of the ‘new’ BARC to finance annual work plans of ARIs covering long-term peer reviewed strategic public goods research.

6.32 As in Option B, the Bangladesh Agriculture Research Foundation (BARF), would need to be established to manage the CGP. However, unlike Option B, it would operate under the overall policy guidance of GB of the ‘new’ BARC. BARF would have its own Management Board (MB) and a Chief Executive and three or
four members of the MB representing interests of the private sector, NGOs, scientific community and farmers. BARF would discuss and agree on priorities for funding for each round of CGP funding. Thereafter, BARF would manage the CGP with independence and transparency. Like the Option B, the management positions would be filled through open competition. Other staff needed to run the CGP on a day-to-day basis would be transferred from the BARC Secretariat. Other arrangements for management and funding of the CGP, including establishment of a Trust Fund would be similar to those described under Option B.

**Recommendation 9:**

GOB should:

a. Restructure governance of NARS, including membership of the Governing Board of its apex body, based on one of the three options discussed above and redefine the mandate of BARC as a coordinating and funding agency;

b. Empower the Governing Body to: (i) establish uniform service and business rules of the NARS; and (ii) harmonize governance of NARS under one Act to facilitate research coordination, allocation or resources, and implementation of the uniform service rules and business rules; and

c. Enable MOA, MOFL and MOEF, on recommendation of the Governing Body of the apex body, to channel the NARS research budget (excluding salaries) to ARIs to finance peer reviewed research programs on agreed priorities on strategic public goods research.

6.33 **Ensuring good leadership.** Performance-oriented management style and autonomy in personnel matters have profound influence on the performance of organizations. Accordingly, selection of individuals with management abilities and leadership skills, identified through an open merit-based recruitment process, is the most important element of a productive and effective research organization. Under the 1996 Act, CEOs and Member Directors of BARC, as well as Director General and Directors of ARIs, are appointed by GOB. This process should be amended as outlined in the recommendations below since the current arrangement is not consistent with the best international experience for ensuring good leadership.

**Recommendation 10:**

GOB should:

a. Appoint CEO, BARC and Director General, ARIs based on a short-lists prepared by independent and qualified search committees; and

b. Establish an independent Agricultural Services Recruitment Board for appointment of scientists up to the level of Directors in the NARS through merit based open competition.

6.34 **Rationalization of the agricultural research institutes.** Over the years, GOB has made large investment in expanding research infrastructure, including establishment of a network of stations and sub-stations, to provide coverage of all the agro-ecological situations. As there has been weak coordination among ARIs, this has resulted in duplication of facilities and repetitive research. In a period of shrinking financial resources, changes in research requirements and emergence of other agencies (e.g. NGOs, the private sector) as participants in agricultural research, many stations/sub-stations of ARIs are poorly utilized and maintained. Under the institutional reform program of ARMP, this issue was considered but no action was taken to rationalize ARI research facilities and for sharing of field station facilities and resources. Due to the on-going funding constraints and further deterioration of many of these sites, it is now necessary to implement an action plan to rationalize the agricultural research institutes/stations/sub-stations in order to improve system efficiency.
Recommmendation 11:
BARC should appoint an independent multi-disciplinary panel to:

a. Review current mandates of ARIs and make recommendations to meet emerging needs and to correct overlaps and duplications;

b. Assess staffing and skill-mix needs of different ARIs in the context of their revised mandates; and

c. Review the current status and usefulness of the network of stations and sub-stations to develop and implement an action plan for rationalization through consolidation and/or closure of redundant facilities.

6.35 **Pay greater attention to human resource management to improve scientific incentive and arrest deterioration of skill base.** The focus of past investments has been on project related skill enhancement with little attention to other working conditions that impact on overall incentives, including selection, promotion, evaluation and reward systems. As highlighted above in discussion related to institutional autonomy, this requires a change in service rules and regulations. In addition, it would also be necessary for BARC and ARIs to move from a focus on training alone to a more holistic human resource management approach to motivate staff and to stop continued loss of trained manpower.

Recommendation 12:
BARC and each ARI should prepare a human resource management plan for recruitment, improvement and retention of qualified staff and allocate increased resources for its implementation

(d) Need for Action

6.36 NARS faces a number of critical challenges, especially those related to institutional and management reforms as well as funding. The recommendations given above are aimed at addressing issues related to these constraints. Some recommendations highlighted in the reform agenda are not new but lack of action by GOB is seriously impacting on the efficiency and effectiveness of NARS. While in the future, other research service providers may emerge, such as the private sector, a strong and productive network of public agricultural research institutions would still be required to play a critical role in serving the Bangladeshi farmers, who are very small and constitute the majority of the rural poor; to safeguard the nation’s natural resource base and the environment; and to keep pace with global changes. GOB must act now to provide the enabling policies and adequate funding to ensure sustained progress. At the same time, the agricultural research system must change its own institutional culture by developing a demand-based research agenda, making more effective use of available human and financial resources and linking funding, incentives and rewards to performance.

B. Needed Reforms for Agricultural Extension

6.37 The reform issues for improving the cost-effectiveness and efficiency of the agriculture extension system relate to: (i) funding; (ii) management; and (iii) institutional structure.

(a) Funding Issues

6.38 **Improving cost-effectiveness of the public expenditure.** Attainment of greater financial sustainability of the agricultural extension service needs to be a key consideration in planning of future reforms. It is not only necessary to look for increased funding but also to improve effectiveness of the public expenditure. DAE, for example, allocates over 90% of annual revenue budget to cover staff salaries. Operational funds for extension under the development budget are largely provided by externally funded projects being implemented by DAE where extension activities serve specific objectives of individual
projects. Since most of these projects cover a small area in different parts of the country and many are discipline/activity specific, e.g. crop protection, soil fertility and fertilizer use, diversification, construction of small dams etc., very few farmers receive holistic support from the extension service, thus considerably reducing the overall effectiveness of a large expenditure on staff costs. The situation in other line departments (DOF and DLS) is somewhat similar. The first priority for the line departments to improve cost-effectiveness of public expenditure, therefore, is to increase allocations to cover operational costs of the service, including training needs related to human resource development. At the same time, to safeguard against shortfalls in funding for implementation of extension activities due to erratic releases of funds by the government, there is a need to decentralize funding and management decisions. It is proposed that a Upazilla Extension Fund be established with a permanent advance equivalent to 12 months of estimated operational expenditure of decentralized Upazilla extension plans through contributions from the line department extension budgets.

**Recommendation 1:**
MOA and MOFL should:

- Change composition of public expenditure so that a minimum of 30% of the total GOB contribution to the revenue and development budgets is allocated to cover operational costs of the extension service; and

- Establish a Upazilla Extension Fund with a permanent advance equivalent to 12 months of estimated operational expenditure of Upazilla extension plans based on contributions from extension budgets of DAE, DOF and DLS.

6.39 **Diversifying sources of funding and enhancing financial sustainability.** In the long-run complete reliance on the government alone would not ensure sustainable funding to cover all extension needs of farmers. Entry of other extension service providers create opportunities for reducing financial burden on GOB. Provision of extension service by the private sector and NGOs under contract farming, which makes little or no demand on the public service, is one such example which should be pursued vigorously. In addition, empowerment of producers and their organizations through the decentralization process to share responsibilities for planning, implementation and monitoring of extension services would provide a mechanism for cost sharing with producers. At the same time, line departments should examine options for contracting out extension service to other service providers, especially NGOs and farmer groups and their organizations, to improve sustainability through efficiency gains. For example, contracting out could help line departments to hold down staff numbers, improve relevance of extension work and bring greater accountability to clients.

**Recommendation 2:**
MOA and MOFL should:

- Reduce cost of extension service by sharing responsibility for planning, implementation and monitoring of extension with the producer groups and their organizations.

- Increase private funding by facilitating provision of extension services as an integral part of an expanding contract farming system; and

- Reduce staff numbers and/or intensity of public service in areas covered by the private service providers.

(b) **Management Issues**

6.40 **Improving relevance and location specificity of extension interventions.** A good understanding of agro-ecological as well as socio-economic circumstances of farmers is essential in developing relevant extension interventions. Such an understanding would enable the service to improve categorization of potential clients and targeting of the poor. To achieve this goal, it is important for the
extension service to adopt farmer participatory planning and implementation of extension activities as a standard practice. At the same time, adoption of similar approach by the research service would improve availability of relevant technologies. Funding of short-term downstream research to refine recommended technologies would enhance location specificity and is a low-cost method of enhancing relevance, farmer adoption and impact of agricultural extension.

**Recommendation 3:**

DAE, DLS, DOF should:

a. Mainstream farmer participatory planning, implementation and monitoring of extension activities; and

b. Where necessary, fund on-farm validation and refinement of extension interventions based on agro-ecological and socio-economic circumstances of the farming communities to ensure location specificity.

6.41 **Mainstreaming innovations already pilot tested.** Over the years, mostly under the Bank/DFID financed ASSP and ASIRP, Bangladesh has tried a number of different extension methodologies to enhance the impact of extension on agricultural production and farm productivity. These have included:

- Extension partnership at the Upazilla/Union levels by either strengthening of Upazilla Agriculture Extension Coordinating Committee (UAEC) or using the ‘Resource Center Model’ involving the establishment of Farmer Information and Advice Centers.

- The Farmer-Led Extension Model involving group approach to extension and facilitated by an NGO that combined technology demonstrations and micro-credit activities with a potential to make an impact on broader livelihoods issues.

- Integrated Extension Approaches, an initiative of DAE, to promote cooperation between different ESPs, especially other line departments of GOB (DLS and DOF).

- Farmers Field School model, tried mainly for the promotion of Integrated Pest Management (IPM) practices but with potential for broader application.

- Group-based micro-credit program to finance and improve agricultural and other self-employment activities, especially by poor women.

6.42 In practice, no single model emerged to be appropriate in all situations and there were some unanswered questions about the sustainability and replicability of some approaches over a large area. For example, the rainfed and irrigated production systems have different extension requirements. Despite these reservations, however, a review of these pilot experiments suggests that decentralization to allow local planning and budgeting of extension can bring a number of benefits in terms of improved farmer contact, relevance and ownership. These conclusions are consistent with findings of a recent review of international experience undertaken by Anderson and Feder (2004), which showed that, while each situation calls for a locally adapted extension method, significant efficiency gains can come from locally decentralized delivery and incentive structure that is based largely on private provision but, in many situations, requiring public funding. In view of this, it is important to combine lessons from different models tested in Bangladesh to improve effectiveness of the service. The scope of extension service needs to be broadened to cover all categories of farmers by adopting a decentralized partnership approach, involving both the public and the private service providers.

**Recommendation 4:**

DAE, jointly with other line departments (DOF and DLS) should:
a. Mainstream the community-led decentralized extension partnership approach through the Upazilla Agricultural Extension Coordination Committees (UAECCs) to cover all categories of farmers, using guidelines of the model tested under ASIRP;

b. Integrate UAECC as an integral part of a decentralized extension institutional structure; and

c. Strengthen and expand membership of the UAECC to include representatives of all stakeholders, including marketing and credit institutions.

6.43 Improving research-extension-farmer linkages. Adoption of farmer participatory approach by the research and extension systems would considerably improve linkages between these two public services and with farmers. At the same time, introduction of priority setting for extension as well as production systems research programs by joint teams of ARI scientists and extension staff would further help to improve understanding of farmer’s constraints and improve targeting under both the programs.

Recommendation 5:
MoA and MOFL to ensure involvement by the ARI scientists in participatory micro-level priority setting and planning of extension programs at the Upazilla/Union levels and identification of technology options for different categories of farmers.

6.44 Increasing the role of private sector through expansion of contract farming. There are several constraints to greater involvement of the private sector in expanding contract farming which can be addressed by the extension service in partnership with other institutions with relevant expertise. For example, by working closely with ARIs and the agro-processors, the extension service can help to identify priority areas for market-oriented research to select appropriate crops/varieties and agronomic practices for the high value crops and other agricultural commodities which has been identified as a gap by agro-processors. Research and development work on some of these priorities could be financed through the CGP. Development of equitable contractual arrangements, identification of potential markets, establishment of linkages with potential buyers and capacity building are other areas where farmers wishing to participate in contract farming can be helped by the extension service. However, in providing this assistance to farmers, the extension service would also need to work with an agency which has experience of working with the private sector and in promoting contract farming, e.g. Hortex.

Recommendation 6:
In cooperation with specialized organizations such as Hortex, DAE, DLS and DOF should facilitate expansion of the private sector-led contract farming by:

a. Building capacity of commodity-based producers’ groups through training and knowledge transfer to improve farming practices and negotiating skills with the purchasing organizations;

b. Developing ‘best practice’ models for contract farming, including transparent and equitable contractual agreements;

c. Promoting vertical integration of the production-post-harvest handling-marketing-processing chain through the private sector investments; and

d. Involving ARIs and the private sector to ensure availability of suitable crops/varieties and production systems recommendations for producing high value crops.

(c) Institutional Issues

6.45 Strengthening of decentralized pluralistic institutional structure of extension service providers. Increasing deregulation and diversification of agriculture has attracted the private sector and some large
NGOs to start providing agricultural extension services to farmers, especially those engaged in commercial agriculture. The new extension service providers are working with a different client base and have brought about changes in the nature and approach to extension delivery. Continued expansion of their operations would strengthen the pluralistic structure of the national extension system. In view of these developments and taking into account the NAEP and AEP principles, the conceptual organizational structure of a decentralized extension service is given in Figure 6.1. The key elements of the institutional reforms included in this proposal are:

- **Decentralization of planning, budgeting and coordination** responsibility by the line departments (DAE, DOF, DLS) to Upazilla Agriculture Extension Coordination Committee (UAECC) with representation from all the key stakeholders (line departments, NGOs, the private sector, farmers’ organizations) to approve and fund demand-led micro-plans of farmer groups. Plans to be prepared using participatory approaches by Union level teams involving farmer resource persons identified by the farmer groups, line department staff and/or NGOs. The research system would provide technical support to both UAECC and the teams developing Union-level micro-plans. Funds to implement these plans would come from the Upazilla Extension Fund.

- **Institutional mechanism for inter-agency coordination/collaboration** to broaden the scope and coverage of extension. Formation of multi-disciplinary teams of staff drawn from different line departments and other relevant agencies at Upazilla level to provide broad-based technical, marketing and financial advice/facilitation to farmer groups and their organizations. District-level staff to train and supervise extension service providers and monitor overall progress of the Upazilla-led program.

- **Capacity building and formation of Producers’ Organizations** to share responsibility for planning, implementation and monitoring of extension activities at the Union level.

- **Support for participation by other service providers, such as NGOs and the public and the private agribusiness enterprises through contracting out on-farm service delivery and promotion of contract farming**

- **Involvement of ARIs at an early stage in the planning process of extension program and for technical back-stopping of the extension staff and other professionals at the Zilla, Upazilla and Union levels.**

- **Oversight, inter-agency policy coordination and guidance by the National Agricultural Extension Coordination Committee** with representation from all the stakeholders

**Recommendation 7:**

MOA and MOFL should:

- Support decentralized partnerships involving the public agencies, NGOs, the private sector and farmers’ organizations as providers of broad-based extension service;

- Develop a new national livestock extension policy;

- Delegate planning, funding and coordination responsibility to Upazilla Agricultural Extension Coordination Committee (UAECC);

- Work with existing and new farmers groups and federate them into Producers’ Organizations at the Union, Upazilla and Zilla levels (including federations) and build their capacity to share responsibility for planning, implementation and monitoring of extension activities.
Figure 6.1: An Approach to Revitalize the National Agricultural Extension System

- **Village**:
  - Community Groups
  - SHGs
  - Affinity Groups

- **Union Parishad**:
  - Farmers Resource Group
    - Water Mgt
    - Fisheries
    - Livestock
    - Horticulture
    - Forestry
    - IPM
    - Seed
    - Agronomy
    - Marketing
    - IG Technologist
  - NGOs
  - Other service providers

- **Upazilla**:
  - UAEC
    - Line Dept. Staff
    - Other Partners
  - ZAECC
    - Line Dept. Staff
    - Other partners

- **National**:
  - Private Sector
    - DAE
    - DLS
    - DOF
    - FD
    - NGO
    - NARS

- **Key Roles**:
  - Funding
  - Policy Guidance and Oversight
  - M&E
  - Oversight on Upazilla Staff
  - Training of ESPs
  - Training of Trainers
  - New research information
  - Specialist Support and studies
  - Participation in farmer need identification with extension

- **Support Functions**:
  - Day to day technical support
  - On-farm training
  - Conducting of demonstrations
  - Planning of village plan
  - Technical support to farmers through FFS Team
  - On-demand technical advice from office
  - Support for on-farm demonstrations
  - Help with preparation of need-based proposals by groups/villages
  - Market intelligence demonstrations
  - Facilitation of linkages with other services as credit inputs
  - Collation of Upazilla Plan and review
  - Funding of Upazilla Plan
  - Training of FRG/Para Technicians
  - Data Collection & Reporting
  - Funding of proposals from groups/FRG
  - M&E
  - Identification of location specific technological packages.
  - On-going technical trouble shooting / on-farm validation trials.
  - Identification of researchable issues (jointly with research)
  - Preparation of district strategic plan
  - M&E

The diagram illustrates the collaborative approach to revitalizing the national agricultural extension system, involving various stakeholders from the village to the national level, with specific roles and responsibilities outlined for each tier.
Enhancing organizational efficiency of the line departments. As recognized by the second Strategic Plan, implementation of principles embodied in the NAEP requires a change in DAE’s organizational structure and the business processes. The initial steps to introduce NAEP related changes were commenced towards the end of ASSP and further supported under ASIRP. DAE has recognized the need for the change process to continue and have included a number of actions in the second Strategic Plan to improve efficiency. However, the recommended actions do not go far enough to allow development of a decentralized, pluralistic, partnership approach to agricultural extension, as has been recommended above. To achieve this, DAE would need to delegate more responsibilities and budgetary control to the Upazilla/Union level organizations. Somewhat similar recommendations for policy and institutional reforms, particularly of DLS, were made by a recent report that reviewed growth potential of the livestock sector in Bangladesh (GOB ((MOFL)/FAO, 2005). Under the FFP, DOF is examining its organizational structure and roles and responsibilities to make them much more participatory and demand-driven.

The continued entry of other service providers would require the line departments (DAE, DLS and DOF) to pay greater attention to facilitating and coordinating extension work and encouraging collaboration between different stakeholders. This would allow the line departments to adjust organizational structure and core functions of different units, and focus extension work to serving the priority needs of the small and marginal farmers. In many cases this may require contracting out services to NGOs and/or empowered farmers’ organizations. To maintain consistency in extension approaches and to improve coordination of extension activities being financed from different sources, a program-based approach to planning and budgeting would be needed.

Recommendation 8:
To enhance the organizational efficiency of DAE, DLS and DOF and to provide a pro-poor extension service, MOA and MOFL should:

a. Re-define mandate of line departments to accelerate development of a pluralistic institutional structure of extension service providers;

b. Develop a new national livestock extension policy;

c. Reposition staff to provide better coverage of poor Upazillas;

d. Rationalize and define core functions of various divisions/units of departments in line with the new mandate; and

e. Move from a project-based to a program-based planning and budgeting system to avoid duplication, maintain consistency in extension methodologies and promote coordination of funding from different sources.

Expanding scope and coverage of extension service. The key to changing the scope and coverage of extension services is to strengthen the emerging pluralistic institutional structure recommended above. This would increase direct contact with farmers and allow a better service to all categories of farmers, especially the poor, including women. Since farmers often face constraints in obtaining appropriate inputs in a timely manner, in marketing their produce and in accessing credit, facilitation of linkages with appropriate agencies would be important in addressing these constraints.

Recommendation 9:
DAE, DLS, DOF should:

Promote linkages of farmers with appropriate public and private input supply companies, financial institutions and marketing agencies to facilitate access to critical inputs, credit, markets and marketing information.
6.49 **Give higher priority and allocate more funds to human resource management.** The second Strategic Plan emphasizes the importance of enhancing knowledge and skills of DAE’s professional staff in the context of NAEP and the changing role of public extension. Similar observations have been made in policy documents and internal reviews undertaken by DLS and DOF. Three is a need to move away from training alone to a more holistic human resource management approach that links performance with reward and motivation of staff. While a move to such an approach is important, its implementation should not neglect the need for up-to-date technical skills of field staff of the line departments based on a systematic assessment of the current needs. To deliver the training programs, the line departments should forge new partnerships with other agencies with relevant expertise, including agricultural universities and NGOs, instead of completely relying on in-house training facilities. At the same time, greater autonomy, along with changes in the governance as well as organizational arrangements of in-house facilities, would strengthen their ability to meet the changing training needs of staff and other stakeholders.

**Recommendation 10:**

DAE, DLS, DOF should:

a. Assess skill gaps of field staff to support a decentralized farmer participatory extension service and implement a training program to meet the current needs;

b. Adopt a more holistic approach to human resource management for recruitment, utilization, improvement and retention of qualified staff; and

c. Examine opportunities for developing strategic partnerships with other educational organizations, e.g. agricultural universities and NGOs, to strengthen the in-house training facilities.

(d) **Need for Action**

6.50 The existing national agricultural extension system faces a number of challenges to adequately and efficiently serve the changing needs of the farming communities. The recommendations outlined above are designed to address some of these challenges. The emphasis is on establishing a decentralized system in which farming communities, NGOs and the private sector play an increasingly important role in planning, implementation and monitoring of the extension service. Government needs to consider and implement these recommendations on a priority basis so that the extension system is able to serve farmers more efficiently in increasing agricultural productivity and farm income.

**C. Supporting High Value Agriculture**

6.51 A recently completed study of the rural non-farm sector in Bangladesh has shown that the growth in rural income, since the late 1980s, was largely due to the increasing non-food crop production, high value agriculture and marketing activities (World Bank 2004). The fastest growing economic activities were business and trade, followed by non-rice agricultural crops, primarily horticultural crops and shrimp farming. Impressive increases in productivity of cereals, especially rice, due to use of improved technologies, access to irrigation and limited farm mechanization, have made it possible for farmers to allocate some of their land and financial resources to the production of high value commodities such as shrimps, poultry, vegetables and fruits. During this period, Bangladesh has also seen improvements in communications, both roads and telecommunications. Cellular phones are now available in most rural areas and are increasingly used by all sections of communities which helps with information flow on subjects of importance to the rural communities. Combined impact of these changes has resulted in growing commercialization of agriculture with a potential to increase farm incomes. For example, farmers entering into vegetable production market 96% of their production for cash as compared to only 19% of cereal production (Weinburger and Genova (2005).
Recent information reported by the World Bank in the agriculture and rural development strategy shows that within food sector, the market for non-cereal commodities is strong. For example, fruits, fisheries and livestock products are claiming a larger part of the incremental income, especially of people moving to urban areas. In response to increasing demand, the cropped area under spices, vegetables, potatoes, and fruits has increased and, if this trend continues, the growth in supply of non-cereal food items would need to be much higher in the future to meet the demand. Work undertaken by Ali and Hau (2001) in Bangladesh has shown that entry into horticultural crops provides higher income to smallholders and increases demand for labor, thus creating employment opportunities for landless laborers in the rural areas. These developments are now attracting private investment in value addition through agro-processing of agricultural commodities both for the domestic and export markets. Hortex, a semi-autonomous publicly funded agency, has played a catalytic role in promoting increased cultivation, processing and export of horticultural crops from Bangladesh (see Annex 3 for more information on Hortex). Commercial experience with high value agriculture (HVA) using exports of French green beans and shrimps from Bangladesh is summarized in Annex 4.

While there is considerable potential for further growth, a number of constraints must be addressed to fully exploit the potential of high value agriculture. Some of these constraints can be directly addressed by the technology system and are the focus of attention here. These include:

- **Greater investment in research and extension in support of HVA.** In view of low productivity and absence of suitable technologies greater allocation of resources to bridge these gaps should be a high priority for the research and extension systems.

- **Promotion of contract farming.** To ensure that farmers practicing HVA have access to assured markets, timely credit, inputs and technical support, considerable attention should be given to promotion of contract farming involving the public and the private sectors, and NGOs. An early assessment of the current situation in Bangladesh, discussed in Annex 5, has highlighted the need for development of broad guidelines for transparent contractual arrangements, strong emphasis on capacity building, provision of good quality inputs and technical support.

- **Capacity building of research scientists and extension functionaries to support HVA.** As the focus of attention in the public research and extension institutions has traditionally been on the food crops, they lack necessary skills and knowledge to address needs of HVA. It would be necessary, therefore, to build capacity of the technology system to respond to the changing needs of the agricultural sector.

- **Building social capital of farming communities.** Given the level and status of participation in HVA by small and marginal farmers, support for building of social capital through formation and empowerment of producers organizations is essential to gain access to markets, improve responsiveness of the public institutions and to encourage poor and marginal farmers to enter HVA and participate in setting of development agenda that meets their priority needs/goals. Empowerment of farming communities would also strengthen their ability to negotiate more balanced social, financial and economic relationships with other more powerful members of the society, including the private sector.

- **Strengthening of regulations and their implementation governing HVA.** Technical assistance is needed to develop appropriate food safety and quality standards that are consistent with the international sanitary and phyto-sanitary requirements, including biosafety related to genetically modified organisms (GMOs). These standards meet requirements of the export markets and improve the situation at home. Concurrently, it would be necessary to build capacity
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of all stakeholders and enhance awareness of the need for better enforcement of safety, quality and environmental regulations. The existing Bangladesh Standards and Testing Institute (BSTI) needs substantial upgrading and strengthening to assure food safety and quality that is consistent with international standards.

- **Establishment of effective system for collection and distribution of market information.** Timely availability of relevant market information is a constant problem for farmers. Removal of this constraint would help farmers to market their produce at better prices. Among others, this will require substantial strengthening of the Department of Agricultural Marketing (DAM) under the Ministry of Agriculture as well as Bangladesh Bureau of Statistics (BSS).

6.54 There are a number of other constraints which are not directly under the control of the technology system. Here the attempt would be to influence or to facilitate a change in government policy and/or the private investment, e.g. lack of infrastructure, marketing and processing facilities for agro-food systems, tariff and tax anomalies. For example, a targeted policy analysis and/or socio-economic research may be able to suggest priorities for investment in improved transport infrastructure, market infrastructure, delivery of finance and provision of legal and regulatory framework (property and bankruptcy law, intellectual property rights, licensing law, company and cooperative law) to facilitate private investment. Support for a business development facility, e.g. Hortex, to facilitate backward and forward linkages can be of help to small rural entrepreneurs to increase investment in agro-processing, in developing reliable food quality and safety assurance system and in identifying suitable post-harvest technologies for value addition.

**Recommendation 1:**

MOA and MOFL, along with BARC and ARIs, should:

a. Re-assess the role of the public technology system in supporting HVA and focus resources on priorities that are likely to benefit small and marginal farmers from the expanding market for high value agricultural commodities;

b. Develop an action plan to acquire suitable skills to support research on high value commodities;

c. Develop a regulatory framework for an effective system of food quality and safety assurance, including biosafety of GMOs and phyto-sanitary requirements of the export markets;

d. Facilitate development of legal and regulatory framework to facilitate private investment in agro-processing; and

e. Promote appropriate partnerships with the private sector to develop suitable system for the collection and distribution of market intelligence to help producers and entrepreneurs.
Chapter 7: Strategy for Implementing the Reforms

7.1 A key element of the strategy for implementing the recommended reforms outlined in Chapter 6 would be to continue to build a consensus and ownership by the key stakeholders. Since generation, transfer and adoption of new technologies and/or improvements in farm management practices require close collaboration and mutually supportive efforts of research and extension, it is important that the reform of both the services is initiated simultaneously. Support of MOA and MOFL would be crucial for success of the reform program as they are the key stakeholders in both the research and extension services. In discussions with the Bank, the Minister of Agriculture has shown willingness to provide the leadership needed to internalize and manage the reform process in collaboration with his counterparts in MOFL and MOEF. Other players, whose support would be critical in managing the reform process, include the Secretaries of the three concerned ministries (MOA, MOFL and MOEF) as well as the Ministry of Finance, CEO of BARC, and the Director Generals of ARIs. Oversight and support from PM’s office would ensure that the change process is not stalled by inter-institutional disagreements.

A. Sequencing the Reform Agenda

7.2 The stakeholder consultations undertaken during preparation of this report have indicated acceptance of a declining status of the technology system. However, this process also revealed differences about priorities. The scientific community sees issues related to the autonomy and governance of NARS, including coordination role of BARC, uniform service rules etc, as priorities. The view of the senior officials in the concerned ministries is that the first priority is for ARIs to solve problems constraining higher productivity to bridge the yield gap between what is possible and what is actually being achieved by farmers. Institutional reforms can follow later. It is also clear that the sector interests of key ministries (MOA, MOFL, and MOEF) come in the way of achieving a unitary system of research coordination and funding. In building a broad consensus, therefore, it would be important to develop an implementation plan that responds to different interests of the key stakeholders. Phasing of the reform agenda would be prudent in view of the past experience and scope and coverage of the proposed actions. However, as issues to be addressed are interrelated, there would be considerable overlap during implementation of different phases (priorities) of the reform agenda. In addition, in view of the critical importance and institutional complexity, the implementation strategy requires use of all lending and non-lending instruments available to the Bank.

B. Addressing the Funding Crisis

(a) Research Funding

7.3 There is a strong case for increased public investment as Bangladesh is under investing in agricultural research in comparison with other developing countries in a similar situation. At the same time, the country needs to address the instability of funding resulting from the dichotomy between the revenue budget that largely finances salaries and the development budget that largely finances operational costs but depends on externally financed development projects for support. Furthermore, erratic releases of funds by MOF make it very difficult for research institutions to implement the work program in a timely manner.

7.4 The proposal to establish an endowment Trust Fund to finance the CGP would help to sustain funding over the long-term and address some of the funding constraints impacting on the effectiveness of the system. In addition, independent management of CGP would help to strengthen pluralistic institutional structure and overcome issues related to inter-sectoral coordination in research. It would provide a mechanism for direct release of funds to researchers and, in time, diversify sources of funding by attracting
contributions from other stakeholders, including the private sector. The CGP would also have potential to enhance relevance, quality and accountability of research.

(b) Extension Funding

7.5 Some of the problems faced by the extension service are similar to that of the research services, e.g. dependence on project funds, erratic release of funds by MOF. An added constraint for the extension service is the allocation of over 90% of the revenue budget to pay salaries of a large work force. It is essential for the line departments (DAE, DOF and DLS) to allocate a greater proportion of available funds to operational costs of the service to improve effectiveness of the current public expenditure. This would require a review of staff numbers and/or intensity of public service in areas that can be covered by other service providers. At the same time, greater efforts would be needed to diversify sources of funding to enhance financial sustainability.

(c) Strategy for Addressing Issues Related to the Funding Reform.

7.6 As a part of the on-going reform program supported under the Development Support Credits (DSCs), GOB has agreed to a pilot program starting FY05/06 under which revenue and development budget would be combined into a single budget in four ministries, including MOA. Under the pilot program, MOF would transfer the combined approved budget to the participating ministries, who in turn would release combined funds to different implementing units. This would make it possible for MOA to allocate a greater proportion of available budget to cover operational costs. If successful, it is expected that, in time, GOB would move to a single budget system as a regular feature of financing government expenditures. Establishment of Trust Fund to provide an income stream to finance CGP may require the use of a quick disbursing lending instrument. Since a broad multi-sector reform agenda, including issues related to budget and finance, are being addressed under the on-going DSC program, it is desirable that recommendations related to the funding issues are included as a part of the reform agenda being discussed under the next phase of DSC or the new lending instruments, including DPL (Development Policy Loan) and PRSC (Poverty Reduction Strategy Credit). Further actions needed to reform the funding arrangements can continue under a future agriculture and rural sector operation to support the national agricultural technology system. However, to ensure continued political support for stable funding in the long-term, the technology system must demonstrate its responsiveness to policies and priorities of those who finance research and extension and to the changing needs of farmers.

C. Improving the Technology System Management

7.7 The second set of priority actions are aimed at making the research and extension programs more effective and relevant to the small and marginal farmers. Simultaneous reform of research and extension services, along the lines recommended in this report, would go a long way in ensuring that these services are better prepared and work more closely not only to exploit full potential of existing technologies but generate a steady flow of new technologies to address the emerging challenges of the agricultural sector.

(a) Exploiting Full Potential of Existing Technologies to Bridge the Yield Gaps

7.8 To prepare a more demand-driven research agenda a rigorous participatory priority setting mechanism is proposed which would involve all the stakeholders, including farmers. The proposed CGP would fund time-bound production systems research to fully exploit existing technologies. Joint operations between research and extension to validate and transfer appropriate technologies would respond to location specific needs of farmers. Concurrent strengthening of a decentralized extension service with an emphasis on empowerment of farming communities to participate in planning and implementation of the research and extension agenda should ensure benefit from a broad-based knowledge and information support on key
services (technical, credit, inputs, marketing) relevant to their farming operations. Combined impact of these actions would help to bridge the yield gaps.

(b) Benefiting from Advances in New Sciences

7.9 Since the basket of existing technologies can become empty relatively quickly and there is a time lag between commencement of research and availability of new technologies, it is important that the NARS is prepared to explore and support new opportunities. The ability of the research system to address new constraints depends on its ability to acquire new skills and capacity to benefit from rapidly advancing new sciences such as biotechnology (changes in genetic makeup of crops, animals and fishes) and information and communication technology (crop modeling, bioinformatics, geographic information systems). To develop this capacity, Bangladesh would need to forge stronger regional and/or international alliance with appropriate public and private organizations.

D. Making the Technology System Work More Efficiently

(a) Agricultural Research

7.10 Without national commitment to address the institutional problems of the technology system the country would not be able to make the best use of human and financial resources to accelerate the growth of a diversifying agriculture sector. The institutional reform agenda calls for greater autonomy, better governance, greater attention to human resource development and a more effective coordination and resource allocation mechanisms to improve efficiency of the system. Restructuring of the apex body and strengthening of its core activities would lead to better coordination of research and allocation of resources to public goods research. The proposed introduction of an independently managed CGP with sustainable funding to finance peer reviewed priority research activities from all sub-sectors would address the immediate needs of farmers with the help of scientific skills available both within and outside of the ARIs. This focus on applied and adaptive research would help to bridge the yield gap, the priorities identified by the ministries and help to build consensus for institutional reforms.

(b) Agricultural Extension

7.11 Since strengthening of a decentralized and pluralistic institutional structure is critical to the organizational efficiency of the extension service, institutional changes would need to be implemented simultaneously with other reforms discussed above. Since building capacity of farmers and their organizations to share responsibility for planning, implementation and monitoring of extension activities would take time, this work would need sustained support from the government. Continued support would also be required to enhance the caliber of extension service human resource with good grounding in technical information, understanding of market opportunities and an ability to utilize participatory approaches in planning and execution of extension programs.

E. Promoting High Value Agriculture

7.12 The growing demand for high value commodities offers opportunity to farmers to diversify production systems and to improve livelihoods. The proposed expansion of contract farming through the private agribusiness enterprises is aimed at tapping this growing potential.
F. Role of the Development Partners

(a) Investment Needs

7.13 The overall funding needed to implement the policy and institutional reforms is going to be relatively small. The main funding requirement would be for establishment of a sustainable mechanism for financing CGP through the Trust Fund and to bridge the gap in the government funding for the public goods research on strategic themes such as germplasm improvement, natural resource management, socio-economic research and economic and sector work. Funding would also be required to support an increased emphasis on human resource development, both through training of staff and development of strategic institutional partnerships with national and international centers of excellence. In addition, actions to improve access to new sciences, including greater use of information and communication technology and access to latest scientific literature would need to be financed to ensure that the system has capacity to effectively use tools and techniques based on new sciences to address both the existing and emerging problems.

(b) Role of the World Bank

7.14 As highlighted in the PRSP, the government is once again giving high priority to accelerating agricultural growth as an important component of its strategy for economic development and poverty reduction. In response to a request for support to agriculture and the rural sector from the government, the Bank has renewed dialogue with a number of agencies, especially MOA and MOFL. The Bank has also updated its strategy for agriculture and rural development. This work has highlighted several areas for possible Bank assistance, including revitalization of the agricultural technology system. The understanding of interplay between issues affecting the efficiency and effectiveness of the technology system and overall growth of the sector provides an opportunity to the Bank and GOB to agree on an agenda for reforming and strengthening the technology system through a combination of lending and non-lending activities.

7.15 The Bank has wide experience in helping governments to improve and reform their agricultural research and extension systems, including lessons learnt from the earlier projects in this area in Bangladesh. The Bank’s unique association with the Consultative Group for International Agricultural Research (CGIAR) system provides opportunities for supporting further strengthening of linkages with the international centers of the CGIAR and with the wider international scientific community.

7.16 In addition to the World Bank, other development partners have also been active in providing technical assistance and meeting financing needs of the agriculture sector in Bangladesh. Among others, this includes ADB, IFAD, EU, DFID, UNDP, FAO, USAID/USDA, JICA/JBIC and DANIDA. However, in the context of the PRSP, there is a need for these development partners to deepen and widen involvement in the agricultural sector, particularly in reforming and revitalizing the agricultural technology system. Government of Bangladesh may consider deepening its dialogue with the bilateral and multilateral development partners for them to consider pro-poor agricultural growth a priority in their allocation of resources as part of their country assistance strategies.
Annexes
Annex 1: Current Status of the National Agricultural Research System

1. NARS, as currently constituted in Bangladesh, includes an apex body the Bangladesh Agricultural Research Council (BARC) and ten Agricultural Research Institutes (ARIs). The Agricultural University and agricultural faculties of regular Universities, NGOs and the private sector also undertake some agricultural research but are not integrated with NARS. Similarly, the relatively new Bangladesh Sericulture Research and Training Institute (BSRTI) has also not been fully integrated with NARS. An assessment of the current status of NARS is, therefore, is limited to BARC and ARIs. This review covers crops, fisheries and livestock research institutes. Bangladesh Forest Research Institute, which is also part of NARS, has not been included.

A. Bangladesh Agricultural Research Council (BARC)

2. Under the Presidential Order No. 32, 1973, BARC was established to coordinate research undertaken by ARIs and other organizations in the country. Since then the BARC Ordinance has been amended three times, the latest being the BARC Act 1996. Under the revised Act, while BARC was given wider responsibilities (of human resource development, planning, priority setting, coordination, monitoring, review and evaluation of the research programs of ARIs), it also left a number of gaps which weakened BARC’s ability to perform these functions effectively. Key weaknesses of the 1996 Act included: (a) limited autonomy of the Governing Body, especially in the formulation of service and business rules for the system; (b) restriction on BARC to receive funds for the system directly from the Ministry of Finance and ability of ARIs to receive funds directly from their parent Ministries which limits the ability of BARC to prioritize and coordinate research; (c) lack of explicit provision for direct involvement of Universities, NGOs, CBOs and the private sector as important constituents of the NARS which inhibits development of a strong pluralistic institutional structure of NARS. Implications of these gaps are discussed below.

3. The organizational structure of BARC (Figure 3.2) consists of the Governing Body (GB), the Executive Council (EC) and the Secretariat. Chairman of GB is the Minister of Agriculture, with Ministers of Fisheries and Livestock, and Environment and Forests as Co-Chairs. Its other members include: members of parliament (2), civil servants (11 including Director Generals of Departments of Agriculture Extension, Livestock and Fisheries and Chief Conservator of Forests), Member (Agriculture) Planning Commission, Vice Chancellors of Agricultural Universities (2), senior scientists (3), representative of NGOs (1), the agricultural business community (1) and a farmer (1). Executive Chairman, BARC is a member and the Member-Director of Administration and Finance, BARC, acts as the Secretary of GB. To respond to changing needs of the agriculture sector and increasing participation by other organizations in agricultural research, e.g. Universities, NGOs and the private sector, the membership and functioning of GB needs a fresh look. In this context, it would be desirable to reduce the number of civil servants and increase representation of the non-government members.

4. Although, GB is the supreme authority of BARC, as discussed below, its role needs further clarity and definition. Under its present mandate it plays a limited role in influencing the direction of research as BARC has no control over allocation of research funds. It also lacks autonomy to establish service and financial rules for BARC or influence such decisions related to ARIs as they have their own Acts or Ordinances and their own governing boards.

(a) BARC EC

5. A 20-member EC consists of Executive Chairman and Member-Directors of BARC, Director-general and Directors of ARIs. Executive Chairman of BARC is the Chairman of EC. EC is responsible to GB and assists it in implementing its decisions and in various policy matters of BARC. There is need for EC
to play a more pro-active role in the planning, prioritization and resource allocation and in advising the Governing Body accordingly.

(b) **BARC Secretariat**

6. The BARC Secretariat is headed by the Executive Chairman. It has seven divisions headed by Member-Directors who help with priority setting, planning and review of progress of research programs. The current staff strength of BARC is 216, of which 42 are technical staff.

7. With its present organizational structure, weakening capacity, skill-mix of its senior staff, lack of control over the allocation of research resources and little operational funds, BARC is not effective in coordinating research or in influencing its overall direction, quality and relevance. It is also constrained by being an agency of MOA which is responsible for ARIs of three other ministries. On the positive side, it should be noted that under the World Bank-financed Agriculture Research Management Project (ARMP), when BARC had control over allocation of resources under some of the ARMP components and a stronger implementation capacity, it was relatively successful in carrying out its mandate of facilitating and coordinating research programs, especially of ARIs under MOA. However, after closure of ARMP the situation declined rapidly due to reduced funding for research by GOB and lack of control over allocation of resources, albeit under a much smaller budget. After the closure of ARMP, many of the senior staff left BARC due to lack of funding to finance salaries (as they were employed under development budget) and operational funds. BARC’s basic problem now is that the 1996 Act did not give it autonomy and authority over allocation of funds and to take independent decisions in financial, administrative and personnel matters without prior government approval. As a result, it has limited role in facilitating flow of funds from Government to ARIs, which remains the responsibility of ministries. As ARIs get their budgets approved by the parent ministries they can ignore BARC’s recommendations.

8. If the unfinished institutional reform agenda applicable to BARC agreed under ARMP is to move forward, the Government would need to amend the BARC Act 1996 and other Ordinances/Acts governing individual institutes to establish an autonomous GB and enable it to harmonize governance of NARS under one Act to facilitate stronger research coordination and establishment of uniform service and business rules for the national agricultural research system. In addition, BARC would need to play a more pro-active role in coordinating a unified research programs and budget proposals for the NARS, which after approval by the BARC GB/EC, can be presented to MOF by MOA, MOFL and MOEF for direct release of funds to ARIs.

9. Under the reformed mandate, BARC’s Secretariat would need to be restructured and downsized with a greater emphasis on its role in research coordination, including prioritization, planning, resource allocation, monitoring and evaluation. In addition, it would need to have greater capacity to undertake economic and sector work, including policy analysis, and promote socio-economic research in the NARS.

**B. National Agriculture Research Institutes (ARIs)**

10. Agriculture research in Bangladesh has a long history. During the colonial period prior to partition of India, early attention, based on systematic research, was given to jute. This was also the earliest crop to have its own independent research institute in 1951. Since then the number of institutes in the national system has grown to 10, with each institute having its own mandate, supporting infrastructure and trained manpower. During 2000-2001, under the Bank financed ARMP, BARC had organized external reviews of all the 10 institutes (the relatively new Bangladesh Sericulture Research and Training Institute (BSRTI) is not yet fully integrated into the NARS). Attachment 1 to this Annex provides a list of these reports. The information summarized below on the current status and performance of ARIs is based largely on these reports, supplemented by discussions with BARC, eminent scientists and visits to of some of the institutes.
11. Established in 1976, BARI is the largest and most diversified of the crop research institutes under MOA. Its origin dates back to 1908 when a government laboratory (later named Agricultural Research Institute) was established at Dhaka farm to serve the province of Bengal and Assam under the British rule in India. It moved to its present site in the 1980s.

12. **Mandate and Organization.** It has primary responsibility for research on oilseeds, pulses, wheat, tobacco, cotton, maize, other coarse grains, potatoes, and wide range of horticultural crops, including fruits and vegetables. The emphasis of its mandate is to increase and stabilize crop yields. BARI is also responsible for collecting and maintaining germplasm of these crops. It fulfills its mandate through research on varietal improvement; land, water, fertilizer, pest and disease management; cropping systems improvement; development of tools and machines; training of research and extension staff; relevant publications; technology transfer; and collaboration with other national and international research organizations. Since inception in 1976, the mandate and functions of BARI have not undergone any major change despite substantial changes in its structure and in the agricultural sector of Bangladesh.

13. BARI, with a Board of Governors headed by the Minster of Agriculture, now employs about 562 scientists. The institute is headed by a Director General (DG), its three wings (research, support service and Training and Communications) by Directors and two units (Planning and Evaluation and Training) directly by the DG. Research is the largest wing which is composed of six Research Centers (based on commodity programs), 15 Research Divisions (based on disciplines), 6 Regional Agricultural Research Stations (RARS), 34 Agricultural Research Sub-stations (ARS), 12 Farming Systems Research (FSR) sites and 83 Multi Location Trial (MLT) sites spread over different places in the country. The intersection of commodity and discipline approaches complicates institute and research management, which has been further exacerbated by uneven growth due to funding from development projects. Organization and management of regional and sub-regional stations and On-farm Research and Development (OFRD) work needs further review and rationalization.

14. **Research Programs and Outputs.** In its mandate to collect, catalogue, conserve and evaluate germplasm of a variety of crops, BARI is being hindered by shortage of trained staff and operational funds. BARI has plant breeding programs on a number of crops. Several of these programs have received or continue to receive technical and, in some cases, financial support from international research centers under the CGIAR. Examples include: CIMMYT (Maize, Wheat); ICRISAT (Sorghum, Chickpea, Groundnut); CIP (Potato). Program on hybrid maize, operating in active collaboration with CIMMYT, has received greater attention and has tested Quality Protein Maize (QPM) and downey mildew resistant hybrids. This work is in line with national priorities and released hybrids are helping to meet demand from the rapidly expanding market for poultry feed. A lot of the work in progress under various Divisions, e.g. of Entomology, Plant Pathology, Soil Science, Agricultural Economics, Vertebrate Pest Management, was found by the reviewers to be weak in scientific contents, not linked to priorities and lacking in direction. The work of Research Centers receiving external support, e.g. CIMMYT in case of wheat and maize, was better managed and had better direction. Management of regional agricultural research stations and sub-stations was found to be variable and many did not have suitably qualified scientists to undertake meaningful research. For example, the Citrus Research Station, Jaintapur, Sylhet, was found by the reviewers to be in particularly bad situation due to neglect over a long period.

15. While the work of BARI in some areas has been remarkable, e.g. varietal development of a range of crops, including wheat, maize, groundnut, potato, several legumes and vegetables, other areas have not been well managed. As a result output from many divisions/centers has been weak. It also suffers from shortage of well trained scientists. This is not surprising given the scope and coverage of BARI’s work program and complexity of its organizational structure. BARI needs a major rationalization of its organizational structure and pruning of research programs to focus attention on critical current priorities of agriculture in Bangladesh.
(b) Bangladesh Rice Research Institute (BRRI)

16. Established in 1970, it is one of the older crop research institutes in the country under the MOA. Financial assistance for its establishment was provided by the Ford Foundation which also linked BRRI with IRRI from the beginning for equipment procurement, training, technical assistance and on-going scientific support. It was made an autonomous institute by the Parliament Act of 1973, which was further amended in 1996. Out of total strength of 605 employees, BRRI has about 259 scientists.

17. **Mandate and Organization.** BRRI defines its mandate as: (i) conduct research on all aspects of rice plant, including development of new varieties and associated production technologies and stabilize yield by incorporating resistance to abiotic and biotic stresses; (ii) develop appropriate farm machinery and post-harvest technologies; (iii) develop package of practices and disseminate through training and other mass media for the benefit of growers; (iv) develop collaboration with other national and international organizations and institutes to strengthen and broaden role of rice research; and (v) train extension personnel on rice production technologies and publish books, periodicals and newsletter.

18. BRRI has its own Governing Board, which was reconstituted as Management Board under the 1996 amendment of the Act. It is now headed by the DG BRRI, with 11 other members representing the NARS institutes, scientific community, NGOs, farmers and the government. Director Administration of BRRI is the member secretary. BRRI has 18 scientific research divisions, 10 administrative divisions/sections and 9 research stations located in different parts of the country. Out of 9 stations only about half are well located to serve the research needs of rice and two have only recently been upgraded.

19. DG is assisted by Director Research and Director Administration in the management of the institute. However, frequent changes in the position of DG and long periods when there was no Director of Research have negatively impacted on the overall management of the institute and its productivity. BRRI has made significant contributions towards development of trained scientific manpower for rice research in country. However, in more recent years it has been loosing many of its experienced and well trained staff due to limited prospects for promotion and poor working environment.

20. The 18 scientific research divisions of BRRI have been grouped under the following seven programs for effective administration and management under the Director Research. These are: (i) Variety development covering Plant Breeding, Genetic Resources and Seeds, Biotechnology, and Grain Quality and Nutrition; (ii) Crop-Soil-Water Management covering Agronomy, Soil Science, Plant Physiology and Irrigation and Water Management; (iii) Pest Management covering Entomology and Plant Pathology; (iv) Rice Farming Systems; (v) Farm Mechanization; (vi) Technology Transfer; and (vii) Socio-economics and Policy covering Agricultural Economics, Statistics and Farm Management.

21. **Research Programs and Outputs.** While the research programs under different divisions cover a wide range of activities, development of new rice varieties and supporting technologies (green revolution technologies involving high yielding varieties, fertilizer and irrigation) has been the main contribution of BRRI. It has so far released over 37 rice varieties. In this work BRRI received considerable help from IRRI. BRRI’s major success has been the development of irrigated “Boro” (dry season) rice. In general, BRRI’s research programs lack strategic direction in relation to important areas e.g. natural resource management, development of hybrid rice, IPM, and in integrating new sciences, e.g. biotechnology and genetic engineering. Implementation of research programs is being hampered by shortage of operational funds. Significant changes are needed in management of research programs to strengthen impact of research and bridge the yield gaps on farmers’ fields.
Annex 1: Current Status of the National Agricultural Research System

(c) Bangladesh Jute Research Institute (BJRI)

22. BJRI was established in 1951 building on a long history of jute research as it was an important export commodity. It is linked to MOA. The institute was made autonomous under the 1974 Act which was further amended in 1996.

23. **Mandate and Organization.** The current mandate of the institute covers production, processing and regulation of marketing. More specifically, BJRI is responsible for: (i) promoting agricultural technology and economics research on jute and allied fibers and their manufacture and dissemination of results there of; (ii) production, testing and distribution of seeds of improved varieties; (iii) setting up research centers, pilot projects and farms in different locations in the country for research ; (iv) organizing demonstrations of new varieties and to train farmers; and (v) publishing monographs, annual reports, bulletin and other literature relating to jute research and on other activities of the institute. The institute currently employs 194 scientists, many of them are located in Dhaka, where there are no research facilities, while the sub-stations are facing shortages of trained staff.

24. The BJRI Headquarters at Sher-e-Bangla, Dhaka, includes administrative offices and a small area for research. The Central Research Farm is at Jagir. Two large farms covering nearly 550 ha are used for seed multiplication. In addition, the institute has six sub-stations. BJRI is headed by a DG who responds to a Board of Management (BOM). Two directorates for Agricultural Research and Technology Research, headed by directors report to DG. The third division, headed by an Additional Director is for Administration and Finance. Economic research, even though part of the institutes mandate, does not have a dedicated unit. Scientific work at the institute has suffered from frequent changes in DG, lack of strategic direction of research and declining morale of staff.

25. **Research Programs and Outputs.** The agriculture division has given a broad attention to testing agronomic elements of jute production, especially variety testing for higher yields and better fiber quality as well as tolerance to drought, waterlogging and salinity. The other focus area has been the production and, testing of improved seeds and their multiplication and distribution to growers. Technology division undertakes a large number of trials but the program lacks focus on critical issues related to fiber quality, new products and technology and improved processing.

26. Given the declining market for raw jute, improvements in productivity and fiber quality for production of high quality products is essential. Therefore, varietal development should aim at high yields, better quality fiber, and stability of production under marginal conditions. Work program of other units should be oriented towards development of improved packages of practices in support of new varieties. Research on diversification from jute to other more profitable crops should be given due attention. Research program of the Technology Wing should focus its attention on finding new uses for jute fiber.

(d) Bangladesh Sugarcane Research Institute (BSRI)

27. The Bangladesh Sugar Mills Corporation and Bangladesh Sugar Foods Industrial Corporation established a Sugarcane Research Institute in 1973 under the Ministry of Industry and Commerce. It was essentially run for sugar industry (the publicly owned sugar mills). In early years, it worked closely with BARI. Later, with the addition of training responsibilities for the sugar mills and field stations, its name was changed to Sugarcane Research and Training Institute. In 1989, it became a government department under MOA. Under 1996 amendment Act of Sugarcane Research Institute it became autonomous national institute BSRI. It employs about 73 scientists, out of total staff of 253.

28. **Mandate and Organization.** Under the present mandate, BSRI covers mills and non-mills zones all over the country for: (i) developing new varieties and other technologies for production of sugar, gur, syrup from carbohydrate enriched crops/plants; (ii) collecting and maintaining different sugarcane...
varieties/clones; (iii) evolving technologies concerning uses of sugar, gur and syrup producing carbohydrate enriched crops/plants; (iv) with prior approval of government, initiating sugarcane related collaborative national and international research; (v) publishing journal, reports on the basis of results and recommendations of the institute research; (vi) helping the government in formulating sugar policy and advice on any other matter related to sugarcane; and (vii) organizing training and education for sugarcane farmers.

29. BSRI Act of 1996 provides for a Board of Management (BOM) but unlike other institutes under Schedule A, Minister of Agriculture is the Chairman of BOM. There are 16 other members. DG responds to BOM. Many of the senior positions are either vacant or filled by acting staff, which weakens management. The institute has 10 divisions, 8 units and 2 regional stations. Research and Training wings are headed by Directors. Other areas include Accounts, Audit, Central Administration, Civil Engineering and Planning. Ten discipline based divisions (Breeding, Agronomy and Farming Systems, Physiology and Sugar Chemistry, Plant Pathology, Soils and Nutrition, Training and Technology Transfer, On-farm Research, Agriculture Engineering and Agricultural Economics) are located at the main station and are responsible for all agricultural research.

30. **Research Programs and Outputs.** Research programs have attempted to develop sugarcane varieties that are responsive to fertilizer use, suitable for different regions with tolerance/resistance to different biotic and abiotic stresses. Attempts have also been made to develop varieties with varying maturities to allow continuous and uniform supply of ripened cane for mills. The institute has also conducted research on cultural and cropping patterns, notably for intercropping and relay cropping.

31. About 14 varieties released by BSRI showed tolerance to insect pests and diseases and have high yield potential. A few varieties were tolerant to drought, flood and waterlogging conditions. This program can be further strengthened through biotechnology and genetic engineering. Farming Systems Research, especially on intercropping should be strengthened. Sugarcane yields are low. Better training and transfer of known technologies is needed. Work on IPM should be further strengthened. Policy research in sugarcane production, procurement and processing is weak. Program based research capacity and facility development is probably the best way to enhance skill-base of staff and plan further development needs. The institute also needs to undertake research related to the impact of sugarcane policy that forces farmer to sell sugarcane to the sugar mills (particularly in the sugar mill areas) on farm income and hence rural poverty.

(e) **Bangladesh Institute of Nuclear Agriculture (BINA)**

32. Since early 1960s until mid-70s, the nuclear agricultural research in Bangladesh was carried out by a unit of Bangladesh Atomic Energy Center (BAEC), Dhaka. Following early success it was given independent status as Institute of Nuclear Agriculture and moved to its present site in Mymensingh in 1975. In 1982, it was moved from BAEC to MOA and linked with BARC as part of the NARS through a Presidential Order. In 1984, it was renamed as Bangladesh Institute of Nuclear Agriculture (BINA) under declaration of an Ordinance No. II. The institute employs 312 staff, of which 76 are scientists.

33. **Mandate and Organization.** The mandate of BINA includes: (i) research on nuclear techniques for evolution of new varieties of crops, scientific management of land and water, techniques to improve quality and quantity of crops and development of methods for control of disease, insect and management of pests; (ii) agronomic and soil-plant studies; (iii) demonstrations and trial-runs of new crop varieties and their management practices; (iv) training of research and extension staff; (v) provision of post-graduate research facilities; (vi) research in collaboration with other national and international institutions and through bilateral agreements with foreign institutions for academic degrees, specialized training, scientific visits and exchange programs.
34. BINA has a Management Board for general management and supervision of institute. DG is the chief executive of the institute and is assisted by Directors of Research and Administration & Support Services. There are eight research divisions (Plant Breeding, Crop Physiology, Soil Science, Entomology, Plant Pathology, Agronomy, Agricultural Engineering, Training, Communications and Publications) and 5 sub-stations under the Research Director.

35. **Research Programs and Outputs.** In line with its mandate, research has given high priority to development of high yielding and better quality crop varieties using both mutation and conventional breeding techniques. Other areas receiving attention have included: assessment of efficiency of utilization of applied nutrients by crop plants using radioisotope techniques; development of control measures against pest and diseases of crops; and agronomic studies.

36. BINA has been successful in developing crop mutants/varieties through induced mutations. This work has so far developed over 23 mutants/varieties of different crops (rice, jute, mustard, mungbean, chickpea and tomato) which have been approved by the National Seed Board. The development of effective rhizobium strains for production of nitrogenous biofertilizer holds promise for improvement of pulse crops. Four mutants of Trichoderma sp. have shown promise for the control some diseases.

37. BINA has weak linkages with other institutions in NARS and with other agencies. Even within its own organization inter-divisional dialogue is weak. In addition, not enough attention has been given to the technology transfer program. As a result, despite potential demand for BINA developed varieties from local farmers, not enough attention has been given to development of linkages with other agencies for seed production and multiplication. Like many other ARIs, BINA faces funding problems. As a result, substantial part of research is either laboratory based or is undertaken at the main site. Sub-stations are poorly staffed and grossly underutilized. BINA has generated a number of genetic variables with different attributes but they can not be fully assessed or maintained due to lack of facilities and funds. Some aspects of BINA’s mandate overlaps with that of BRRI and BARI, There is a need for much tighter assessment of priorities and reallocation of resources accordingly.

38. **Soil Resources Development Institute (SRDI)**

39. **Mandate and Organization.** The mandate of SRDI is to provide services related to soil fertility management, land use planning, studies on soil mineral composition and characterizing soil resources using remote sensing and GIS techniques. In addition, MOA has asked SRDI to manage the 4 regional laboratories which previously were with BARI, and to undertake chemical analysis of fertilizers as a part of the quality control of fertilizers sold in Bangladesh.

40. The institute is a department of MOA and is headed by a Director. It has five technical divisions at the Headquarters. These are: Soil Survey, Field Service, Land Use Planning, Soil Testing, and Research and Development. Administration, Training and Communication and Planning and Evaluation are three other sections of the institute reporting directly to the Director. While SRDI has 102 scientists, many of them are on development budget and have concerns about service conditions and career development.

41. SRDI has four regional laboratories and four regional offices in close vicinity of laboratories. It also has 20 district offices at district Headquarters. In addition, it supports establishment of Soil Testing Laboratories (STL) and Mobile Soil Testing Van (MSTV) as development activities. It manages two Centers on Soil Salinity and Management and Soil Conservation and Watershed Management.
42. **Research Programs and Outputs.** With the support of four regional offices, SRDI carries out monitoring of soil resources and assessing land suitability in the country. Thana (Upazilla) Nirdeshika has been prepared based on the soil survey data. It serves as a sourcebook in understanding the broad distribution and characteristics of soils and for assessing crop production potentialities at the lowest administrative level. Fertilizer recommendations are based largely on soil chemical properties. In this work, SRDI worked closely with BARI, BRRI, BINA, DAE and BARC. Survey Division has been preparing: (i) inventory of soil and land resources and land suitability assessment; (ii) correlate soils of Bangladesh with the International Soil Classification System; and (iii) interpretation of soil and land resource information for the national land use policy. The Land Use Planning Division is undertaking crop performance, assessment of crop loss due to drought, flood etc. Soil Testing Division is concentrating on Thana Nirdeshika, soil fertility monitoring, mobile soil testing and soil health checks. Through its analytical laboratories, the Division provides soil sample analysis service and has capacity to analyze 25,000 soil samples annually. However, there is a tendency to see this as a research support facility rather than a service unit. The Research and Development Division, through two sections and two research centers, work mostly in hilly areas, soil physics and mineralogy and microbiology. However, the studies are mostly on soil chemistry and soil fertility studies.

43. SRDI is more of a service providing development organization than a research organization. In this role its major achievements have included: preparation of Thana Nirdeshika reports, soil survey of Thanas and quality control of soil analysis, salinity survey in South Western region, establishment of a GIS unit and preparation of soil classification and related maps, provision of land and soil data with interpretation and location maps.

(g) **Bangladesh Tea Research Institute (BTRI)**

44. Tea industry in Bangladesh, prior to partition of India, received technical support from Tocklai Experiment Station, Assam, India. After partition, a separate research station was established, which in 1971 became Bangladesh Tea Research Station. In 1973 it was upgraded to Bangladesh Tea Research Institute under the Tea Board, Ministry of Commerce. The institute now employs 60 scientists.

45. **Mandate and Organization.** BTRI conducts research to increase yield and quality of tea by developing improved production technologies and high yielding tea clones and seeds through comprehensive breeding. It is charged with conservation of soil and fertility of tea land and proper utilization and management of land, water and environmental resources. It investigates tea processing and manufacturing aspects that impact on quality and standardization of Bangladesh tea for quality control. It has responsibility for providing advisory service for the tea industry.

46. BTRI is headed by a Director who looks after research and administration. It has 9 Divisions (Soil Chemistry, Biochemistry, Botany, Agronomy, Entomology, Plant Pathology, Technology, Statistics and Economics, Accounts and Administration) grouped under five Departments. BTRI has one experimental farm and three sub-stations. These are used for multiplying tea clones, seedlings, demonstration trails, experimentation and conservation of germplasm.

47. **Research Programs and Outputs.** The research programs of the institute are mostly adaptive and field oriented in order to meet the current and future needs of the industry. The research proposals are prepared by divisional heads based on field surveys and experience. These are prioritized at the institute in collaboration with the scientists and the planters. Current research programs cover a wide field in all disciplines. Varietal improvement through clonal selection and breeding is an important area of research for the Department of Crop Production. This work has been supported by the Botany Division by its work on enrichment of tea germplasm. Soil Chemistry division has given attention to integrated nutrient management strategies and to upgrading of fertilizer recommendations. Biochemistry work is looking at effects of processing and pests which influences quality. Work of Agronomy Division is focused on improving soil productivity through cultural practices and on development of improved irrigation and drainage systems.
Entomology and Pathology Divisions are emphasizing control of local pest (termite, Helopeltis) and diseases (die-back) both through pesticide use and IPM practices. Technology Division is researching means of improving withering and fermentation processes for better quality. Productivity and input use efficiency is being analyzed by the Economics and Statistics Division.

48. Despite a fairly broad-based research, impact on productivity does not appear to be large as yields in Bangladesh are considerably lower and the quality of tea is poor compared to other leading tea producers. Average for the country is around 1150 kg/ha, whereas experimental farms are able to produce around 2700kg/ha. In well managed tea estates, it can be around 4000 kg/ha. Poor soils, unfavorable climatic conditions (e.g. drought) and poor genetic stock could be important contributors to low productivity. For example, organic matter content of the tea soils is low. Attempts to improve on this situation should be intensified through mulching to improve fertilizer use efficiency and tea productivity. Another important contributor to low yields could be the weak advisory service. Stronger service can help to improve productivity through improvement of genetic stock as well as crop management practices. BTRI also suffers from poor human resource development program. Better planning and greater investment in human resource development are needed.

(h) Fisheries Research Institute (FRI)

49. Fisheries Research Institute was established in 1984 under an ordinance promulgated by the President of the People’s Republic of Bangladesh. It was later renamed as Bangladesh Fisheries Research Institute by an Act in 1996. FRI inherited existing fish research facilities (four research facilities and one fish seed multiplication farm) from the Department of Fisheries. The establishment of FRI has resulted in some increase in public investment in fisheries research. However, as compared to crops, this is very small.

50. **Mandate and Organization.** Article 6 of the 1984 Ordinance defines the function of the institute to be: to carry out and coordinate fisheries research; to assist in the development of more efficient and economic methods for fish production, management, processing and marketing; and to do such other acts or things as may be considered necessary for carrying out the purpose of the Ordinance.

51. The apex body of FRI is its Governing Board chaired by the Minister of Fisheries and Livestock and includes 12 other members. The institute is headed by Director General. FRI has 6 divisions, 4 research stations (fresh water, riverine, brackish water and marine) and 2 sub-stations. FRI employs about 98 scientists, but the skill-base of scientists is not commensurate with its various fields of research.

52. **Research Programs and Outputs.** The institute has research facilities to carry out work on development of improved technologies and management practices. It coordinates research activities of field stations and takes appropriate measures for dissemination of technologies. Four research stations of FRI undertake most of the research. This has included on-station applied research on freshwater, brackish water and coastal aquaculture including riverine and reservoir fisheries with emphasis on Hilsa fisheries. Fresh water station has produced significant results in fish breeding and genetics, culture technology and feed development. Riverine and Marine stations emphasized Hilsa fishery. Riverine sub-station Rangamati has undertaken good work on management of Kaptai lake fisheries. Lack of facilities hindered work of marine station. In addition, FRI has also been involved in a number of externally aided projects. However, greatest attention has been given to aquaculture and aquaculture-related issues. Research topics have included breeding and genetics, feed and nutrition, integrated fish farming, disease and health management and socio-economic aspects of aquaculture. Cost-effective technologies on integrated fish farming adapted/tested under local conditions included: polyculture farming, rice-fish farming, improved carp nursery, Thai sarapunti farming, Tilapia farming, poultry-fish farming.

53. It is not clear, however, to what extent these technologies have been adopted by farmers. There are serious gaps in socio-economic research. It is suggested that FRI is not addressing emerging concerns in
Revitalizing the Agricultural Technology System in Bangladesh

aquaculture, including in-breeding depression in hatcheries, poor growth and environmental degradation. A benchmark survey to identify current constraints of producers would provide a sound basis for planning future research work.

54. The institute lacks appropriately trained manpower, facilities and resources to address more complex and demanding work involving integrated stock assessment, environmental protection and conservation in both inland water and marine fisheries resources. FRI should encourage private sector participation in development and dissemination of technologies through technical support and training.

55. Under the World Bank-financed Forth Fisheries Project (FFP), the plan was for DOF to expand support for environmentally and socially appropriate small-holder shrimp production in selected areas. However, due to long delays in establishing ownership and lease-free status of land areas, limited progress had been made in promoting improved production systems. FRI has not been involved in supporting this work under FFP. This is indicative of weak linkages between FRI and DOF. The main source of new technologies at present seem to be the USAID-funded Agro-based Industries and Technology Development Project (ATDP), which has introduced a number of new methods of growing shrimps in Bangladesh. Although, most shrimp farmers are still using traditional technologies, there seem to be some interest amongst progressive growers with resources to try out new methods.

(i) Bangladesh Livestock Research Institute (BLRI)

56. BLRI was established in 1984 under an ordinance entitled, ‘The Livestock Research Institute Ordinance 1984’ and took over some of the functions previously performed by different laboratories and Animal Husbandry Institute.

57. **Mandate and Organization.** BLRI, a multidisciplinary research institute, is responsible for: (i) identifying and solving problems affecting the growth and development of livestock production; (ii) improving job opportunities and self-employment of rural people through improved livestock production technologies and thereby reducing poverty and improving socio-economic conditions of small farmers; and (iii) improving the national economy by increasing foreign currency earnings through exports and by supplying adequate nutrition to under nourished population of the country.

58. The apex body of the institute is the Board of Management (BOM). It has responsibility for general direction, administration and supervision of affairs of the institute. BOM is chaired by the Minister of Fisheries and Livestock and Secretary, Ministry of Fisheries and Livestock as the Vice-Chairman. It has 11 other members. The institute is headed by Director General. It has 6 research divisions (Systems, Animal Health, Animal Production, Poultry Production, Socio-economic, Support Services), 7 regional centers and 11 sub-stations. At present, about 55 scientists are working at the institute. A Technical Committee headed by the Director General provides technical inputs and reviews the annual research programs, including the research budget for submission to the Board and the MOFL for approval. As per the Act, BLRI is a semi-autonomous research institute, which should be governed and managed by its Board. In practice, however, it is dependent on MOFL for all important decisions. For example, in addition to approving the annual budget, the Secretary of MOFL chairs the committee dealing with appointment and promotion of Principal Scientific Officers (PSOs), Chief Scientific Officers (CSOs) and equivalent positions.

59. **Research Programs and Outputs.** Like fisheries, livestock research also has suffered from inadequate investment in the past. Since its inception 1984, BLRI has initiated research on a number of aspects, including work to improve livestock feed availability by selecting high yielding grass species and multi-purpose cash crops, breed improvement of suitable dairy beef cattle, improvement of Black Bengal goat through selective breeding, vaccine production against important diseases. Research on conservation of native poultry and to improve yield are also undertaken.
In general, the research programs have been very ambitious which do not relate to available scientific manpower and financial resources for full development and dissemination of results. As a result, impact has been limited, despite high potential benefits of some of the technology packages developed, especially for the poor e.g. forage work, Black Bengal goat rearing and calf raising model. Veterinary research has received limited attention and is undertaken by the Animal Health Division. This division also provides some services to the private sector. BLRI lacks capacity for effective planning and monitoring and evaluation of research to meet the changing short and long-term needs of the sector with considerable potential for growth. One of the major constraints to greater progress at the institute is lack of well trained manpower. In recent years very little investment has been made in manpower development. Frequent changes in DGs have also created a leadership gap and lack of continuity leading to poor direction and management of the research programs. There have been many important changes, largely driven by the market forces, that must be taken into account in developing the future research programs. These changes would also require a review of BLRI’s functions and its organizational structure taking in to account a growing role of the private sector, especially in the fast growing poultry industry.

C. General Observations on Research Management in ARIs

One of the recurrent concerns in research management in Bangladesh in recent years has been the weak leadership, which has manifested in several different ways. Many institutes have suffered from frequent changes and long gaps in appointment of senior managers, especially Director Generals, e.g. BRRI, BLRI, BARI. As a result, institutes have not been managed properly and scientists have not been receiving appropriate guidance and support in conducting research.

Over-ambitious work plans without due attention to available resources and needs of farmers appear to be a common feature of research programs being pursued by most of the ARIs. Internal review processes and the oversight provided by BARC is clearly inadequate to privatize research and reduce the overall scope and coverage to fit available resources. The situation is further compounded by commodity focus of work which lacks systems perspective. Furthermore, due to funding constraints a lot of work is undertaken on research stations without further validation on farmer’s fields. As a result a significant proportion of research findings are of little value in addressing farm level constraints. What ever useful research is being undertaken, it is not being disseminated effectively due to weak linkages between research and extension.

Funding crisis is also affecting the skill-base of scientists due to shrinkage of opportunities for further studies and training. Poor working conditions, low salaries and limited opportunities for career progression means that scientists have little incentive for hard work and innovation. Overall human resource development is also a concern in relation to the use of new sciences such as biotechnology, informatics and ICT in agricultural research. While the crop research institutes, especially rice, wheat maize and legumes, have maintained good collaboration with IRRI, CIMMYT, CIP and ICRISAT, linkages of other institutes with international organizations are weak. Regional collaboration with other research organizations in South Asia has not been actively sought.

In more recent years, the research output has declined and average yields of crops, milk, meat and fish have remained low with a large gap between what research produces and what farmers want as well as between farmer yields and the research station yields. In order to support development of high-value commercial agriculture with new technologies and to increase farm incomes through higher agricultural productivity from a declining land resource, the system needs to broaden the research agenda beyond a focus on improvement of cereal crops to support all the sub-sectors (such as crops, horticulture, fisheries, livestock and forestry) and pay greater attention to issues related to natural resource management. What was once a productive agricultural research system now appears to be in decline and is finding it difficult to respond to current development challenges faced by Bangladesh agriculture, in the regional and global context.
D. List of Review and Evaluation Reports

65. The review and evaluation reports of Agricultural Research Institutes (ARIs), commissioned by BARC during 1999-2001 under the World Bank-financed Agricultural Research Management Project, are listed below:


Annex 2: Role of the World Bank in Promoting the Agricultural Technology System

1. The World Bank has been very active in supporting the modernization of agriculture in Bangladesh by promoting the agricultural technology system since independence in 1971. In the area of agricultural research and extension, the World Bank has financed ten projects (see Annex Table A2.1 for a summary) with a cumulative total of $143 million (actual commitment was $189 million and the country was able to use only about 75% of it). The World Bank has been instrumental, in collaboration with the Government of Bangladesh and other development partners (particularly USAID and DFID), to lay the foundation for modern agricultural research and extension systems.

<table>
<thead>
<tr>
<th>Table A2.1</th>
<th>World Bank Financing for Agricultural Research and Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>IDA Amount (US $ m)</td>
</tr>
<tr>
<td></td>
<td>Commitment</td>
</tr>
<tr>
<td>Agricultural and Rural Training Project</td>
<td>12.00</td>
</tr>
<tr>
<td>Agricultural Research I Project</td>
<td>6.00</td>
</tr>
<tr>
<td>Agricultural Research Management Project</td>
<td>50.00</td>
</tr>
<tr>
<td>Silk Development Pilot Project</td>
<td>11.35</td>
</tr>
<tr>
<td>Agricultural Services Innovation and Reform Project</td>
<td>5.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>188.95</td>
</tr>
</tbody>
</table>

Note: Overall disbursement rate was 75% ((disbursement divided by commitment) × 100).

A. Contributions to Research, Extension and Training

2. The funds for these projects have been used to finance infrastructure (office buildings, research stations, training facilities); equipment necessary for agricultural research and extension; human resource development (training of research scientists and extension personnel with modern skills, both in Bangladesh and abroad); institutional development (establishment of agricultural research and extension institutes and the development of necessary legal framework); and linkages with the international agricultural research system under the Consultative Group for International Agricultural Research (CGIAR). The main contribution of these ten Bank-supported projects was to lay the foundation for science-based agriculture, create modern technology institutions, train human resources with scientific and technical skills, develop technology programs appropriate for Bangladesh and sustain them as part of the still evolving national agricultural research and extension systems.

3. Specifically, the selected key contributions of these agricultural research and extension projects were: (i) development of appropriate physical infrastructure all over the country (including BARC complex and physical facilities for other agricultural research institutes) in order to undertake and promote modern agricultural research and extension; (ii) development, implementation, testing and refinement of various agricultural extension methodologies appropriate for conditions prevailing in Bangladesh and the
establishment of the Department of Agricultural Extension; (iii) development as well as implementation of the contract research programs for priority research areas all over the country; (iv) training of the scientific staff for both agricultural research and extension, both in Bangladesh and abroad; (v) establishment and/or strengthening of BARC, BARI, BRRI, BLRI, FRI, BFRI, and BSRTI; (vi) preparation and adoption of National Agricultural Extension Policy (NAEP), Vision for Agricultural Research, 2000-2020, at the national level and Master Plans, 2000-05, at the level of individual research institutes; (vii) adoption of 1996 BARC Act; (viii) establishment and strengthening of Horticultural Export Development Foundation (Hortex) and promotion of high value horticultural commodities from Bangladesh.

B. Unresolved and Emerging Problems

4. Despite these significant contributions, however, the agricultural research and extension systems in Bangladesh remain fragmented, lack appropriate financial and political support, continuously losing the best quality scientific staff and are not very effective in fulfilling their mandates to modernize agriculture through appropriate agricultural research (technology generation) and agricultural extension (technology transfer). More importantly, the agricultural research and extension systems are not capable of meeting the development challenges of providing appropriate technologies to Bangladesh agriculture in the 21st century global economy. As indicated in Annex Table A2.2, the sustainability for most of the achievements under these projects is uncertain, unlikely or likely under only certain favorable conditions. One of the main reasons has been unwillingness or inability to mainstream and transfer successful activities to revenue budget once the projects funded under the development budget are complete. For this reason, agricultural extension remains focused more on implementing development projects rather than providing a broad-based extension service to farmers. The BARC does not really have the necessary autonomy in practice to serve as a funding and coordinating council and therefore remains very ineffective to carry out its mandate. Furthermore, the various Agricultural Research Institutes (ARIs) were created under their own legal Acts and therefore the National Agricultural Research System (NARS) cannot function as one system in the absence of uniform service and business rules.

| Table A2.2 |
| Performance of Agricultural Research and Extension Projects |
| Financed by the World Bank |

<table>
<thead>
<tr>
<th>Project</th>
<th>Performance with respect to</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outcome</td>
</tr>
<tr>
<td>1 Agricultural and Rural Training Project</td>
<td>Partial</td>
</tr>
<tr>
<td>2 Extension and Research Project</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>3 Agricultural Research I Project</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>4 Second Extension and Research Project</td>
<td>Partial</td>
</tr>
<tr>
<td>5 Second Agricultural Training Project</td>
<td>Partial</td>
</tr>
<tr>
<td>6 Agricultural Research II Project</td>
<td>Partial</td>
</tr>
<tr>
<td>7 Agricultural Support Services Project</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>8 Agricultural Research Management Project</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>9 Silk Development Pilot Project</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>10 Agricultural Services Innovation and Reform Project</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

Notes:
1. Lack of revenue budget and limited staff incentives were generally identified as the main reasons for uncertain sustainability. The development projects are generally financed by the development budget and the project generally stops functioning after the funding stops.
2. Despite substantial contributions over time (in terms of physical infrastructure, human resource development and institution building), the agricultural research and extension systems remain fragmented, unsustainable and lack necessary financial and political support.
C. Brief Summary of Individual Bank-financed Projects

5. A brief summary for each of the agricultural research and extension projects financed by the World Bank is provided below. In addition to the information provided in Annex Tables A2.1 and A2.2, this summary focuses on three items only: (i) project objectives; (ii) project components; and (iii) key contributions. The main sources of this information have been the project completion reports (PCRs) or implementation completion reports (ICRs) for each of these projects, along with project performance assessment reports for selected projects by the Operations Evaluation Department (OED) of the World Bank.

(a) Agricultural and Rural Training project (1976-83)

6. Project Objectives: The main objective of the project was to expand and strengthen the administrative framework, physical facilities and manpower for the training and extension system dealing with agriculture and rural development.

7. Project Components: (i) Establishment/improvement of training institutions, including three new and four existing Agricultural Training Institutes (ATI), one new Rural Development Academy (RDA) in Bogra, 15 Thana Training Units (TTU), 40 Field Extension Facilities (FEF), and dormitories at the Bangladesh Agricultural University in Mymensingh; and (ii) strengthening in-service training programs for extension field personnel and/or village extension agents.

8. Key Contributions: (i) Established the Rural Development Academy (RDA) in Bogra; (ii) established or improved a large number of training institutes for agricultural extension personnel in the rural areas; and (iii) provided in-service training to over 3000 practicing agricultural extension workers.

(b) First Extension and Research Project (1977-82)

9. Project Objectives: The project supported the introduction of the Training & Visit (T&V) extension system in Bangladesh. In addition, the project supported efforts to make adaptive research more relevant to the needs of the country and helped establish linkages between research and extension.

10. Project Objectives: (i) Agricultural extension (increasing the number of Village Extension Agents (VEA) and training the extension staff); (ii) agricultural research (development of research sub-stations and financing contract research); and (iii) rehabilitation and construction of housing and training units. The project covered five districts from the North-West region (Bogra, Dinajpur, Rangpur, Pabna and Rajshahi). These districts refer to the old districts before reorganization.

11. Key Contributions: (i) introduction of T&V extension system; (ii) development of agricultural research and extension infrastructure; (iii) institutional development and (iv) training of extension staff.

(c) Agricultural Research I Project (1978-84)

12. Project Objectives: The objective of the project was to strengthen (i) agricultural research, specifically the research facilities, management and scientific manpower at Bangladesh Agricultural Research Institute (BARI); and (ii) the planning, coordination and monitoring functions of Bangladesh Agricultural Research Council (BARC).

13. Project Components: (i) BARI regional station development; (ii) BARC headquarters complex; (iii) BARC financed research sub-projects; and (iv) manpower development. The project was national in scope but most of the resources were spent to construct BARI research stations and BARC complex.
14. **Key Contributions**: (i) Construction of BARC Complex; (ii) financing of contract research in priority research areas through grants; (iii) preparation of national agricultural research plan; and (iv) financing of training and higher studies abroad for scientific staff.

(d) **Second Extension and Research Project (1982-87)**

15. **Project Objectives**: The main objective of the project was to extend the Training & Visit (T&V) system of extension, from a pilot area in the Northwest, to 70% of the agricultural districts of the country. In addition, the project aimed at developing appropriate production technologies through adaptive and cropping systems research programs for both rain fed and irrigated farming systems, and an intensification of the extension effort to accelerate adoption of high yielding varieties (HYV) and use of agricultural inputs (mainly for rice and jute).

16. **Project Components**: (i) Agricultural extension (reorganize five existing crop extension agencies into one agency and intensification of extension work); (ii) agricultural research (improving coconut research station under BARI and improving adaptive research by reorganizing regional research); and (iii) training of agricultural extension and research personnel.

17. **Key contributions**: (i) establishment of T&V system of agricultural extension all over the country; (ii) provision of training, skill development and equipment to promote effective extension; and (ii) establishment of the Department of Agricultural Extension (DAE).

(e) **Second Agricultural Training Project (1983-89)**

18. **Project Objectives**: The main objective of the project was to improve the quality of middle-level agricultural training. In addition, the project was designed to (i) improve the planning, management and coordination of all middle-level training programs of the Ministry of Agriculture, in conjunction with the creation of the Division of Training (DOT) under the Department of Agricultural Extension (DAE); and (ii) support the Government’s career development strategy for Block Supervisors (BS) of the extension service.

19. **Project Components**: (i) Improving the quality of middle-level agricultural training; (ii) constructing and equipping a new training center – the Higher Agricultural In-service Training Institute (HAITI); and (iii) training and technical assistance for personnel in Agricultural Training Institute (ATI), Central Extension Resources Development Institute (CERDI) and HAITI.

20. **Key Contributions**: (i) Improvement in the quality of middle-level agricultural training; (ii) provision of training material and equipment; and (iii) strengthening of agricultural training management and coordination.

(f) **Second Agricultural Research Project (1984-92)**

21. **Project Objectives**: The main objective of the project was to consolidate improvements in agriculture research management systems made under the Agricultural Research I Project. In particular, the project was intended to provide continued support for Government’s efforts to develop a strong research planning, coordinating and monitoring organization at BARC by bringing livestock, forestry and fisheries more effectively into the national agricultural research system and to strengthen national research station network.

22. **Project Components**: (i) Strengthening of BARC; (ii) funding for priority research areas through contract research; (iii) establishment of three new agricultural research institutes, i.e. Bangladesh Livestock Research Institute (BLRI), the Fisheries Research Institute (FRI) and Bangladesh Forestry Research Institute (BFRI); and (iv) training for research scientists.
23. **Key Contributions:** (i) Establishment (infrastructure, equipment and facilities) of three new agricultural research institutes, i.e. BLRI, FRI and BFRI; (ii) strengthening of BARC and BARI; and (iii) strengthening of contract research program as an approach to finance research in priority areas.

(g) **Agricultural Support Services Project (1991-98)**

24. **Project Objectives:** The main objectives of the project were to increase agricultural production (especially food grains) and to initiate the introduction of high value export crops.

25. **Project Components:** (i) Technology transfer aimed at improving the efficiency of outreach and increasing the coverage of farmers; (ii) training of DAE staff and farmers; (iii) seed industry improvement aimed at improving the production of breeder seed for rice, wheat and jute; (iv) homestead production designed to demonstrate on-farm and homestead activities for women; (v) agro-business aimed at stimulating private sector interest in the export of high value horticultural crops; and (vi) technical assistance to assist DAE with strategic planning.

26. **Key Contributions:** (i) Preparation and adoption of New Agricultural Extension Policy (NAEP) that promoted new farmer focused, decentralized bottom-up group approach to extension service; (ii) establishment of breeder seed units and the promotion of farmer to farmer seed exchange; (iii) the promotion of homestead production activity was quite successful in improving nutrition and extension outreach to women; (iv) the promotion of the export of high value horticultural crops through the establishment of Horticulture Export Development Foundation (Hortex); and (v) the promotion of NGOs in facilitating homestead production as well as export of horticultural crops.

(h) **Agricultural Research Management Project (1996-2001)**

27. **Project Objectives:** The main objective of the project was to increase efficiency of the National Agricultural Research System (NARS) and thereby generate profitable, relevant and sustainable agricultural technologies for agriculture in Bangladesh.

28. **Project Components:** (i) Research organization and management in order to strengthen research planning, coordination and management by BARC; (ii) funding of priority research by the agricultural research institutes (ARIs) on crops, livestock, fisheries and forestry; and (iii) participatory farming systems research in order to strengthen farming systems research through support to research-extension linkages and testing dissemination of appropriate technology. The project was national in scope and, in addition to BARC, seven ARIs were involved in project implementation.

29. **Key Contributions:** (i) Institution development in order to promote efficiency of the NARS in terms of both effectiveness of research management and gains in the productivity of the research system; (ii) preparation of national research strategy by BARC (Vision for Agricultural Research, 2000-2020) and management plans (Master Plans, 2000-2005) by each ARI; (iii) success of the contract research program (demand-led competitive applied research) due to increased research discipline, accountability and incentives for good performance; (iv) holistic approach to conduct farming systems research; and (v) adoption of 1996 BARC Act.

(i) **Silk Development Pilot Project (1997-2003)**

30. **Project Objectives:** The project was designed to ascertain whether Bangladesh can be competitive in sericulture provided the institutional, economic and technical constraints affecting silk development are addressed. The objective of the project was to increase incomes of small-scale silk producers (mostly women) through improved technology and creating an enabling institutional and policy environment to encourage sustainable development of the silk sector.
31. **Project Components:** (i) Policy reform and institutional development; (ii) productivity enhancement and research support; (iii) technology dissemination; (iv) product development and market promotion; and (v) monitoring and evaluation.

32. **Key Contributions:** (i) On a pilot basis, the project demonstrated that Bangladesh has the potential to produce quality silk and that sericulture can be an attractive income earning activity for rural women; (ii) the Bangladesh Sericulture Research and Training Institute (BSRTI) was separated from the Bangladesh Sericulture Board (BSB) and the legal framework of BSRTI was amended to provide full autonomy from BSB; (iii) BSB scaled down its commercial operations, including closing of two silk mills operated by BSB; (iv) the Silk Foundation (SF) was established as a forum for the NGOs, private sector and the Ministry of Textiles (MOT) to exchange ideas and forge partnerships to promote the development of silk sector.

(j) **Agriculture Services Innovation and Reform Project (1999-2003)**

33. **Project Objectives:** The objective of this Learning and Innovation Loan (LIL) project was to test and refine various agricultural technology transfer programs designed to foster more demand driven and locally responsive extension techniques. Specifically, the project aimed to (i) provide support through Hortex to promote horticulture production and export activities; and (ii) test and develop methods for improving partnership programs between DAE and other extension providers (NGOs and private entrepreneurs) in providing extension.

34. **Project Components:** (i) Provision of support through Hortex to promote horticultural exports; (ii) strengthening implementation of NAEP at the upazilla, district and national levels through extension partnership programs; and (iii) small-scale pilot trials and demonstrations with respect to on-farm water management, village level soil fertility management, and crop yield forecasting and weather advice to farmers.

35. **Key Contributions:** (i) Strengthening of Hortex to promote exports of horticultural crops; (ii) testing of partnership programs (multi-donor and multi-stakeholder) to provide agricultural extension to farmers, particularly at the Upazilla level in efforts to further refine implementation of NAEP.
Annex 3: Horticulture Export Development Foundation (Hortex)

1. Horticulture Export Development Foundation, in short, Hortex Foundation¹, was established at the initiative of GOB in 1993 with support under the Bank-financed Agricultural Support Services Project (ASSP). Hortex was registered under the Companies Act, 1913 (Registration # C-323 (11)/93) and operates as a not-for-profit association within the meaning of Section 26 of the Act. It started functioning in June, 1996 and received further financial and technical assistance support under the Bank-financed Agricultural Services Innovation and Reform Project.

2. At the time of establishment, the mandate of Hortex was to develop, promote and market exportable horticultural produces, particularly high-value non-traditional crops to high-price markets. In March, 2003, the Memorandum and Articles of Association for Hortex was amended to allow it to promote other areas of agribusiness as well.

3. The affairs of the Hortex Foundation are managed by a Governing Body of 7 Directors with Secretary, Ministry of Agriculture, as the Chairman. The Directors of the Governing Body are elected/nominated for a fixed term of 3-year by the General Body, which presently consists of 17 members. The Chairman is, however, elected/re-elected on yearly basis after every Annual General Meeting (AGM): The day-to-day administration of the Foundation is the responsibility of the Managing Director.

A. Activities Supported by Hortex

4. Hortex Foundation works through NGO and private sector firms/farms having MOUs with it and provides them technical assistance and support services for export development of horticultural crops and other agribusiness products. In support of its main objective of providing business development services, the major activities supported by the Foundation have included:

(a) Development of a model zone for export oriented production and marketing of horticultural produces by providing demonstration inputs such as quality seeds, fertilizers, pesticides, training and technical assistance.

(b) Jointly with the partner organizations, introduction of contract farming system.

(c) Help with the selection of appropriate varieties and other agronomic techniques for producing high value horticultural crops.

(d) Identification of mainstream markets and development of linkage with potential buyers in Europe and elsewhere.

(e) Assistance in improvement of the quality and marketing system of traditional horticultural crops to international market.

(f) Introduction of improved packaging cartons of international standard.

(g) Provision of training to improve production, harvesting, post-harvest handling practices and cool-chain management to improve quality.

¹ Based on information extracted from a brief prepared by Hortex.
(h) Facilitated development of local sources of seeds for non-traditional horticultural crops and introduced new varieties adapted to the local conditions.

(i) Established a trade name and mark for Bangladesh fresh produce abroad.

(j) Encouraged diversification of horticultural export crops to ornamental plants, frozen vegetables and orchids.

(k) Participated in international fairs, fielded marketing and study missions, conducted market research, subscribed to various overseas marketing network services and disseminated market information to exporting community and other concerned agencies.

B. Early Achievements

5. During the implementation period of ASIRP (July, 1999 – March, 2003), highlights of the achievements of the Hortex Foundation, jointly with its partners, principally BRAC, are summarized below.

<table>
<thead>
<tr>
<th>Performance area</th>
<th>Target</th>
<th>Achievement</th>
<th>% Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export by volume (MT)</td>
<td>870</td>
<td>1300</td>
<td>149</td>
</tr>
<tr>
<td>Export by FOB value (Million Tk.)</td>
<td>32.62</td>
<td>66.23</td>
<td>203</td>
</tr>
<tr>
<td>Area cultivated (Ha)</td>
<td>109</td>
<td>128</td>
<td>118</td>
</tr>
<tr>
<td>Contact farmers (No.)</td>
<td>2,000</td>
<td>3,371</td>
<td>169</td>
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<tr>
<td>Rural employment at farm level (person/days)</td>
<td>66,178</td>
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<td>125</td>
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C. Performance Evaluation

6. An independent impact evaluation study on Hortex as well as the project completion report of ASIRP found performance of Hortex to be satisfactory. The general consensus is that Hortex has contributed to a better understanding of production parameters, such as varietal selection, time and method of crop production, post harvest grading, packing and chilling. However, it must be emphasized that Hortex has largely worked with one major customer, BRAC, an NGO, with its own highly successful program of rural development. In other words, Hortex has not been very successful in helping the private sector entrepreneur dealing with high value agriculture. BRAC, with help from Hortex, was successful in establishing reputation for exporting produce in the domestic market and a trade market (logo) in international markets. Hortex facilitated the increase in the volume of product exported. Now, BRAC has in-house technical and managerial capacity to support all phases of value chain in vegetable production for export and has successfully obtained Eurogap certification for exporting fresh vegetables.

D. Present Status

7. Presently, there is no donor-funded project under implementation by Hortex. It has had limited success in generating sufficient revenues to finance all services provided to partner organizations. It is, however, continuing some of the business development services through limited funds generated by service
charges and ‘seed’ funds provided by the government. Hortex has prepared a five year business development plan but it is quite clear that without greater government support and/or external assistance it would not be able to finance its implementation.

8. The Hortex Foundation has helped in initiating the process leading to export of high value horticultural products from Bangladesh. At the same time, it has been successful in creating awareness about specific requirements in the area of production, quality and export marketing of horticultural crops, particularly fresh vegetables. However, for Hortex to play a significant role in the growth of high value agriculture in the future continued financial support from the government would be necessary.

9. Furthermore, Hortex needs to be much more active in promoting the development of value chain with private entrepreneurs and farmers, and in finding solutions to emerging problems faced by the producers, processors and exporters of high value agriculture.

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2 The Ministry of Finance provided a grant of Tk.5.00 crore for use as seed money by Hortex Foundation. This money is presently kept with a bank as FDR and the interests generated there from are assisting Hortex to continue its regular activities.
Annex 4: Promoting High Value Agriculture

1. For the purposes of this report, the high value agriculture (HVA) includes horticultural crops (fruits and vegetables), animal products (meat, milk and poultry) and fisheries (fish and shrimp). Most of the information provided in this annex relates to vegetable crops and shrimp production.

A. Importance of High Value Agriculture

2. A recently completed World Bank study of the rural non-farm sector in Bangladesh has shown that the growth in rural income, since the late 1980s to early 90s, was largely due to the increasing non-food crop production, high value agriculture and marketing activities. The fastest growing economic activities were business and trade, followed by non-rice agricultural crops, primarily horticulture, and shrimp. The estimated annual growth rates in the agricultural GDP sub-sector between 1997/98-2002/03 were estimated to be:

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<th>Sector</th>
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<tr>
<td>Crops</td>
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<td>Forestry</td>
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3. Increased crop production was largely due to higher productivity of cereals, especially rice, based on the green revolution technologies and expansion of irrigated rice production during the ‘boro’ (dry season). Amongst the horticultural crops, vegetable production grew almost 20% per annum, but there was little change in fruit production. Increase in livestock production was largely due to poultry, which has grown rapidly with strong forward linkages with poultry processing. The growth in the fisheries sub-sector has been largely contributed by aquaculture and the increasing shrimp exports. Tiger prawn production, which accounts for over 80% of exports, grew over 20% per annum over the last 15 years with forward linkages with the processing units. Thus, the two critical factors contributing to the growth have been the improved technologies and forward linkages with processing and markets, both domestic and international.

4. Recent information reported by the Bank in the Agriculture and Rural Development Strategy shows that within the food sector, the market for non-cereal commodities is strong. For example, fruits, fisheries and livestock products are claiming a larger share of the incremental income, especially in the urban areas and there is increasing opportunity for exports to the overseas market. The growing demand for high value commodities and a reduction in real prices of staple cereals has encouraged many farmers to allocate increased area to cultivation of high value crops, e.g. spices, vegetables and potatoes, at the expense of other crops. The diversification to HVA has considerable unexploited growth potential in the future, and, if the current trend continues, the supply of non-cereal food commodities would need to be much higher to meet the increasing demand.

5. In general, production of high value commodities tends to be more labor intensive. In Bangladesh the average number of labor days per hectare required for vegetable production is about 338 days as compared to about 133 days for cereals. These commodities usually have higher market integration than is the case for cereals. For example, in Bangladesh, it is estimated that farmers, on an average, sell 96% of their vegetables as compared to only 19% of their cereal output (Weinburger and Lumpkin, 2005). Due to the

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perishable nature, these commodities also require some local value addition through post-harvest processing. As a result, an expanding HVA can generate additional employment and become an important contributor to growth of the rural farm and non-farm economy. However, due to high cost of production, variable yields (resulting from limited availability of improved varieties and greater susceptibility to both biotic (pest and diseases) and abiotic (e.g. soil quality, drought stress) factors and price fluctuations related to supply and demand, production of high value crops tend to be more risky, especially for the small and marginal farmers with limited resources.

B. Public Agricultural Research and Extension and HVA

(a) Agricultural Research

6. At present, the technology needs of farmers entering HVA is largely being met by the private sector. As compared to cereals, especially rice, other commodities have received little attention from the public research institutions. Limited research on fruits and vegetables is undertaken at the Horticulture Research Center (HRC) of BARI. It has released some varieties of different crops, including papaya, guava, leaf vegetables and tomatoes. However, impact of these varieties has been limited, partly due to problems related to availability of seed. BARI also undertakes limited work on processing of fruits and vegetables through its Post-harvest Technology Division. However, it has limited resources and capacity to undertake significant research on post-harvest management issues concerning growers and processors.

7. It is likely that the private sector would continue to meet the short-term technology needs of farmers and processors through direct introduction and adaptation of readily available technologies from other countries, particularly in Asia. However, problems requiring medium to long-term work in Bangladesh, e.g. to develop high yielding varieties/breeds suited to local conditions with pest and disease resistance/tolerance, improved nutritional content, product quality and safety, would require attention from the public research institutions. The research system, therefore, needs to reassess priorities in the light of changing needs and allocate additional resources to research that directly addresses the growing needs of farmers diversifying their production systems to include HVA. The issues requiring attention include the need for genetic improvement of both the exotic crops as well as of traditional vegetables, which often are an important source of minerals and vitamins in the diet of poor households.

8. As there is limited capacity in the private sector to produce the breeder/basic seed of horticultural crops, the public institutions would need to bridge the gap in the foreseeable future, with support from the private sector for further multiplication, marketing and distribution of the selected varieties. Another important area for public sector research is the development of integrated pest management (IMP) practices, which are a serious threat to safe and cost effective cultivation of the horticultural crops. Most common method of pest control at present is the use of pesticides, often leading to unacceptable residues due to misuse. In addition to pesticide residues, fruits and vegetables production in Bangladesh would also require monitoring for contamination from heavy metals, i.e. arsenic, lead and cadmium. These contaminants in fresh fruits and vegetables are serious issues, especially for export markets, and need to be part of any food quality and safety assurance scheme. To reduce large post-harvest losses, estimated to be over 30%, there is a need for research on low-cost techniques for cleaning, packing, storage and transportation.

(b) Agricultural Extension

9. The main function performed by the Department of Agricultural Extension (DAE) at present (through Horticultural Centers) seems to be the distribution of subsidized planting material of some fruit crops. However, in view of the increasing importance of horticultural crops, it is now considering the establishment of a Horticulture Development Wing to provide extension support to farmers and private entrepreneurs in production and processing of high value crops. DAE’s support for promotion of producers
groups/organizations and contract farming can help to meet the extension needs of farmers and accelerate growth of HVA.

10. The Department of Fisheries (DOF) is providing extension service to fishermen, especially for aquaculture and for shrimp farming. Shrimp farming is an important component of HVA but yields at present are very low. Under the World Bank-financed assisted Forth Fisheries Project the plan was for DOF to expand support for environmentally and socially appropriate small-holder shrimp production in selected areas. However, due to long delays in establishing ownership and lease-free status of land areas, very little progress had been made in promoting improved production systems. The main source of new technologies at present seem to be the USAID-funded Agro-based Industries and Technology Development Project (ATDP), which has introduced a number of new methods of growing shrimps in Bangladesh. Although, most shrimp farmers are still using traditional technologies, there seem to be some interest amongst progressive growers with resources to try out new methods. The Directorate of Livestock Services (DLS) has also facilitated the development of commercial poultry industry through demonstrations, technology transfer, veterinary services and subsidized input supply.

C. Commercial Experience with High Value Agriculture

(a) Exports of Fresh Vegetables

11. Hortex (see Annex 3 for more information on Hortex), estimates that Bangladesh exported about 12,761 MT of fresh vegetables (French green beans, chili, okra, bitter gourd, yard long bean, broccoli) in 2001-2001, mainly to Middle East (70%), European Union (EU; 25%) and SE Asia (Singapore, Malaysia; 5%). Although, in comparison to other major exporting countries, present exports of fresh vegetable from Bangladesh are miniscule, the potential for growth is significant and the industry expects it to grow at around 25-30% per year over the coming 5 years.

12. Bangladeshi exports are largely sold in the ethnic market (about 98%) where the customer prioritizes the type of vegetable and its origin and accepts certain quality variations and flaws. The other, very small, market (about 2%) is with mainstream supermarkets where retail customer insists on consistently high quality. However, investigations undertaken by Hortex have shown that Bangladeshi producers can deliver a wide range of vegetable to meet both ethnic and supermarkets quality standards (Table A4.1).

13. There are five major exporters of fresh produce from Bangladesh. Bangladesh Rural Advancement Committee (BRAC), an NGO, exports about 97% of the total. The remaining four private exporters (Crown Fruits and Vegetables, APBL, AP, and Badhon Enterprises) export about 3% between them. Exports leave Dhaka each week, mostly on flights operated by BIMAN, British Airways and Gulf Air.

14. BRAC entered this field in late 1990s and applied its long experience of working with rural communities and resources to help farmers to produce export quality vegetables. In the beginning BRAC received some financial as well as technical assistance from Hortex (through a World Bank supported project) in promoting high quality vegetable production methods, post-harvest management systems which helped in the establishment of a successful French green bean export business. Now, BRAC has in-house technical and managerial capacity to support all phases of value chain in vegetable production for export.

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3 Information extracted from (a) literature supplied by the Hortex Foundation, Dhaka, Bangladesh, and (b) a World Bank report entitled ‘Bangladesh: Growth and Export Competitiveness’, May 4, 2005.
**Table A 4.1**

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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Broccoli</td>
<td>1.00</td>
<td>-</td>
<td>4.00</td>
<td>300</td>
<td>4.00</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ridge gourd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Leafy vegetable</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Others</td>
<td>5.00</td>
<td>-</td>
<td>1.00</td>
<td>-80</td>
<td>3.00</td>
<td>200</td>
<td>43.92</td>
<td>1364</td>
<td>71.54</td>
<td>63</td>
<td>128.99</td>
<td>80</td>
</tr>
<tr>
<td>Total</td>
<td>169.00</td>
<td>-</td>
<td>262.00</td>
<td>55</td>
<td>461.00</td>
<td>76</td>
<td>680.06</td>
<td>48</td>
<td>693.47</td>
<td>2</td>
<td>871.00</td>
<td>26</td>
</tr>
</tbody>
</table>

**Note:**
* Approximately, 90% of these exports go to ethnic markets
**Over the corresponding period of the preceding year

Source: Hortex Foundation, Project Completion Report, March 2003 and Hortex Quarterly Newsletters
(b) Production and Processing of French Green Beans For Export

15. **Background.** Since 1997 French green bean (*Phaseolus Vulgaris L*) (variety Amy) is being produced in Bangladesh for export to European Union countries (which is the largest market in the world for fresh fruits and vegetables) and the Middle East. BRAC accounts for the largest share of fresh vegetable exports.

16. **French bean Production.** BRAC contracts about 300 growers in Shipu and Chandina areas and provides them with extensive technical assistance to produce and deliver export quality beans to its packing houses located in the production areas. French beans are available from mid-November to mid-March and, according to Hortex, Bangladesh exported about 73 MT in 1999-2000; 100 MT in 2000-2001; 78 MT in 2001-2002.

17. It is estimated that in 2004 farmers produced beans at a cost of Tk 69,955/ha. At an average yield of 8750 kg/ha, this works out to a production cost of Tk 7.99/kg ($0.14 kg/ha at an exchange rate of Tk 57 = $1). Prices paid to farmers were:

- Very fine beans (diameter 5-6 mm; about 45% of harvest) : 20 Taka/kg
- Fine export quality (diameter 6-7 mm; about 35% of harvest) : 15 Taka/kg
- Local quality (diameter >7 mm; about 20% of harvest sold locally) : 3 Taka/kg

18. According to the study, the three main cost items in the production cycle are:

- Planting (including labor and seeds) : 15,586 taka/ha (about 24%)
- Fertilizer (DAP, Urea, Muriate of Potash, Gypsum, Zinc Sulphate, Farmyard manure) : 9016 taka/ha (about 17%)
- Harvesting : 19,000 taka/ha (about 28%)

19. The study highlighted the need for support from the research system in reducing the cost of seed (at present 15% of overall production costs) by producing it locally or through introduction of more productive varieties. The labor costs, which account for a significant proportion of planting (about 30%) and harvesting (about 96%), can be reduced by increasing labor productivity. In the case of fertilizers, the study concluded that the Bangladeshi farmers seem to be applying very high rates of fertilizers compared to other French bean producing countries. There is a need for further research to establish the optimal cost/benefit and mix of fertilizers to reduce the application rates. This work is particularly important as farmers in Bangladesh are paying higher prices for DAP compared to other countries in the region.

20. More recently, agricultural research supported by BRAC and Hortex has identified a new variety of French bean which increases yield by as much as 50%. This has significantly enhanced the profitability of French bean cultivation, especially in Chandina, Comilla area, and has further emphasized the need for improved technologies as a means of enhancing competitiveness.

21. **Post-harvest Handling and Processing.** Processing of French bean consists of seven value adding activities. These include: sorting/cleaning, grading, cooling, packing, transport to airport, inspection and air freight. Based on these value adding activities, the cost of processing of French bean has been estimated at about Tk 99/kg ($1.74/kg). The air freight represents the highest cost factor amongst these activities, accounting for about 86% of the cost. Access and cost of air freight strongly influences the competitiveness of horticultural exports generally and are important constraints in increasing exports from Bangladesh particularly. The shipping cartons used by exporters are quite expensive, partly because of protection given to local producers of packaging materials in Bangladesh. There is a need for less expensive good quality,
packing and wrapping materials for international transport to reduce the overall cost of post-harvest handling and processing.

22. **Summary of Constraints Faced by the Horticulture Sector.** The likely constraints, possible solutions and needed actions for promoting horticulture in Bangladesh are summarized in Table A4.2.

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Possible Solution</th>
<th>Action by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited research capacity in the public and the private sectors to develop technologies, including appropriate varieties, seed and crop management (fertilizer, pests, irrigation) practices</td>
<td>Increased investment in horticultural research and improved targeting of resources on priority issues based on market signals</td>
<td>NARS - through the public or public-private partnership research</td>
</tr>
<tr>
<td>Low labor productivity</td>
<td>While labor costs are competitive with other producing countries in a similar situation, overall costs of some operations (planting and harvesting) can be reduced by increasing labor productivity. This can be achieved by providing training to improve efficiency of cultural practices (seeding, weeding), harvesting techniques and by use of more appropriate farm implements</td>
<td>Agencies practicing/entering contract farming, machinery manufacturers and public institutes, especially to look at the socio-economic implications of mechanization.</td>
</tr>
<tr>
<td>Absence of food safety and quality standard regulations</td>
<td>Develop guidelines/regulations, consistent with requirements of the importing countries, especially EU, to ensure that production, processing and storage follow good practices. This would help to enlarge export volume and broaden markets to include supermarkets.</td>
<td>Concerned public institutions, including agricultural research, in consultation with the private sector</td>
</tr>
<tr>
<td>In general, unorganized smallholders with limited experience of high value agriculture and contract farming.</td>
<td>Organize farmers into commodity associations and identify resource persons amongst them who can be trained to help members with better production, harvest and post-harvest handling techniques to meet the volume and quality of export demand. At the same time, greater emphasis on development of linkages with the private sector for contract farming would provide assured markets.</td>
<td>NGOs, the private sector and public extension service</td>
</tr>
<tr>
<td>Lack of cold storage facility at the airport, which, due to frequent delays in obtaining cargo space, leads to deterioration of quality and increase in rejection rate</td>
<td>Facilitate establishment of privately owned cold storage facility at Dhaka airport</td>
<td>GOB policy and the private sector</td>
</tr>
<tr>
<td>Lack of cargo space and BIMAN monopoly on all air cargo handling</td>
<td>GOB should adopt open sky policy and allow competition in air cargo handling</td>
<td>GOB</td>
</tr>
<tr>
<td>Export quality shipping cartons are very expensive</td>
<td>GOB should lift ban on imports of cartons to encourage competition</td>
<td>GOB</td>
</tr>
<tr>
<td>Poor rural roads</td>
<td>Better rural roads needed to improve access and produce quality</td>
<td>GOB</td>
</tr>
<tr>
<td>Inadequate and unpredictable power supply</td>
<td>Improve power supply to reduce cost and spoilage of stored produce both in packing houses and frozen food manufacturing places</td>
<td>GOB</td>
</tr>
<tr>
<td>Weak national and international communication system leading to loss of business</td>
<td>Introduction and greater availability of mobile phones has helped but further improvements in communications infrastructure are needed.</td>
<td>GOB</td>
</tr>
</tbody>
</table>
(c) Shrimp Farming and Processing for Export

23. **Background.** Increasing exports of shrimp, especially tiger shrimp, since late 1980s, have made it an important means of reducing poverty and increasing income in rural areas involved with this activity. This industry generates over US$300 million in foreign exchange earnings. There are now over 37300 farms cultivating Bagda (tiger shrimp). There are 124 shrimp processing factories mostly in Khulna and Chittagong areas and over 40 hatcheries, mostly in Cox’s Bazar. Despite these gains, the industry suffers from production inefficiencies and is exposed to serious social and environmental risks related to coastal ecosystem and destruction of mangrove forests. As majority of farmers follow traditional (semi-extensive) methods of shrimp farming, yields are generally low and few follow the Hazard Analysis and Critical Control Point (HACCP) for maintaining a quality standard which is applicable at all stages of production. Adoption of HACCP method would require a shift to more intensive farming methods. In general, the small shrimp farmers lack capital, training and motivation to change the production system.

24. **Production and Processing.** The steps involved in shrimp production and processing include: raw material production, weighing and washing, sizing and grading, de-heading, laying and freezing, package and storage and administration and export.

25. Raw Material Production is the most expensive and critical part of the production cycle. There is great demand and shortage of land on which ponds are prepared. This increases the cost of land as well as social conflicts. The basic material for shrimp production is fries or Post Larvae (PL), locally called ‘Pona’. There are 44 hatcheries producing Pona, most of them are in and around Cox’s Bazar in the southeastern part of Bangladesh. To collect eggs, hatcheries buy mother shrimp through brokers from sea going ships that catch natural shrimp. Mother shrimps are reared in tanks for 2-3 days until the egg separate. Eggs are fertilized for 24 hours from which nuplis are produced. Nuplis are moved to bigger tanks where in 10 days they turn to larvae or PL. The feed used by hatcheries largely consists of dried Artemisia and is imported from Thailand and/or USA. At Tk 30,000/ton, the feed is very costly.

26. Ex-hatchery price is around Tk 108/1000 PLs. PLs are procured by brokers from hatcheries who transport these by air to Jessore taking the landed price to about Tk 245/1000 PLs. From Jessore airport, a broker takes them to wholesale market in Khulna district and sells them at about Tk 262/1000 PLs. From the wholesalers another group of brokers sells it to farmers at the rate of Tk 310. Most of the ponds and processing units are located the Khulna district. Involvement of several brokers at different stages is not only inefficient but also increases the cost of PLs to farmers. Another factor which adds cost to the production of shrimp is the high cost of feed.

27. Vast majority of farmers raise shrimp from PLs in ponds using the traditional method. PLs used under this method are not tested for viruses. Virus tested PLs (using Polymerase Chain Reaction machine) cost an additional 30-40% with a farm gate price of Tk 430-450/1000, but have low mortality rate. Yield of shrimp using traditional method is around 400 kg/ha. Under ATDP, a number of improved technologies, especially better pond preparation, virus tested PLs and feed, have been promoted to farmers, which cost about 60% more than traditional methods but provide 3 times more yield at over 1200 kg/ha.

28. **Distribution and Processing.** The distribution chain from farmer to processor involves a number of steps starting with Farias, who buy shrimps from producers, and changes hands twice more (sub-agent and depot agent) before reaching the processor. In this process the price of about Tk 280/kg that farmer gets increases to about Tk 366 that processor pays at factory gate. At the factory, shrimps are graded, weighed, sized and washed before being beheaded and frozen either in a block or individually quick frozen (IPQ). Following another round of grading, shrimps are put in cartons and transported to the port.

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4 The name of fries varies based on their age from eggs (nupli) to fries (pona) to larvae to post larvae (PL).
29. Current average utilization of factory capacity is low at around 30%. Quality control at factories has been a problem in the past resulting in a EU ban on imports of fishery products from Bangladesh. This included poor hygiene at factories and insufficient guarantee of quality control by Bangladesh government inspectors. However, since then the situation has improved considerably with major efforts by plants and the government to meet EU standards which led to lifting of the ban on exports. Many plants now spend about 15% of their overheads costs on quality control. As a result, some exporters are now recording an average unit price of more than $15 per kg, a price comparable to that received by major exporters from the region. However, despite this improvement, profitability of shrimp production in Bangladesh is low compared to other countries because of high cost of raw material. A comparison with Indonesia, included in the report, showed that the estimated cost of raw material for Bangladesh was $4.04/kg as compared to $2.57 for Indonesia. An important contributing factor to higher raw material cost in Bangladesh is related to the cost farmers and others must pay to non-value added brokers (which also makes it difficult to enforce the traceability requirements). A similar comparison of administration and export cost shows this to be much higher in the case of Bangladesh. As a result, the FOB price of producing black tiger shrimp in Indonesia was estimated at around $3.78 as opposed to $5.20 to 6.30 for Bangladesh.

30. **Summary of Constraints faced by the Shrimp Sector.** The likely constraints, possible solutions and needed actions for promoting shrimp exports in Bangladesh are summarized in Table A4.3.

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Possible Solution</th>
<th>Action by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low productivity due to poor knowledge and technologies</td>
<td>Enhance knowledge of hatcheries about better production and transportation techniques and provide training to farmers and others in the chain in improved production techniques; develop vocational training modules in conjunction with appropriate existing educational institution</td>
<td>Public research and extension service and the private sector</td>
</tr>
<tr>
<td>Collusion between suppliers throughout the value chain keeps prices on a number of inputs artificially high</td>
<td>Promote and empower producers groups/ associations and improve access to credit to enable bulk procurement of inputs by farmer groups</td>
<td>Extension service/NGOs</td>
</tr>
<tr>
<td>Safety regulations not well entrenched due to weak enforcement of safety, environmental, phytosanitary and labor regulations during production and processing stages</td>
<td>Build human capacity, improve testing facilities and improve enforcement</td>
<td>Concerned government agencies</td>
</tr>
<tr>
<td>Weak forward linkages and limited ability to develop and build new markets.</td>
<td>Develop capacity through training and better market intelligence and formation of new linkages</td>
<td>Industry association and public agencies like Hortex.</td>
</tr>
<tr>
<td>Poor infrastructure reduces competitiveness, especially due to geographic separation of shrimp hatcheries, production and processing regions</td>
<td>Improve rural infrastructure</td>
<td>GOB</td>
</tr>
<tr>
<td>High cost and erratic power supply forcing processors to rely on even higher cost power from dedicated diesel generators</td>
<td>Improve power supply</td>
<td>GOB</td>
</tr>
</tbody>
</table>
D. Strategy to Promote HVA

31. The proposed strategy adopts two pronged approach to the promotion of HVA. The first element of the strategy is to give priority attention to constraints that can be directly addressed by the technology system. These include:

- **Greater investment in research and extension in support of HVA.** In view of low productivity and absence of suitable technologies for many HVA activities, greater allocation of resources to bridge this gap is considered a high priority. Specific areas of research would need to be demand driven based on market signals. Possible areas for intervention have already been highlighted.

- **Promotion of the private sector-led contract farming.** To ensure that farmers practicing HVA have access to assured markets, timely access to credit, inputs and technical support, considerable attention should be given to promotion of contract farming involving the public sector, the private sector and the NGO. However, in promoting this approach, it would be important to learn from both national and international experiences of producers as well organizations purchasing the HVA produce to avoid conflicts and misunderstandings. An early assessment of the current situation in Bangladesh, discussed in Annex 5, has highlighted the need for development of broad guidelines for transparent contractual arrangements, strong emphasis on capacity building and provision of good quality inputs and on-going technical support.

- **Capacity building of research scientists and extension functionaries to support HVA.** As the focus of attention in the public research and extension institutions has traditionally been the food crops, they lack necessary skills and knowledge to address needs of the HVA. It would be necessary, therefore, to build capacity of the technology system to respond to the changing needs of the sector.

- **Building social capital of farming communities.** Given the level and status of participation in HVA by small and marginal farmers, support for building of social capital through formation and empowerment of producers organizations is essential to gain access to markets, improve responsiveness of the public institutions and to encourage poor and marginal farmers to participate in setting of development agenda that meets their priority needs/goals. Empowerment of farming communities would also progressively strengthen their ability to negotiate more balanced social, financial and economic relationships with other more powerful members of the society.

- **Strengthening of regulations and their implementation governing HVA.** Technical assistance is needed to develop appropriate food safety and quality standards, including biosafety of GMOs. These standards meet requirements of the export markets and improve the situation at home. Concurrently, it would be necessary to build capacity of all stakeholders and enhance awareness of the need for better enforcement of safety, quality and environmental regulations.

- **Establishment of effective system for collection and distribution of market information.** Timely availability of relevant market information is a constant problem for farmers. Timely collection and distribution of market information would help farmers to take advantage of emerging opportunities in the domestic and export markets.

32. The second element of the strategy advocates a more pro-active role in influencing government policy and the public as well as the private investment in areas which are not under the direct control of the technology system. For example, a targeted policy analysis and/or socio-economic research may be able to suggest priorities for public investment in improved transport infrastructure, market infrastructure, delivery of finance and provision of legal and regulatory framework (property and bankruptcy law, intellectual property rights, licensing law, company and cooperative law) to facilitate private investment. Provision of
business development facility to small rural entrepreneurs to increase private sector investment in agro-
processing.

33. Bangladeshi farmers can produce export quality high value agricultural products for which there are
growing markets. Experience of BRAC and Hortex has shown that growers and exporters need step-by-step
assistance to overcome problems associated with production, post-harvest handling, shipping and marketing.
For future expansion of HVA in Bangladesh, therefore, farmers would need to have reliable access to suitable
technologies, credit, efficiently operating markets and greater involvement of the private sector. Other
requirements for the growth of HVA include: improved infrastructure (roads, ports, air freight, power, cold
storage), better business environment for the private sector, and transparent and effective legal and regulatory
framework for food quality and safety assurance that takes into account the phyto-sanitary requirements of
the export markets.
Annex 5: Experience with Contract Farming

1. Bangladesh has limited experience with contract farming. Three case studies are summarized in this annex. These are (i) French bean contract farming by BRAC (an NGO); (ii) potato seed contract farming by BADC (a public sector enterprise); and (iii) aromatic rice contract farming by PRAN (a private sector agribusiness enterprise).

A. French Bean Contract Farming by BRAC

2. The Bangladesh Rural Advancement Committee (BRAC), in an effort to promote economic well-being of the rural farmers, undertook a program to reduce the barrier for domestic farmers to sell their produce to international export markets. BRAC, in collaboration with the Hortex Foundation, ventured into a contract farming program for producing French Bean in 1997 in both Chandina and Gazipur (which was later dropped due to lower quality soil and weaker farming skills of vegetable growers).

(a) Process of Farmer Identification

3. French beans are usually grown in Chandina area during the early part of October to early part of March, since cooler weather conditions are required for cultivating the crop. The composition of the contractual farmers was 90% men (landless or marginal farmers i.e. having less than 50 decimal are of land). Of the rest 5% were marginal women farmers and the other 5% were small farmers who had more than 50 decimal land. From the start of the program in 1997 and till 2002 the total number of contract farmers was over 3,665. The number of contact farmers grew with 61 farmers producing 32 Metric Tons of the vegetable in 1997-1998 to 965 farmers with 272 Metric Tons by the end of December 2002.

(b) Contract

4. The contract between the farmers and BARC specified the price, quality and quantity of the produce. It was a formal contract in nature, but was not a legal contract in the sense it could not be used in court. Most of the conditional ties like supervision, monitoring etc. were all informal (perhaps in verbal agreement between farmers and BRAC).

(c) Cost of Production

5. All the required material inputs were provided by BRAC. This included seeds, fertilizer, pesticides and other required materials. Since BRAC had a local village organization of farmers, it was easier for BRAC to administer the program with close supervision. All the logistical support was provided by BRAC. The management of inputs were carefully administered by BRAC. BRAC’s extension officers trained the contract farmers, gave them necessary inputs and monitored the cultivation process. The cost of the inputs was deducted from the final payment received by the farmers. BRAC also provides financial assistance in the form credit to these farmers. During the period from 1997 to 2002 the number of farmers trained by BRAC extension agents increased from 100 to 2412. Also during harvest time, there were additional employment created. A total of 84,397 people were employed from 1997 to 2002 at farm level and during the same period some 42,555 were simultaneously engaged for packaging the produce. This was a good source of income and employment for the village community.
6. The French beans were graded into three categories: very fine, fine export quality and local quality. The farmer is paid according to the type of French bean. The very fine variety receives TK 20/Kg, the fine export variety receives TK 15/Kg and the local quality receives Tk 3/kg. The average cost of production for French bean at the farm was TK 7.92/Kg.

<table>
<thead>
<tr>
<th>Stage/ Item</th>
<th>Taka/ Hectare</th>
<th>Taka/ Kg*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Production:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Land Preparation</td>
<td>5876</td>
<td>0.67</td>
</tr>
<tr>
<td>(ii) Planting:</td>
<td>16156</td>
<td>1.84</td>
</tr>
<tr>
<td>(a) Labor cost</td>
<td>4932</td>
<td>0.56</td>
</tr>
<tr>
<td>(b) Seeds</td>
<td>10000</td>
<td>1.14</td>
</tr>
<tr>
<td>(c) Electricity</td>
<td>1137</td>
<td>0.13</td>
</tr>
<tr>
<td>(d) Water</td>
<td>67</td>
<td>0.01</td>
</tr>
<tr>
<td>(iii) Fertilizing:</td>
<td>11892</td>
<td>1.36</td>
</tr>
<tr>
<td>(a) DAP</td>
<td>3112</td>
<td>0.36</td>
</tr>
<tr>
<td>(b) Urea</td>
<td>1334</td>
<td>0.15</td>
</tr>
<tr>
<td>(c) Murate of Potash</td>
<td>1976</td>
<td>0.23</td>
</tr>
<tr>
<td>(d) Zinc Sulfate</td>
<td>371</td>
<td>0.04</td>
</tr>
<tr>
<td>(e) Farmyard manure</td>
<td>741</td>
<td>0.08</td>
</tr>
<tr>
<td>(f) Gypsum</td>
<td>1482</td>
<td>0.17</td>
</tr>
<tr>
<td>(g) Other costs</td>
<td>2876</td>
<td>0.33</td>
</tr>
<tr>
<td>(iv) Spraying/ Pesticides</td>
<td>6506</td>
<td>0.74</td>
</tr>
<tr>
<td>(v) Weeding</td>
<td>4757</td>
<td>0.54</td>
</tr>
<tr>
<td>(vi) Harvesting</td>
<td>19447</td>
<td>2.22</td>
</tr>
<tr>
<td>(a) Labor cost</td>
<td>17502</td>
<td>2.00</td>
</tr>
<tr>
<td>(b) Other costs</td>
<td>1945</td>
<td>0.22</td>
</tr>
<tr>
<td>(vii) Transport to packaging house</td>
<td>4687</td>
<td>0.54</td>
</tr>
<tr>
<td>Total Production Cost</td>
<td>69302</td>
<td>7.92</td>
</tr>
<tr>
<td>2. Farmers Profitability:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Returns to the Farmer</td>
<td>60636</td>
<td>6.93</td>
</tr>
<tr>
<td>(A) Price paid to Contract farmers**</td>
<td>129938</td>
<td>14.85</td>
</tr>
<tr>
<td>3. Processing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Sorting/ Cleaning</td>
<td>1730</td>
<td>0.20</td>
</tr>
<tr>
<td>(ii) Grading</td>
<td>11246</td>
<td>1.29</td>
</tr>
<tr>
<td>(iii) Cooling</td>
<td>2595</td>
<td>0.30</td>
</tr>
<tr>
<td>(iv) Packing:</td>
<td>67200</td>
<td>7.68</td>
</tr>
<tr>
<td>(a) Labor cost</td>
<td>5981</td>
<td>0.68</td>
</tr>
<tr>
<td>(b) Carton</td>
<td>52483</td>
<td>6.00</td>
</tr>
<tr>
<td>(c) Wrapping Material</td>
<td>8736</td>
<td>1.00</td>
</tr>
<tr>
<td>(v) Transport to Airport:</td>
<td>22581</td>
<td>2.58</td>
</tr>
<tr>
<td>(a) Labor cost</td>
<td>14000</td>
<td>1.60</td>
</tr>
<tr>
<td>(b) Fuel for the use of refrigerated truck</td>
<td>8581</td>
<td>0.98</td>
</tr>
<tr>
<td>(vi) Inspections (local)</td>
<td>12112</td>
<td>1.38</td>
</tr>
<tr>
<td>(vii) Air Freight</td>
<td>747711</td>
<td>85.45</td>
</tr>
<tr>
<td>(a) Air Freight</td>
<td>735000</td>
<td>84.00</td>
</tr>
<tr>
<td>(b) Documentation</td>
<td>3739</td>
<td>0.43</td>
</tr>
<tr>
<td>(c) Inspection at destination</td>
<td>8973</td>
<td>1.03</td>
</tr>
<tr>
<td>(B) Total Processing Cost</td>
<td>865175</td>
<td>98.88</td>
</tr>
<tr>
<td>(C) Total Cost incurred by Processors (A+B)</td>
<td>995113</td>
<td>113.73</td>
</tr>
<tr>
<td>Market Price***</td>
<td>1147125</td>
<td>131.10</td>
</tr>
<tr>
<td>Processor’s/ Exporter’s Profit (BRAC)</td>
<td>152012</td>
<td>17.37</td>
</tr>
</tbody>
</table>

Note:
* Calculation based on average yield rate of 8750 Kg/ Ha
** Processors categorize French beans into three categories on quality based selection criteria. Average price paid by the processors is 14.85 Tk/ Kg
*** In March 2004, Tk. 131.10/ Kg represented a typical market price that a Bangladeshi exporter could earn for French beans delivered to the London airport.


The Table shows the breakdown of the value chain, with the net profit for BRAC at Tk 17.37/Kg of French bean. The farmer would make, in the form of returns to his land, management and any investment, about Tk 7.08 per Kg for the fine export variety and Tk 12.08 per Kg for the very fine variety. However, as shown in the Table, the average return to the farmer is about Tk 6.93/Kg.

(d) Issues

7. The first issue relates to contract breaching by farmers. There is little BRAC can do to prevent farmers from selling their produce to external markets through other agents when the prevailing market price is higher than the contract price. Usually the farmer would put up an excuse or a plea that somehow his produce has been damaged or stolen and he cannot meet the quantity specified. In the event the market price is lower than what BRAC has agreed to offer then the farmers will try to sell more than what is specified in the contract. This is not a problem with the French beans since BRAC is the only market outlet for it, it is a serious problem for other crops like chilli.

8. The second concern is related to cargo or freight space. BRAC complained that due to lack of sufficient cargo space they are not able to optimize their production. They have identified this as the number one concern relating to export of high value agricultural produce, which impacts on the long-term sustainability of contract farming.

(e) Future Prospects

9. According to BRAC, there is lot of potential for contract farming in Bangladesh. One of the major obstacle in the contract farming system of Bangladesh is in the supply chain to foreign markets. Due to size restrictions for cargo freight, there is not enough demand for the products of contract farming hence lower motivation for businesses to practice contract farming. As far as farmer is concerned, the main advantages of contract farming with BRAC are summarized below:

<table>
<thead>
<tr>
<th>Before contract farming</th>
<th>After contract farming</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Farmers were engaged in traditional vegetable farming, producing low value products.</td>
<td>• BRAC, with the help of Hortex Foundation initiated the cultivation of high value French bean.</td>
</tr>
<tr>
<td>• Farmers did not have an assured market for their product.</td>
<td>• Farmers have an assured market for their product.</td>
</tr>
<tr>
<td>• Farmers have to purchase the input required for cultivation.</td>
<td>• Farmers received inputs in advance and pay for them when they harvest the French bean.</td>
</tr>
<tr>
<td>• There was no extension service catering to French bean cultivation.</td>
<td>• Farmers received regular extension service from BRAC at free of cost.</td>
</tr>
<tr>
<td>• Farmers had to buy their own pesticides</td>
<td>• Farmers received pest control facilities at free of cost</td>
</tr>
<tr>
<td>• Farmers generally received less than market prices</td>
<td>• Farmers received usually a higher than the prevailing market prices.</td>
</tr>
</tbody>
</table>

B. Potato Seed Contract Farming by BADC

10. BADC (Bangladesh Agricultural Development Corporation), which is the Government’s seed producing agency, has been producing quality tubers with contract farming. BADC is the largest public sector enterprise in the country which supplies foundation tuber/seeds to farmers for potato and variety of other crops.

(a) Process of Farmer Identification

11. BADC has thirteen zones and there are blocks in each zones. Potato is usually grown in the Munshiganj district. The potato tubers are cultivated in areas like Rangpur, Jessore, Bogra. The contract farmers producing potato are large or medium farmers and are economically quite well off. Due to high investment needs, small and marginal farmers generally do not participate. There are about 3000 to 4000 contract farmers working with BADC for producing potato seed.
(b) **Contract**

12. The contract between the farmers and BADC is a legal contract made with stamped paper. The contract specifies the price, quantity and approximate time to provide the potato seed.

(c) **Cost of Production**

13. The contract farmers working for BADC usually obtain loans from the nationalized banks with BADC acting as the guarantor. The total cost of cultivating an acre of potato ranges from TK 25,000 to TK 30,000. The average loan size is about TK 20,000, which provides them financial means to purchase inputs like fertilizer, pesticide, irrigation cost. They usually utilize some of their own funds to finance potato cultivation. The BADC provides farmers with foundation tubers at TK 17 per Kg. About 700Kg of foundation seed would produce 10 M.Ton of replicable tubers per acre of land. These replicable tubers are sold to BADC at approximately TK 9 per Kg. BADC would buy about 5 M.Ton (these are the best quality tubers), about 2 to 3 M.Ton would be sold to private business and the rest is kept by the farmers for his own stock and replication. The farmer can replicate the foundation tuber at the maximum of three times. After that he has to purchase new foundation tubers from BADC. On an average, total revenue is about TK 65,000 per acre and given the cost is about TK 25,000, it leaves a profit of TK 45,000 per acre. This is in a single planting season so the annual income is far greater than this amount. The pesticide and fertilizer are usually part of the loan package with the banks issuing vouchers to buy these inputs from certain suppliers of farming inputs. As summarized below, the farmer benefits through contract farming:

<table>
<thead>
<tr>
<th>Without Contract Farming</th>
<th>With Contract Farming</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The farmers would probably continue traditional farming with relatively low returns for their land.</td>
<td>• A source of high income, as opposed to cultivating crops like rice. Because BADC provides the foundation tubers it is possible to do so.</td>
</tr>
<tr>
<td>• They would not have an assured market</td>
<td>• They have an assured market for their tubers.</td>
</tr>
<tr>
<td>• It would be very difficult for an individual farmer to receive loan from bank.</td>
<td>• They are able to receive loans from the nationalized banks, thus reducing financial stress.</td>
</tr>
<tr>
<td>• No development of skills would have taken place.</td>
<td>• The technical experts of BADC provide supervision and training to farmers, as a result their farming skills improve.</td>
</tr>
</tbody>
</table>

(d) **Issues**

14. According to BADC, there are not many issues or problem as far as contract management is concerned. But there are two other issues which they think need some attention. The first issue is the fact that the national demand for potato tuber is 400,000 M.Tons but they are only able to produce 11,000 M.Tons of tuber. This is due to the lack of adequate storage facilities. If they had adequate cold storage facilities then they would have been able to address this problem.

15. The other critical issue is the foundation tubers are usually imported from Netherlands. If they could be produced in the country, it would have been cheaper for BADC and could upscale the production of foundation tubers. BADC recommends that if the Tuber Crop Research Center (under BRRI) could produce these expensive foundation tubers, then the farmers could benefit from purchasing these tubers at lower price thus improving their income level.

(e) **Future Prospects**

16. BADC feels that if more resources are allocated to BADC, then it can provide better service to the farmers. If efficiency in internal management is improved and bureaucratic procedures for faster release of funds can be addressed, then the organization would become more effective in delivering its mandate.
C. Aromatic Rice Contract Farming by PRAN

17. PRAN is the largest private sector agro-processing industry of Bangladesh. It has become one of the most successful commercial producer of agro-processed food, both in the domestic market and recently it has been exporting its products to different export markets. They have used contract farming quite successfully and at present they have been doing contract farming in rice, pulses and tomato cultivation. They have been very successful in producing the aromatic rice which has found a good market overseas. The contract farming for rice is in the western part of the country, mainly Rajshahi.

(a) Process and Farmer Identification

18. Unlike the conventional models of contract farming, the contract farmers of PRAN are not directly engaged by PRAN but they operate through a “middle-man” known as the “center head”. These medium/large farmers were producing rice before they were producing for PRAN. There are about 15 men supervised by a center-head and about 40 to 50 center head farmers. These center heads are usually the largest farmers with good financial ability.

(b) Contract

19. The contract is between the center head and PRAN, it is a legal contract and it specifies the amount of rice produced, quality and the approximate delivery date of the product. The center-head actually is doing the job of the middle man in the sense that he buys the rice from the farmers and then sells it to PRAN and he gets a commission.

(c) Price and Profit

20. The farm inputs (except seed) are all provided by the farmers themselves since they are economically self reliant. They purchase their own fertilizer and pesticide. The farmers are given seed in advance and the seed cost is collected at harvest. There is no extension service provided. The farmers are given guidelines about the quality of rice to produce with close supervision by center-heads. PRAN buys the rice at a price between TK 10 to TK 18 per Kg (depending on the market). As summarized below, the farmer benefits from the contract farming arrangement as follows:

<table>
<thead>
<tr>
<th>Without Contract Farming</th>
<th>With Contract Farming</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The farmers would receive the prevailing market price for rice.</td>
<td>• The farmers receive higher price for rice.</td>
</tr>
<tr>
<td>• Farmers are producing rice on their own.</td>
<td>• Through the center-heads, there is more coordination among the farmers to increase efficiency.</td>
</tr>
<tr>
<td>• The farmers have to sell rice at the local market which involves a market risk.</td>
<td>• The farmers have an assured market.</td>
</tr>
<tr>
<td>• Farmers are on their own and the sense of belonging to an organization does not exist.</td>
<td>• The center heads and the farmers receives a sense of belonging by working for PRAN. This is a source of social standing and acceptance.</td>
</tr>
<tr>
<td>• They are not aware of the market in such great detail.</td>
<td>• They have a better sense about the market system.</td>
</tr>
<tr>
<td>• Limited skill transfer.</td>
<td>• Farmers improve skills through knowledge transfer.</td>
</tr>
</tbody>
</table>

(d) Issues

21. As in any contract farming situation there is always the price issue which usually encourages the farmer to stay in the contract or stay out of the contract. When the price is relatively high in the market the farmers have the tendency to stay out of the contract and sell their product to external market, and the reverse is true when prevailing market price is low. Previously, PRAN used to have price written in the contract but pre-fixing the price was a reason for farmers to swing with the market. Recently PRAN has taken
the step of not fixing the price at the time of the contract signing but informs the farmers that they would receive a higher price than the prevailing market price during the harvest time.

22. PRAN has formed a committee (which includes a center head of the particular area) to survey the local market and reach a consensus on a price for the local market price for rice. PRAN then pays the farmers (via the center head) a percentage higher than the prevailing local market price.

23. There are also issues related to supply chain in the sense that transportation disputes and inefficiency among the suppliers often is the cause of consignment not reaching destinations on time and thus is a source of loss to PRAN. Quality is also an issue with the aromatic rice growers since it is very often that farmers provide PRAN with poor quality rice.

(e) Future Prospects

24. PRAN believes that it has a market and wants to stay in business. It hopes that the enabling environment for making agro-processing industry prosper would only come when there is effort from all stakeholders. There has to be more coordination and support service provided by the public sector. Government regulations could favor the export of agro-processed goods. There is a lot of scope for promoting public-private partnership that will result in innovations necessary to accelerate growth in the agribusiness sector and solve problems faced by private entrepreneurs.
## Annex 6: Past Recommendations for Reforming the NARS and the Current Status

<table>
<thead>
<tr>
<th>Recommended Actions to Reform NARS</th>
<th>Reports</th>
<th>1996 Act</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve planning and prioritization of research in line with Government policies and the needs of producers.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Enhance the autonomy of the NARS and its components.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Provide full autonomy of the ARIs.</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Separate institutes from direct control of line ministries.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Reorganize BARC and redefine its relationships with the rest of the NARS.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Give the Executive Chairman of BARC the rank of Secretary.</td>
<td>X</td>
<td>X</td>
<td>S</td>
</tr>
<tr>
<td>Have BARC facilitate the work of the NARS through common services.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Have BARC be the sole interface between the NARS and Government.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Have BARC commission external reviews of the ARIs.</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Give BARC responsibility for review of research programs of the ARIs.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Have all funding flow from Government to BARC and allocated by BARC to the ARIs.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Have a unified personnel system for the entire NARS.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Develop a new set of service rules and a performance evaluation and reward system.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Provide for promotion based on merit, rather than seniority.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Provide for <em>in situ</em> promotion.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ensure open, objective merit-based selection of heads of institutions through use of Search Committees.</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Empower Boards of ARIs to select and appoint their chief executive officers.</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Develop Business rules for procedures and financial management that are appropriate for research institutions and provide for accountability.</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

---

4. 1996 Act. Degree to which the Act provides for the actions recommended by the various reports is estimated as follows: 0=None, 1=Very Little, 2=Little, 3=Some, 4=Much, 5=Total. "S" indicates that the Act is silent on this matter.
5. NC=No change since the Act was passed. Implementation Progress: + = Very little, ++ = Limited, +++ = Some, ++++ = Much, +++++ = Total; Implementation progress is being hampered by rapid loss of skilled staff and shortage of funds after the closure of ARMP.
6. For Schedule A institutes only.
7. Through creation of a Human Resources Development Board.
Annex 7: Competitive Grants Program for Agricultural Research

1. The Competitive Grants Program (CGP) for agricultural research has been piloted in Bangladesh under projects funded by development partners, including the World Bank. This annex briefly summarizes the objectives, implementation, operational structure and the review process for the CGP.

A. Objectives

2. The general aims of CGP are to: (i) diversify and gradually increase financial resources for research from the private sector, farmers' organizations, etc. making research financing more sustainable; (ii) increase the efficiency of allocating funds for technology generation and transfer; (iii) get the users of research (such as the private sector and farmers' organizations) more directly involved in planning and implementation of research and technology transfer and making research and technology transfer more client-oriented; (iv) broaden the base of participants in agricultural research to include staff of universities, NGOs, private industry, and farmers' organizations; and (v) capitalize on the synergies that are possible from the involvement of several institutions, agencies, groups and industries, working in partnership, to solve agricultural problems of direct importance to the agricultural sector. The collaborative/partnership approach enables weaker institutions to benefit from an association with partners that are stronger and have a well-established research base.

B. Implementation

3. To operate a CGP, research needs are formally prioritized and funds are allocated preferentially to research areas which receive a high priority ranking. Areas of research (commodities and/or research disciplines) to receive competitive grant funding are normally selected from those given high priority in strategic plans. Some resources are generally reserved for conducting studies on problems that may well be very important to society but which may not have been on the priority agenda of most research institutions. This might include responses to outbreaks of certain unanticipated pests and diseases (such as avian flu) or economic issues related to the sector (such as the impact of WTO).

C. Operational Structure

4. To operate a CGP, generally the structure consists of an independent Management Board (the Apex Body), and an Executive Technical Committee (ETC) supported by a Secretariat. The Apex Body would, inter alia, (i) review research priorities; (ii) provide final approval for the research sub-projects recommended by the ETC; (iii) approve the members of the ETC. The ETC would: (i) translate the research demands identified and prioritized by the Apex Body into research programs; (ii) advertise the request for research for the priority topics, generally once a year in national daily newspapers and on the Internet; (iii) manage the review process; (iv) appoint review committees; (v) evaluate the scientific merits of proposals; (vi) rank and recommend proposals for funding; (vii) monitor the flow of funds; (viii) oversee monitoring and evaluation; (ix) prepare a roster of national and international reviewers.

5. The EC would also determine indicative ceiling amounts which would be allowed for any particular area of research (e.g. by commodity or discipline) and the ceiling amounts which would be allowed for individual projects. The Secretariat supports the ETC in CGP administration, financial management and monitoring and evaluation. As soon as a project proposal in standard format is received by the Secretariat, it would be given a code number which would be used thereafter to identify the project and which would be entered into the regular project database on computer. Before proposals are assessed by expert reviewers for technical value, the Secretariat must examine each proposal and eliminate any which do not meet a set of basic administrative criteria. The Secretariat does not make any judgment on technical merits of the proposal.

6. The advertisement is specific in terms of priority research that would be funded. The priority areas generally reflect the changing priorities of agricultural research in the country. For example, family farms may be one of the priority within which broad areas for future research including, inter alia, sustainable use of resources, integrated crop production under low fertility, IPM and the economics of pesticides use, etc. may be identified. Agribusiness could be another priority area within which broad areas for future research may include, inter alia, commodity chains, processing and industrialization, post-harvest and storage. Advanced technology could be another priority area within which sub-priorities such as production of technology for use of biological products in agricultural production systems may be identified.

D. Review Process

7. The review process is done by technical reviewers selected from a panel of reviewers\(^2\). They can be selected from contacts known to senior management of the agricultural research system. If this proves to be difficult, a local consulting company could be engaged to provide the required technical reviewers. The first method is likely to be less expensive in terms of only having to pay honoraria rather than consultancy fees. The names of the reviewers (generally two independent reviewers for each group of projects) should not be disclosed to any scientists involved in a project proposal to prevent lobbying on behalf on any proposal. The funds are allocated to research groups which have applied for funding to work on high priority research through a system of open competition for the funds. The group, which is judged best able to do the research, enters into a contract with the body which controls the funds. The contract sets out the conditions under which the research would be done and the funding body carries out rigorous monitoring and evaluation of the research to make sure that the research group is performing at the highest level.

\(^2\) It would also be necessary to establish a systematic and rigorous procedure for evaluation of proposals. For example, in India under NATP, ICAR has developed a system based on objective criteria such as relevance of research, competence of researchers, scientific quality, chances of research success, and equity considerations such as development of marginal areas, poverty alleviation and gender impact.
Annex 8: Institutional Reform of NARS for Greater Autonomy, Sustainability and Relevance

1. During consultations with the NARS partners, special efforts were made to identify the critical elements of the institutional reform agenda and to agree on possible options for reform that are most likely to work under the Bangladesh conditions. The areas of concern highlighted by the NARS partners related to the institutional autonomy, working environment for the scientists and the level and sustainability of funding of the research system. The area of concern highlighted by the MOA officials related to the responsiveness of the NARS to its clients. Accordingly, the proposed actions are aimed at addressing the issues highlighted during the consultation process. In considering various options for reform, the study has drawn on lessons learnt from experiences of other countries, e.g. India, Brazil, where the research systems (under ICAR in India and EMBRAPA in Brazil) have addressed similar issues. The institutional changes proposed below include three options. Each option has its own advantages and disadvantages in terms of efficiency, sustainability and implementation feasibility.

A. Proposed Options

2. Three options are proposed for institutional strengthening to improve efficiency and sustainability of the national agricultural research system (NARS) in Bangladesh. It is expected that these options would:

- provide greater autonomy and flexibility in the governance of NARS;
- broaden stakeholder representation in governance of NARS to promote results-oriented and more responsive institutions;
- strengthen mechanisms for research coordination, prioritization, planning, monitoring and evaluation to ensure equitable allocation of resources on problems of concern to the small and marginal farmers covering crops, livestock and fisheries and on strategic public goods themes such as natural resource management; and
- promote pluralistic institutional structure of NARS by introducing sustainable and competitive funding mechanism to allow additional scientific skills in the Universities, NGOs and the private sector to be tapped to address the priority research needs of the system, thus improving efficiency.

B. Option A (Figure A 8.1)

(a) Proposed Action

3. GOB/MOA/MOFI to restructure BARC into an autonomous agency under the Companies Act as a ‘not-for-profit’ Association to be known as the Bangladesh Agricultural Research Foundation (BARF). Under this Option, the BARC Act 1996, currently in force, would be abolished in due course, but is not a prerequisite for the establishment of BARF.
(b) Proposed Mandate of BARF

4. The key features of the mandate would be:

- Prioritization of all agricultural research undertaken by the NARS partners taking into account the government policies and recommendations of the Poverty Reduction Strategy Paper (PRSP).
- Review of mandates and organizational structure of ARIs.
- Facilitation of preparation and review of annual research plans by the component institutes and agencies of NARS.
- Development of agricultural technology policy and socio-economic research on issues of national and/or international significance for the future growth, equity and profitability of the Bangladesh agriculture.
- Monitoring and evaluation of all research financed and undertaken by the NARS.
- Maintain an oversight and support human resource development of the NARS, including service rules and criterion for promotion.
- Maintain liaison with national, regional and international agricultural research organizations/institutes.
- Management of the CGP with full independence and transparency.

(c) Organizational Structure

5. Organization of BARF would be composed of three main constituents represented by the Governing Board (GB), the Executive Council (EC) and a Secretariat (Figure A8.1).

(d) Governance

6. Establishment of BARF under the Companies Act would provide the Governing Board (GB) of BARF full autonomy and authority to prepare its own laws and by-laws. The Board would be chaired by the Minister of Agriculture, with the Minister of Fisheries and Livestock and the Minister of Environment and Forests as the co-chairs. It would have representation of all the key stakeholders (government, ARIs, Universities, NGOs, the private sector and farmers) with a majority composed of non-officials.

7. Executive Council (EC) of BARF would be chaired by the Chief Executive Officer of BARF and would include DGs of ARIs and representatives of other organizations, as appropriate. The EC would link the Foundation to the NARS, guide the prioritization of research and coordinate implementation of research programs by the decentralized NARS and its partners involving Universities, NGOs and the private sector.

8. Although linked to MOA, BARF would be administratively and financially independent of the Ministry and establish its own service and business rules. Memorandum and Articles of Association of BARF, when prepared, would include details of its roles and responsibilities, service and financial rules etc.
Figure A8.1: Proposed Organizational Structure of BARF - Option A

BARF = Bangladesh Agricultural Research Foundation
CGP = Competitive Grants Program
EC/CEO = Executive Council/Chief Executive Officer
NARS = National Agricultural Research System
PAU = Policy Analysis Unit
PME = Prioritization, Monitoring & Evaluation

Legend

BARF = Bangladesh Agricultural Research Foundation
CGP = Competitive Grants Program
EC/CEO = Executive Council/Chief Executive Officer
NARS = National Agricultural Research System
PAU = Policy Analysis Unit
PME = Prioritization, Monitoring & Evaluation
9. As a part of the overall institutional reform, the BARF GB/EC would seek GOB approval for the:

- introduction of common service and business rules for all the ARIs, which may also apply to BARF in due course;
- on the basis of the annual work plan for each institute agreed by GB/EC, recommend to MOA, MOFL and MOEF allocation of the NARS research budget (excluding salaries) to finance annual work plans of ARIs covering peer reviewed public goods research on agreed strategic priorities, such as genetic improvement of crops and breeds using conventional as well as new sciences, natural resource management, environmental protection and conservation of biodiversity resources.

10. A restructured BARF Secretariat would have four operational units (Figure A8.1) with the following functions:

   a. The Prioritization, Monitoring and Evaluation Unit (PMEU) to prioritize, plan, monitor and evaluate research;
   b. The CGP Secretariat (CGPU) to manage the Competitive Grants Program;
   c. The Policy Analysis Unit (PAU) to undertake or commission policy analysis on behalf of the government and/or NARS on issues of national and international significance for agriculture in the country; and
   d. Finance and Administration Unit (F&AU) to manage affairs of the Foundation.

(e) Staffing

11. All technical and general establishment positions needed for BARF would be assigned from BARC and funded by GOB under the revenue budget. Staff appointments for each position would be through open competition and based on merit.

(f) Funding

12. Overall: BARF’s operational cost would be fully funded by GOB. It is proposed that GOB increases public investment to support agricultural research. The long-term aim should be to increase the funding level to 2% of AGDP, with an immediate increase to 0.6% of AGDP, which is the average for the developing countries as a group.

13. Core Research: The research budget (excluding salaries) to be allocated to ARIs following review and approval of annual work plans by BARF to finance strategic research on priority themes. Funds for the research programs to be financed under the regular GOB budget would be disbursed directly to ARIs, as per the work plan approved by GB/EC.

14. Funding and Management of the Competitive Grants Program: To ensure sustainability and stability of funding an endowment Trust Fund (TF) would be established to provide an income stream to finance research proposals under the CGP. Establishment of the TF would be financed by GOB and its development partners, which may also receive funds from other sources, including the private sector. Funding provided to TF would be held in a ‘basket’ of hard currencies to hedge against depreciation and would be managed by an independent professional fund manager. Trustees of TF would be appointed in consultation with GOB. Many countries, especially in the industrialized world, e.g. USA, Sweden, use endowment funds as an attractive and efficient mechanism to finance research. This mechanism provides sustainable institutional development and stable funding to plan and execute research. With the exception of
the key management positions, which would be financed from the Trust Fund earnings. Salaries of staff transferred to BARF from other agencies, e.g. BARC, would be financed by GOB. It is expected, however, that additional contributions to the capital base of the Trust Fund from both national and international sources in the future would increase income, which may be sufficient to fully finance the research and operational costs of the CGP management unit.

15. The likely management arrangements for the CGP under the overall guidance of the GB of BARF are given in Annex 7. Disbursement of funds for the research proposals approved under the CGP would be directly to the implementing institutions, as per the agreed financing plan, and disbursement schedule included in the research proposal approved by the CGP management.

C. Option B (Figure A 8.2)

a) Proposed Action

16. Under this option, GOB/MOA/MOFL/MOEF would amend the BARC Act 1996 and other Ordinances/Acts governing individual institutes to give greater autonomy to BARC as the apex body of NARS. At the same time, the Bangladesh Agriculture Research Foundation (BARF) would be established as a separate not-for-profit association under the Companies Act, 1913 (as amended under the Companies Act, 1994).

(b) Proposed Mandate of the ‘New’ BARC

17. The main function of ‘New’ BARC would be somewhat similar to its current role but with an enhanced focus and capacity for:

- Prioritization of all agricultural research undertaken by the NARS partners taking in to account the government policies and recommendations of the Poverty Reduction Strategy Paper (PRSP).
- Facilitation of review of mandates and organizational structures of ARIs
- Facilitation of preparation and review of annual research plans by the component institutes and agencies of NARS.
- Development of agricultural technology policy and socio-economic research on issues of national and/or international significance for the future growth, equity and profitability of the Bangladesh agriculture.
- Monitoring and evaluation of all research financed by the NARS., including the CGP
- Maintain an oversight and support human resource development of the NARS, including service rules and criterion for promotion.
- Maintain liaison with national, regional and international agricultural research organizations/institutes.

18. Governance of ‘New’ BARC. Changes sought in the governance, mandate, and funding of BARC would be similar to that described above under Option A. The key difference, however, would be the separation of governance and management of CGP under a new body the Bangladesh Agricultural Research Foundation (BARF), to be established as a not-for-profit association under the Companies Act with its own Governing Board (GB). The Governing Board (GB) of ‘new’ BARC under this option would be an autonomous body with authority to formulate service and business rules and other functions in relation to the NARS described under Option A above. The membership of GB would be amended to have increased representation of non-government members. Composition and role of the EC would be unchanged. However, the EC would have an additional function of liaising with the BARF management in ensuring that the overall research priorities are reflected in the projects financed under the CGP.
Figure A8.2: Proposed Organizational Structure of BARC and BARF - - Option B

Legend:
A&F = Administration and Finance
AI = Agricultural Information
BARC = Bangladesh Agricultural Research Council
CGP = Competitive Grants Program
EC/CEO = Executive Council/Chief Executive Officer
HRD = Human Resources Development
M&E = Monitoring & Evaluation
NARS = National Agricultural Research System
PAU = Policy Analysis Unit
PME = Prioritization, Monitoring & Evaluation
19. The ‘new’ BARC Secretariat would be smaller in size. Its mandate would be revised to give greater focus to its role in research coordination, prioritization, and allocation of resources to agreed priorities and monitoring and evaluation of all research. To strengthen its research coordination function, the NARS research budget (excluding salaries) would be allocated based on its recommendations to finance strategic public goods research on agreed priorities. The capacity of its Secretariat to help ARIs in formulation of annual work plans and to undertake socio-economic and policy analysis on issues of importance to agricultural sector/research would be strengthened.

(c) Bangladesh Agriculture Research Foundation (BARF)

20. **Mandate.** The main function of the newly established BARF under this option would be to manage the CGP. It would also organize training of researchers in the public and the private organizations in development of good quality research proposals. M&E of research proposals being financed under CGP would also be its responsibility.

21. **Governance.** As a Foundation, it would have its own Governing Board (GB), operating independently of the BARC GB, to manage the CGP with autonomy and transparency. The GB would have representation from GOB, BARC, the private sector, NGOs and the scientific community. This would ensure accountability both to the government as well as to its other stakeholders. In practice, therefore, it would operate like Palli Karma-Sahayak Foundation (PKSF) and would be incorporated under the Companies Act, 1913 (as amended by Companies Act, 1994) as a not-for-profit association. Memorandum and Articles of Association of BARF, when prepared, would include details of its roles and responsibilities, service and financial rules etc.

22. **Management.** The key management positions of BARF would be filled through open competition. However, some of the positions needed for the BARF Secretariat to administer the CGP would be transferred from the BARC Secretariat. Experience of many countries that have adopted CGPs, e.g. Brazil, Ecuador, Chile, shows that independent governance, typically involving an apex council or a board with strong private sector and nongovernmental participation, is critical to the integrity of CGP. At the same time, sound management structure and efficient day-to-day operation of the program requires a secretariat with financial management powers and an appropriate level of technical expertise. Accordingly, the BARF Secretariat would have the following units:

- Competitive Grants Management Unit (CGMU) to invite, assess and manage award under the Competitive Grants Program. This unit would also arrange for training of scientists in ARIs and other institutions for preparation of good quality research proposals.

- Monitoring and Evaluation Unit (MEU) to monitor and evaluate progress of grants awarded under CGP and disseminate findings to all interested parties.

- Finance and Administration Unit (FAU) to manage affairs of the Foundation and keep financial accounts of grants for independent audit.

23. **Trust Fund.** Funding for the CGP would come from an income stream to be generated by an endowment *Trust Fund (TF)* to be established by GOB and its development partners. TF may also receive funds from other sources, including the private sector. Funding provided to TF would be held in a ‘basket’ of hard currencies to hedge against depreciation and would be managed by professional fund manager independently of BARF. TF manager would be accountable to the TF Trustees nominated in consultation with GOB. Many countries, especially in the industrialized world, e.g. USA, Sweden, use endowment funds
as an attractive and efficient mechanism to finance research. This mechanism provides sustainable institutional development and stable funding to plan and execute research.

D. Option C (Figure A 8.3)

(a) Proposed Action

24. Like Option B, under this option also GOB/MOA/MOFL would amend the BARC Act 1996 and other Ordinances/Acts governing individual institutes to give greater autonomy to BARC as the apex body of NARS and establish the Bangladesh Agriculture Research Foundation (BARF) to manage the CGP. However, a key difference compared to Option B would be that the BARF under this option would operate under the overall policy guidance of GB of ‘new’ BARC.

(b) Proposed Mandates ‘New’ BARC

25. This would be similar to those described under the Option B above and include:

- Prioritization of all agricultural research undertaken by the NARS partners taking into account the government policies and recommendations of the Poverty Reduction Strategy Paper (PRSP).
- Facilitation of preparation and review of annual research plans by the component institutes and agencies of NARS.
- Development of agricultural technology policy and socio-economic research on issues of national and/or international significance for the future growth, equity and profitability of the Bangladesh agriculture.
- Monitoring and evaluation of all research financed by the NARS.
- Maintain an oversight and support human resource development of the NARS.
- Maintain liaison with national, regional and international agricultural research organizations/institutes.

(c) Proposed Mandate of BARF

26. This would be similar to those described under the Option B above and include:

- Management of the CGP with full independence and transparency.
- Training of scientists and other researchers in preparation of good quality research proposals.
- Monitoring and Evaluation of research financed under CGP.
- Dissemination of research findings to all interested parties using different media, including workshops.

(d) Organizational Structure

27. The organizational structure would have three main constituents: the Governing Board, the ‘new’ BARC and BARF (Figure A8.3). The organizational structure of ‘new’ BARC would include an Executive Council (EC) and a Secretariat. The organizational structure of BARF would include a Management Board (MB) and a Secretariat.
Figure A8.3: Proposed Organizational Structure of BARC and BARF – Option C
(e) Overall Governance

28. The Governing Board (GB) would provide oversight and guidance to both BARC and BARF. GB would be chaired by the Minister of Agriculture with the Ministers of Fisheries and Livestock, and Environment and Forests as the co-chairs. GOB would bring the NARS under one Act, and would grant autonomy and authority to GB to formulate common service and business rules for the NARS. Overall size of the GB would be reduced along with an increase in representation by the non-government members.

29. New BARC. The other two constituents would include the Executive Council (EC) and the Secretariat. EC would include all heads of ARIs and Member Directors of ‘new’ BARC as members. The Chief Executive Officer of ‘new’ BARC would be the Chairman of the Council. EC would be responsible for administration and management of ‘new’ BARC.

30. Under this option, ‘new’ BARC’s Secretariat would have the following four units:
   
a. Prioritization, Monitoring and Evaluation Unit (PMEU) to prioritize, plan, monitor and evaluate research.

b. Policy Analysis Unit (PAU) to undertake or commission policy analysis and socio-economic research on behalf of the government and/or NARS on issues of national and international significance for the agriculture in the country.


d. Finance and Administration Unit (FAU) to manage affairs of the Council.

31. BARF. Although BARF would operate under the overall policy guidance of the GB and its office would be located in the BARC building, it would have administrative and financial autonomy. BARF would have its own Management Board and would include a representative of the government, ‘new’ BARC Executive Chairman, representatives of NGOs and the private sector. The CEO, BARF would be a distinguished and experienced professional. Director CGP unit in the BARF Secretariat would be the member secretary. Memorandum and Articles of Association of BARF, when prepared, would include details of its roles and responsibilities, service and financial rules etc.

32. BARF’s Secretariat would have the following three units:
   
a. Competitive Grants Management Unit (CGMU) to invite, assess and manage award under the Competitive Grants Program. This unit would also arrange for training of scientists in ARIs and other institutions for preparation of good quality research proposals.

b. Monitoring and Evaluation Unit (MEU) to monitor and evaluate progress of grants awarded under CGP and disseminate findings to all interested parties.

c. Finance and Administration Unit (FAU) to manage affairs of the Foundation and keep financial accounts of grants for independent audit.

(f) Staffing

33. In line with its revised mandate, the ‘new’ BARC would be smaller in size, thus requiring a smaller establishment. All management, technical and general establishment positions needed for BARF would be assigned from BARC and funded by GOB under the revenue budget. The only exception to this would be
the CEO, and three heads of the operational units. Staff appointments for each position would be based on merit through open competition.

(g) Funding

34. **Overall:** It is proposed that GOB increases public investment to support agricultural research. The long-term aim should be to increase the funding level to 2% of AGDP, with an immediate increase to 0.6% of AGDP, which is the average for the developing countries as a group.

35. **Core Research to be managed by ‘new’ BARC:** The research budget (excluding salaries) to be allocated to ARIs following review and approval of annual work plans by ‘new BARC to finance long-term strategic research on priority themes. The fund from the regular GOB budget would be disbursed directly to ARIs, as per the work plan approved by GB/EC.

36. **Trust Fund to Finance Competitive Grants Program:** To ensure sustainability and stability of funding, an endowment Trust Fund would be established to provide an income stream with sufficient earnings to finance research proposals under the CGP Contributions to establish the Trust Fund would need to come from GOB, bilateral donors and multi-lateral agencies. Trust Fund would be managed completely independently of the BARC/BARF by professional fund managers.

E. Benefits of the Proposed Institutional Changes

37. The expected benefits include:

- Increased efficiency and productivity of NARS to generate appropriate technologies and thereby leading to higher impact of research on agricultural growth, farm income generation and poverty reduction.

- Sustainable and stable funding with reduced recurring burden on GOB budget for research under the competitive grants program, which, in time, is expected to account for a significant proportion of agricultural research undertaken in Bangladesh.
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Revitalizing the Agricultural Technology System in Bangladesh


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