PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR73.8 ($100 MILLION EQUIVALENT)

AND A PROPOSED LOAN IN THE AMOUNT OF $96.8 MILLION

TO

INDIA

FOR A

NATIONAL AGRICULTURAL TECHNOLOGY PROJECT

February 12, 1998

Rural Development Sector Unit
South Asia Regional Office
CURRENCY EQUIVALENTS
(Exchange Rate Effective July 1, 1997)

Currency Unit = Rupees (Rs.)

US$1 = Rs.35.6

FISCAL YEAR
Government of India, April 1 - March 31

ABBREVIATIONS AND ACRONYMS

ACT Advisory and Consultative Teams
AICR All India Coordinated Research
APC Agriculture Production Commissioner
ARIS Agricultural Research Information Systems
ATMA Agriculture Technology Management Agency
CAG Controller and Auditor General
CAS Country Assistance Strategy
CG Commodity Group
CGIAR Consultative Group on International Agricultural Research
CGP Competitive Grants Program
DAC Department of Agriculture and Cooperation
DARE Department of Agricultural Research and Education
DOA Department of Agriculture
DOE Department of Extension
FA Financial Advisor
GOI Government of India
IARI Indian Agricultural Research Institute
ICAR Indian Council of Agricultural Research
ICB International Competitive Bidding
ISD Information System Development
ISNAR International Service for Agricultural Research
KVK Krishni Vigyan Kendra
LCB Local Competitive Bidding
M&E Monitoring and Evaluation
MIS Management Information System
MANAGE National Institute of Agricultural Extension Management
MOA Ministry of Agriculture

Abbreviations and Acronyms:

NAARM National Academy of Agricultural Research Management
NAEP National Agricultural Extension Project
NARP National Agricultural Research Project
NARS National Agricultural Research System
NCAP National Center for Agricultural Policy Research
NCB National Competitive Bidding
NGO Non Governmental Organization
NSC National Steering Committee
OED Operations Evaluation Department
PIU Project Implementation Unit
PMC Project Management Committee
PME Priority Setting, Monitoring and Evaluation
PPAR Project Performance Audit Report
PRA Participatory Rapid Appraisal
RPC Research Program Committee
SAMETI State Agricultural Management and Extension Training Institute
S&CGP Sponsored and Competitive Grants Program
SAU State Agricultural University
SAU-E State Agricultural University - Extension
SAU-R State Agricultural University - Research
SMS Subject Matter Specialist
T&V Training and Visit
TAR Technology Adaption and Refinement
TDMC Technology Dissemination and Management Committee
TDU Technology Dissemination Unit
VEW Village Extension Worker
ZRS Zonal Research Station

Vice President: - Mieko Nishimizu
Country Director : - Edwin Lim
Sector Managers: - Michael Baxter/Ridwan Ali
Task Manager: - Ashok K. Seth
India
National Agricultural Technology Project

CONTENTS

Page No.

A. Project Development Objective .......................................................... 2
   1. Project development objective and key performance indicators ............. 2

B. Strategic Context .............................................................................. 2
   1. Sector-related CAS goal supported by the project .................................. 2
   2. Main sector issues and Government strategy .......................................... 2
   3. Sector issues to be addressed by the project and strategic choices .......... 3

C. Project Description Summary .......................................................... 4
   1. Project components ............................................................................. 4
   2. Key policy and institutional reforms supported by the project ............... 4
   3. Benefits and target population ............................................................ 5
   4. Institutional and implementation arrangements ..................................... 5

D. Project Rationale ............................................................................... 11
   1. Project alternatives considered and reasons for rejection ...................... 11
   2. Major related projects financed by the Bank and/or other development agencies ............. 12
   3. Lessons learned and reflected in proposed project design ..................... 13
   4. Indications of borrower commitment and ownership ............................. 14
   5. Value added of Bank support in this project ........................................ 14

E. Summary Project Analyses ............................................................... 15
   1. Economic ............................................................................................ 15
   2. Fiscal impact .......................................................................................... 17
   3. Technical ............................................................................................... 18
   4. Institutional ........................................................................................... 18
   5. Social ..................................................................................................... 18
   6. Environmental assessment .................................................................... 19
   7. Participatory approach ......................................................................... 19

F. Sustainability and Risks .................................................................... 20
   1. Sustainability ........................................................................................ 20
   2. Critical risks ......................................................................................... 20
   3. Possible controversial aspects ............................................................. 21
G. Main Loan Conditions .................................................................................. 22
   1. Effectiveness conditions ..................................................................... 22
   2. Other ................................................................................................. 22

H. Readiness for Implementation ................................................................ 23

I. Compliance with Bank Policies ............................................................... 23

Annexes

Annex 1. Project Design Summary ............................................................... 25
Annex 2. Detailed Project Description .......................................................... 33
Annex 3. Estimated Project Costs ................................................................. 47
Annex 4. Cost-Benefit Analysis Summary, or
        Cost-Effectiveness Analysis Summary .............................................. 49
Annex 5. Financial Summary for Revenue-Earning Project Entities, or
        Financial Summary ............................................................................ 59
Annex 6. Procurement and Disbursement Arrangements ............................. 61
    Table A. Project Costs by Procurement Arrangements ........................... 65
    Table B. Thresholds for Procurement Methods and Prior Review .......... 66
    Table C. Allocation of Loan Proceeds ...................................................... 67
Annex 7. Project Processing Budget and Schedule ....................................... 69
Annex 8. Documents in Project File ............................................................. 71
Annex 9. Statement of Loans and Credits ................................................... 73
Annex 10. Country at a Glance ................................................................. 77
India
National Agricultural Technology Project

Project Appraisal Document
South Asia Regional Office

Date: February 11, 1998
Country Manager/Director: Edwin Lim
Project ID: 10561
Sector: Rural Development
Project ID: 10561
Sector: Rural Development
Lending Instrument: Credit/Loan

Project Financing Data
[X] Loan
[X] Credit
[] Guarantee
[] Other [Specify]

For Loans/Credits/Others:
Amount: Credit SDR 73.8 million (US$100.0 million equivalent); Loan US$96.8 million.
Proposed terms: IDA IBRD [ ] Multicurrency [X] Single currency US$ [ ]
Grace period (years): 10 5
Years to maturity: 35 20
Commitment charge: 0.5% 0.75%
Service charge: 0.75%

Financing plan (US$m): 239.7M
Source
Total
Government 42.9 42.9
Cofinanciers
IBRD 46.5 50.3 96.8
IDA 48.1 51.9 100.0
Total 137.5 102.2 239.7

Borrower: India
Guarantor: N/A
Responsible agency(ies): Ministry of Agriculture, Indian Council of Agricultural Research (ICAR), participating states

Estimated disbursements (Bank FY/US$M):

<table>
<thead>
<tr>
<th>Year</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>20.2</td>
<td>45.6</td>
<td>46.9</td>
<td>44.3</td>
<td>39.7</td>
</tr>
<tr>
<td>Cumulative</td>
<td>20.2</td>
<td>65.8</td>
<td>112.7</td>
<td>157.0</td>
<td>196.8</td>
</tr>
</tbody>
</table>

For Guarantees:
[ ] Partial credit
[ ] Partial risk

Proposed coverage:
Project sponsor:
Nature of underlying financing:
Terms of financing:

- Principal amount (US$)
- Final maturity
- Amortization profile

Financing available without guarantee?: [ ] Yes [ ] No
If yes, estimated cost or maturity:
Estimated financing cost or maturity with guarantee:

Project implementation period: 5yrs
Expected effectiveness date: 06/30/1998
Closing date: 12/31/2003

OSD PAD Form: July 30, 1997
A: Project Development Objective

1. Project development objective and key performance indicators (see Annex 1):

The main objectives of the project would be to: (i) improve the efficiency of the Indian Council of Agricultural Research (ICAR) Organization and Management systems; (ii) enhance the performance and effectiveness of priority research programs and of scientists in responding to the technological needs of farmers; and (iii) develop models that improve the effectiveness and financial sustainability of the technology dissemination system with greater accountability to, and participation by, the farming communities.

B: Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project (see Annex 1):


The strategy for Bank assistance to India is to support policies and investments that promote economic growth and social development in the context of macro-economic stability. The primary CAS objective in Rural Development is to raise rural income and sectoral growth through more effective institutions, better agricultural technology, improved management of natural resources, better infrastructure, reforms of internal and external trade and better directed use of public funds. The NATP supports these objectives through: (i) accelerating the flow of research findings to strengthen the technological base for policy reforms, without which agricultural growth would be slower; (ii) addressing areas of research of relevance for improved management of natural resources, especially for rainfed farming, livestock, horticulture and sustainable intensification of irrigated farming systems; (iii) capacity building of the public sector research institutions; and (iv) initiation of actions to improve the enabling environment for greater participation by the farming communities and the non-governmental sector in technology development and dissemination activities.

2. Main sector issues and Government strategy:

   Since about 1990, India has been experiencing faster agricultural growth exhibiting greater agro-ecological spread across states. In order to continue with this recent growth there is need to deepen reforms and to strengthen institutional capacity in a number of areas including agricultural technology. The Bank has recently completed a series of studies on policies related to key commodities including sugar, cotton, oilseeds, and futures markets. These, as well as further economic sector work, would support a rural sector policy reform agenda relating to public expenditure, trade and rural finance. This agenda would be supported through central government and state government projects. NATP (and several state level projects) would address the policy reform and investment needs of the technology development and dissemination system. The Government recognizes that further improvement in policy framework, while important, would not, in itself, be enough to increase agricultural growth and make it more equitable. The policy reforms, therefore, must be accompanied by an increase in public investment on agriculture technology development and dissemination, rural infrastructure, natural resource management, farm credit, health and education of rural people. The Government is attempting to address poverty, which remains India’s major social problem. The Government has announced its plan to increase public investment in the rural sector during the 9th Five Year Plan. Development and dissemination of improved technologies to support greater productivity in the relatively less developed rainfed and marginal areas is an important objective of NATP and is fully consistent with Government’s plan.
3. Sector issues to be addressed by the project and strategic choices:

The following are the main issues to be addressed:

(a) **Avoiding a Technology Vacuum and Productivity Gap.** With the on-going policy reform program moving agricultural production forward, an increasing technology vacuum can be expected unless a commensurate effort is made to improve the quantity and quality of the technology flow. Similarly, there is considerable potential for bridging the gap between potential and actual yields at farm level through more effective use of available technologies. These are the main aims of the project.

(b) **Addressing Poverty and Sustainability Issues.** These issues are of increasing concern to both the Government and the Bank. The former is being tackled through focusing research on semi-arid and arid areas, small farm systems, livestock etc. and by developing participatory skills. The latter is being addressed through rural development with a focus on improved natural resource management, especially activities aimed at improved land and water management, integrated pest management and integrated nutrient management.

(c) **Evolving Public-Private Interaction.** The project would help to increase the role of the private sector to improve efficiency. The strategic choice made here has been to address the constraints to private sector entry, to promote public/private partnerships, to provide a competitive grants scheme open to the private sector, and to provide a formal consultative mechanism for interaction at the policy level.

(d) **Bridging Gaps in Research and Improving Research Quality.** A particular concern in Indian agriculture research has been the increasing gaps between the frontiers of Indian and international scientific research in certain areas. This is being tackled under the project by supporting partnerships between Indian and international institutions to enhance skills of scientists and by a major focus on processes impacting on quality of research.

(e) **Improving Management Systems.** Weak public research management has been a key issue. This is a major focus of the project. The need for organizational adjustments, improved personnel and financial management, training, coordination and monitoring systems etc. are being addressed by the project.

(f) **Increasing Community Ownership and Participation.** In the past there has been limited participation by the farming communities in the design and execution of technology development and dissemination activities. The project aims to incorporate participatory approaches into technology development and dissemination activities. The initial exercises have already tested PRA methods to elicit and validate the priorities. These will be further developed during project implementation.
C: Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

<table>
<thead>
<tr>
<th>Component</th>
<th>Category</th>
<th>Cost Incl. Contingencies (US$M)</th>
<th>% of Total</th>
<th>Bank-financing (US$M)</th>
<th>% of Bank-financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Development of the ICAR's Organization and Management systems</td>
<td>Development</td>
<td>57.4</td>
<td>24</td>
<td>45.5</td>
<td>23</td>
</tr>
<tr>
<td>(ii) Support for Agro-ecosystems Research through sponsored and Competitive Grants Program</td>
<td>Technology Development</td>
<td>139.5</td>
<td>58</td>
<td>118.2</td>
<td>60</td>
</tr>
<tr>
<td>(iii) Support for pilot program to test support for Innovations in Technology Dissemination</td>
<td>Technology Dissemination</td>
<td>42.8</td>
<td>18</td>
<td>33.2</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>239.7</td>
<td>100</td>
<td>196.8</td>
<td>100</td>
</tr>
</tbody>
</table>

2. Key policy and institutional reforms supported by the project:

Reform of India’s large and complex technology development and dissemination system to meet the challenges of the next century is a long-term undertaking which can only be accomplished in carefully planned stages with continuing commitment and support of all the stakeholders. The proposed project would fund the first five-year time-slice of this long term program, emphasizing the policy and institutional reforms which would:

(i) Improve the efficiency of the organization and management arrangements for technology development through:

- review and revision of the personnel management policies;
- reform of administrative rules and regulations;
- publicly financed activities in areas with clear public good elements, e.g. poverty, regional equity, rainfed agriculture with environmental issues, gender issues; and
- strengthening and expanding of the communication and information system.
- improving overall system capability

(ii) Change the orientation of technology development and dissemination through:

- shifting emphasis from commodity research towards production systems research;
- increasing emphasis on sustainability of production systems adopting holistic and systematic coordination of research on the main cross-cutting issues, e.g. natural resource conservation with emphasis on land and water management, Integrated Pest Management (IPM); and
- emphasizing the development of institutional partnerships, e.g. ICAR/State Agricultural Universities (SAUs)/line departments of state governments involved in technology dissemination, public/private, national/international.

(iii) Change the business processes for technology development and dissemination through:

- institutionalization of revised processes for formulation, review, funding and monitoring and evaluation;
- allocation of an increased share of funds through competitive processes;
- allocation of funds to research problems in accordance with priority setting mechanisms at various levels;
- introduction of new approaches to technology dissemination including: decentralized management system; participatory methodologies to make the service more demand driven; farming systems approach with greater collaboration between public and private institutions to enhance effectiveness and financial sustainability; and
- strengthening of research, extension and farmer linkages.

3. Benefits and target population:

The main benefit from the research components would be the initiation of a process that would improve efficiency and effectiveness of the agricultural research system through improvements in: priority setting, management practices, skills of administrators and scientists, public/private partnerships, system orientation and greater farmer focus on research. In the long term this process is expected to translate into an improved supply of relevant and sustainable technologies to farmers, especially the poor, delivered at lower unit costs. The main benefit from the dissemination component would be the demonstration of a demand driven, financially sustainable, and efficient delivery and feedback system with greater participation and control by farmers. Again, the longer term benefit would be increased productivity and efficiency, especially for the poor. For the project as a whole the immediate target population is the research scientists, administrators, extension staff, NGOs, Farmer Organizations and the farming community. The medium to longer term target population is the majority of Indian farmers.

4. Institutional and implementation arrangements:

Key features of the project implementation arrangements include: (see Organogram in Chart 2 of Annex 2).

(i) **Overall Policy Guidance, Executive Responsibility and Implementation Coordination.**

National Steering Committee (NSC). Policy guidance and oversight for the project would be the responsibility of NSC on which both the research and extension wings of ICAR and Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MOA) would be represented. The steering committee would be chaired by the Director General of ICAR, with the Additional Secretary (incharge Ext. Div.), DAC as its deputy chairman. Its other members would include: Chairman, Research Program Committee (RPC), members of the Project Management Committee, two eminent scientists, two vice chancellors of selected state agricultural universities (SAUs), agricultural production commissioners (APCs) and director (Agriculture/Animal Husbandry/Horticulture) from selected participating states, representatives of the private sector and farmers organizations. It would meet once or twice a year to monitor progress of the project and provide overall policy guidance to the Project Management Committee (PMC).

Project Management Committee (PMC). This committee, working under the chairmanship of the DG, ICAR, would have the main executive responsibility for management of the project. Its other members would include: Additional Secretary (incharge Ext. Div.); DAC, Joint Secretary (extension), DAC; Joint Secretary, Department of Agricultural Research and Education (DARE), Financial Adviser (FA), ICAR, FA, DAC and all the deputy director generals of ICAR. National Director, NATP would be its member secretary. PMC would meet regularly to review progress of the project, approve NATP’s budget and work program and provide the necessary guidance to the national director in the execution of the project. With the key senior staff of ICAR and DAC as its members, it is expected that PMC would help to internalize and, in time, expand coverage of new approaches being introduced under the project to other ICAR/DAC activities with similar objectives but not being financed under NATP.

Technology Dissemination Management Committee: (TDMC). This committee would coordinate, review and guide all activities related to technology dissemination financed by the project. TDMC would be chaired by the Additional Secretary (incharge Ext. Div.), DAC. The Joint Secretary (extension), DAC would be its member secretary. Its other members would include: Deputy Director General (Ext.), ICAR; NATP team leader; National Institute of Agricultural Extension Management (MANAGE); Head of the Technical Dissemination Unit
(TDU), DAC; National Director, NATP; Financial Advisor, DAC; APC/Secretary (Agri.) of one of the participating states; Vice Chancellor of SAU from one of the participating states, director extension of one of the participating states, and one district Agriculture Technology Management Agency (ATMA) officer-in-charge. In addition, in consultation with NSC, four additional members would be nominated representing NGOs, women's organizations dealing with rural development issues, farmers organizations and the private sector. Members nominated from outside of DAC/ICAR would serve for a period of two to three years, with some staggering of appointment starting at the end of the first two years to allow for continuity. The Technology Dissemination Unit (TDU) in DAC would act as the secretariat for the TDMC. TDU will be headed by the Joint Commissioner/ Director Extension, DAC, who would function under the overall supervision of the Joint Secretary (Extension), DAC, and would assist with implementation of the project’s TD activities.

Project Implementation Unit (PIU). PIU would coordinate project implementation through existing divisions/units in ICAR, DAC and state government agencies. PIU, with inputs from individual implementing units, would develop annual budget and work plans for the project for approval by PMC. To provide a focal point for implementation of specific components/sub-components, participating units would be delegated day-to-day management responsibility working closely with the PIU. For example, under component I (Development of ICAR’s organization and management systems), development and introduction of improved priority setting, monitoring and evaluation mechanisms would be the responsibility of the National Center for Agricultural Policy (NCAP). PMC would oversee implementation of O&M reforms until the new division of Policy, Planning and Reform is established in ICAR. Similarly, the information systems development and procurement of all necessary equipment in support of this activity would be coordinated through a separate cell in ICAR.

(ii) Review and Implementation Arrangements for the Research Proposals.

Under the project, all research funding would be made available through sponsored and competitive grants programs (S&CGPs). The sponsored research proposals would largely be from within the ICAR system with outside institutions joining as partners where appropriate. The competitive grants program (CGP), on the other hand, would be open to all, including the private sector, and awarded based on proposals submitted by qualified institutions in response to advertisements in the national press. S&CGPs would fund production systems research as well as strategic and mission-mode research (see Annex 2, Attachment 1) aimed at finding solutions for thematic and/or long-term technical constraints to intensification, diversification and/or sustainability of production systems. An operational manual describing various steps in the technical review of proposals would be available to each scientist/institution wanting to participate under the S&CGPs. All research, whether sponsored or competitive, would be reviewed for technical quality by the same processes (see Chart 2 attached to Annex 2).

The Research Program Committee (RPC), to be appointed by PMC, would be an interdisciplinary scientific panel with the main responsibility (delegated by PMC) for technical review of research proposals. It would have authority to approve projects up to a certain amount set by the PMC. The committee would meet quarterly to review and take decisions on the award of research grants. RPC would be composed of about 15 members, mainly distinguished scientists drawn from universities, the scientific community, government institutions, private sector and ICAR, with one of the senior national coordinators of PIU as the member secretary. In addition, FA (DARE), National Director, NATP, Agriculture Commissioner, DAC would also be members of this committee. The chair of the RPC would be selected on the basis of his/her preeminence in the field of agricultural science. A significant number of its members would be
from outside ICAR. Members would serve for a period of two to three years, with some staggering of appointment starting at the end of the first two years to allow for continuity.

Proposals for production systems research specific to an agro-ecosystem would be reviewed for technical merits by Scientific Advisory Panels (SAPs). Recommendations for funding would be made by SAPs to the agro-ecosystems director (see below). The composition of SAPs would include: an eminent scientist as the chairperson, eight experts in different scientific disciplines, FA (DARE) or his representative, national coordinator research, NATP, concerned agro-ecosystems director. Concerned principal production systems scientist would be the member secretary. Appointment to SAPs would be approved by the PMC.

Responsibility to oversee implementation of production systems research within each agro-ecosystem would be delegated to agro-ecosystem director. At a system level, a principal production systems scientist, located in a nominated lead institute, would be responsible to the agro-ecosystem director for research program planning, implementation oversight and reporting as well as for coordinating the contributions of a multi-disciplinary group of cooperating institutions. Agro-ecosystems director and SAPs would also be responsible for reviewing and approving technology adaptation and refinement work program to be undertaken by the Extension Division of ICAR.

The research to be supported through the competitive grants program (CGP) may be strategic or applied. In addition to encouraging participation by non-ICAR institutions, it would support public-private partnerships and joint ventures for commercializing research "products".

(iii) Review and Implementation Arrangements for Innovations in Technology Dissemination:

For implementation of the technology dissemination component, partnerships with NGOs and the private sector would be developed. Funds would be provided for pilot testing of new approaches in 24 districts in a phased manner. In the first instance work would start in one district in each of the participating states with an active KVK or a zonal research station. Following the first major review of the project, 18 months after effectiveness of the project, an additional 12 districts would be brought under the project. The remaining districts would be added following a second review to be undertaken 36 months after effectiveness. As soon as a district is selected for inclusion in the project, action would be initiated to establish an Agricultural Technology Management Agency (ATMA) for implementing the technology dissemination program. At both stages in the expansion of the pilot program, there would be flexibility to adjust the design and scope of the work based on implementation experience.

At the state level, implementation of the reform program would be overseen by an inter-departmental working group under the chairmanship of the Agriculture Production Commissioner/Development Commissioner/Secretary Agriculture. ATMA would integrate the technology dissemination activities of different institutions that operate in the district into a district strategic extension plan. To enable direct funding and to provide operational flexibility, ATMAs would be registered as societies and directed by a governing board composed of stakeholder representatives. To improve the quality of service provided by the block level office of the line departments their capability would be enhanced through training and assignment of better qualified extension staff. At the village level farm families would form voluntary informal farmers organizations (self-help groups and commodity groups) with the help of NGOs. Representatives from these groups would be trained as a para-technical worker who would share responsibility (with government functionaries) for transferring technical, marketing and other information to group members. In addition, formation of farmer advisory and consultative teams
would be encouraged to provide feedback on programs and activities through ATMAs or directly to senior government officials. Finally, to promote financial sustainability of the technology dissemination system, revolving accounts and cost recovery mechanisms would be established by ATMAs.

The implementation arrangements for the technology dissemination components would be included in the Participation Agreement between GOI and each project state (Andhra Pradesh, Maharashtra, Orissa, Bihar, Himachal Pradesh and Punjab). Each Participation Agreement would include provision whereby each project state, not later than September 30, 1998, would establish at least one district ATMA, and would, thereafter, establish the remaining ATMAs in accordance with the phasing described above.

(iv) Human Resource Development.

For staff development/training related to needs of individual components of the project, e.g. research and technology dissemination, selection of trainees and approval of training activities would be an integral part of the review and decision process for specific technology development and dissemination proposals submitted for approval. This process would also cover support for strengthening of international linkages to improve the quality of science and scientists in the system. PIU would have the responsibility for collating and tracking implementation of the training activities, with expert advice from consultants in human resource development to be engaged to review the effectiveness of the training program. MANAGE would provide training in extension management and assist in building the training capacity of participating states. In its training programs, MANAGE would give special attention to providing training in extension methodologies with emphasis on participatory approaches.

At Negotiations assurances were obtained that:

(a) by December 31 of each year, starting in 1998, PMC would provide to IDA/Bank for review and comments, an annual work program for the Project for the following year;

(b) beginning March 31, 1999 six-monthly and annual progress reports would be submitted by PMC within thirty days of the reporting period for IDA/Bank’s review and comments setting out the progress achieved in carrying out the project during the previous six months or year;

(c) By September 30, 1999 and March 31, 2001, PMC would undertake project implementation reviews, and in consultation with IDA/Bank develop an action plan to implement their recommendations; and

(d) by September, 30, 1998, PMC would select a management agency with expertise in human resource development for placing candidates selected for overseas training under the project; and by December 31 each year starting in 1998 furnish an annual training plan satisfactory to IDA/Bank.

Monitoring and Evaluation. (See Annex 1 - Performance Indicators for detailed listing of monitorable indicators.)

Each component of the project has specific monitoring and evaluation requirements and will be evaluated in terms of: (i) processes (system and farmer orientation, private sector participation, and implementation of new ways of soliciting, reviewing and funding proposals); (ii) implementation of the interventions and investments; and, (iii) impacts of the specific research and extension activities. The M&E system will follow a bottom up process and be highly decentralized. Production system leaders would have the responsibility to monitor and evaluate individual research projects for their system,
agroecosystem directors would monitor research programs, while the PIU will have responsibility for monitoring overall progress as well as the effectiveness of new research and extension processes. The major components of research M&E will be:

**At the project level:** (i) realistic milestones (about two per year) on research inputs, implementation, and expected outputs; these will be unique to each proposal; (ii) brief six monthly reports including achievement of milestones using a revised version of the existing research project file (RPF) documentation; (iii) more comprehensive annual report including achievement of milestones using revised RPF; (iv) final project report using revised RPF.

**At the program level:** (i) annual reports of principal scientists for each production system, team of excellence or mission-mode program noting overall progress in terms of milestones, problems, and corrective actions taken; (ii) reports of field visits by PIU, agroecosystems system director etc.; (iii) annual workshops at production system level; production system principal scientists under the guidance of agroecosystem directors will have major responsibility for decision making, action and follow up with respect to problems in implementation.

**At the NATP level:** (i) annual workshop for all NATP research at national level (involving key team leaders) at which findings will be presented; (ii) external reviews (including international experts as appropriate) at 1.5 and 3.5 years to be arranged by the relevant scientific review panel for each production system, and for mission mode and strategic research (one team to review several mission mode and strategic research programs); (iii) overall monitoring by the research program committee to ensure that technical standards are being met, through sample reviews of research proposals, project reporting, field visits, monitoring of implementation of recommendations of external reviews, and participation in workshops.

The evaluation of the overall NATP process reforms would be undertaken at two levels: (i) external review teams would be asked to review the implementation of improved research processes, including priority setting, technical screening of research proposals, multi-disciplinary and systems orientation, and decentralized financial and administrative management; (ii) external reviews by a team of management consultants would assess progress in implementing reforms through informal interviews and surveys of scientists and managers.

**Impact assessment of research** would be coordinated by NCAP. Because of the long term nature of research, it will not be possible to conduct a full scale impact assessment of research initiated under NATP during the life of NATP. However, some early impacts should become evident. Outside consultancies would be employed as needed.

**M&E for technology dissemination** will also be decentralized to the District level. Each selected District would have a simple milestone-based reporting system which would track key indicators. Impacts of institutional innovations will be evaluated by a contracted agency.

**Overall NATP monitoring,** using a simple and decentralized management information system including computerized project management, will be an ongoing process carried out under the PIU. It will involve several tools including CPM, links to the budgetary and accounting system, analysis of project reports, supervisory visits and field assessments, workshops, meetings of project managers, and quality checks including peer reviewers.

**Accounting, Financial Reporting and Auditing Arrangements:**

Financial advisors in ICAR and DAC would oversee financial management of their respective budgetary
allocation for NATP activities. Project accounts would be maintained by PIU with the help of a full-time senior financial manager. These would provide a comprehensive and consolidated record of project financing and expenditure, including financial contribution from GOI. The accounting data would be capable of generating information for reporting financial performance by project components and expenditure categories. Comparison of actual and budgeted expenditure would also be possible. In addition, in time, the accounting system would also generate information on expenditure by method of procurement adapted to ensure that the ceilings established for various procurement methods laid out in the procurement schedule can be regularly monitored. Detailed documentation for SOE submissions would be maintained either at the PIU or the participating entity level depending on the component and lead institute, and would be made available for Bank review upon request.

ICAR already has a computerized accounting system operating at HQ and many of its institutes. To allow segregation of investment from recurrent expenditure, and to meet IDA/Bank’s financial reporting requirements some modifications in the existing accounting system have been agreed with ICAR and DAC. These include: (i) designation of separate code-groups for project expenditures; (ii) definition of expenditures based on amounts actually spent; and (iii) reporting of actual expenditures, including payments against terms and conditions of contractual agreements, which alone would qualify for reimbursement by IDA/Bank.

ICAR and DAC have agreed to interlink their NATP budgeting system with the accounting system for quarterly financial reporting which would be based on actual expenditures. With these modifications the accounting system would meet IDA/Bank requirements.

Due to the nature of research activities, a lead institution spearheading the work program in one research area may also participate as a cooperating institution in one or several other programs. Therefore, to guide all participants on fund flows, accounting and financial reporting, a detailed exercise has been completed by ICAR to map fund flows from ICAR to the participating entities. This shows how accounting and other information would pass back up the chain to ICAR for incorporation into the PIU maintained Project Account, and at what points the data would be aggregated for financial reporting and analyses.

In view of the weak accounting system in the participating agencies outside the ICAR institutes (some SAUs, for example) and lack of ICAR compatible computerized accounting system, the project would assist with upgrading of accounting and financial management systems of major partners. This would not only enable them to respond to the accounting and reporting needs of the project but also develop capacity that would have broader benefits for the participating institutions. Some support is already available under the on-going Agriculture Human Resources Development Project (AHRDP) where the financial management systems of four SAUs (which represent about half the lead SAU partners under this NATP project) are being studied. Lessons emerging from this work would be used for making proposals for the project funded SAUs.

The Project Account and the Special Account would be subject to normal GOI accounting procedures and control, which are acceptable to IDA/Bank. Both these accounts would be audited by an independent auditor in accordance with standards acceptable to IDA/Bank. The formats of the consolidated project accounting submissions after auditing (which would be based on a components use expenditure categories matrix) were agreed at negotiations. The PIU would be required to submit a summary of project accounts and a summary of SOE disbursements which would be addressed separately in the auditor’s opinion. To meet IDA/Bank requirements for submission of the audit reports submission (six months after completion of the financial year), ICAR has agreed that appropriate auditing arrangements will be in place before negotiations. The fund flow analyses would indicate the agencies and amounts involved, and would form a basis for audit by the Comptroller and Auditor
General (CAG), of the consolidated Project Account maintained by PIU. At Negotiations assurances were obtained that by December 31, 1998, ICAR and DAC, with assistance of financial management consultants, would prepare a manual for accounting, auditing and internal financial control practices acceptable to IDA/Bank and, thereafter, commence a training program on such practices for ICAR and the other institutions participating in the implementation of the project.

D: Project Rationale

1. Project alternatives considered and reasons for rejection:

With respect to the project design alternatives, the options considered were:

(a) support for the research system in its present form without major reforms in the way the public sector research operated. This was rejected as being inefficient, unlikely to foster creativity, and unlikely to be sustainable;

(b) a project focused solely on privatization of research with the majority of funds allocated to competitive grants. This was rejected as being unlikely to address the major problems including the need for greater attention to overall quality of science, the need for more research focus on poor rainfed areas, the need for attention to longer term environmental sustainability issues, and the need for improvement in public goods such as integrated pest management, nutrient management, phytosanitary regulation, biodiversity conservation, soil conservation, etc.; and

(c) a smaller project addressing only a very limited part of the overall research effort in India, perhaps in selected research areas such as drylands. This was rejected on the grounds that the research system needs major redirection, not simply fine-tuning in a limited number of areas.

The project would improve prioritization and management across the board, further consolidate the move towards farming system approaches and strengthen capacity to address location specific technology needs of farmers. In the case of technology dissemination, a small component has been designed to demonstrate in a few districts new approaches to greater inter-institutional coordination, the private sector and community involvement.
2. Major related projects financed by IDA/Bank and/or other development agencies (completed, ongoing and planned):

<table>
<thead>
<tr>
<th>Sector issue</th>
<th>Project</th>
<th>Latest Supervision (Form 590) Ratings (Bank-financed projects only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Implementation Progress (IP) Development Objective (DO)</td>
</tr>
<tr>
<td><strong>Bank-financed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Decentralization of research to State Agricultural Universities (SAUs) to conduct research in various geographic areas with special attention to cereals, pulses and oilseed production under rainfed and mixed farming systems. Another objective of the project was to strengthen research-extension-farmers linkages at a time when IDA was also assisting state agricultural extension services.</td>
<td>Nat’l Agricultural Research Project (Credit 855-IN)</td>
<td>Minor Problems</td>
</tr>
<tr>
<td>- The main objective of this project was to intensify and continue the process initiated by NARP for strengthening capacity of SAUs to undertake location-specific research and to extend the scope to cover priority research needs of both irrigated and rainfed areas with a focus on food self-sufficiency. It also established a network of zonal research stations and supported significant expansion of the research system. After Mid Term Review additional objectives were added to include development of Agricultural Research Information System (ARIS) and support for a selected number of strategic research themes.</td>
<td>Nat’l Agricultural Research Project II (Credit 1631-IN)</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>- In 1974 IDA started assistance to introduce and strengthen the Training and Visit (T&amp;V) system of agriculture extension system throughout India. In all fifteen projects were supported. While initial assistance was given to many individual states, at the national level, later support was given through NAEP I, II and III which resulted in national coverage.</td>
<td>National Agricultural Extension projects I, II and III (Credits 1569, 1523 and 1754-IN)</td>
<td>Partially Successful</td>
</tr>
</tbody>
</table>

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)
3. Lessons learned and reflected in the project design:

- OED evaluation of World Bank experience with agricultural research projects globally indicates satisfactory performance of most projects, but identifies a number of weak areas for improvement. These include: limited government commitment to adequately fund the system and to adopt sound research management principles; poor selection and clear identification of research problems or gaps; limited external linkages of national agricultural research systems (NARS), both in and outside the country, and with appropriate development partners to enhance the effectiveness of national and international research programs; limited linkage between research and technology dissemination to increase the speed and rate of adoption; need to foster procedures in NARS that enhance the relevance of research; and lack of scientific rigor and quality of research due to: ineffective scientific networking, lack of external reviews and linkages and non-competitive funding.

- OED evaluation of agricultural research projects in India (NARP I Report No. 8808 June 1970; NARP II Report No. 1612-IN May 27, 1997) concluded that in general these projects achieved their main objective of helping to strengthen the SAUs and decentralize agriculture research. Since the projects were to strengthen need based research they emphasized a closer link between research and extension at the grassroots level. NARP II also finances a number of sub-projects and selective training facilities. As a result, 120 zonal stations have been established with linkages with the state extension services. However, implementation of NARP II was behind schedule in a number of activities, particularly civil works and procurement and the filling of staff positions. In addition, the performance of the sub-projects was uneven between different participating states.

- Over the years, the PCRs and PPARs of completed extension projects in India have concluded that the T&V model during its time was appropriate for India, the extension projects were implemented satisfactorily and the strengthened service produced a positive impact on improving agricultural output. However, the most recent OED audits (NAEP I, II, and III; Report Nos. 8753, 13632 and 16156 of 1990, 1994, and 1996 respectively) raised some concerns. These included: sustainability with respect to provision of operating costs; weak management and effectiveness of the Village Extension Worker (VEW); the need to enhance the quality of extension through analysis of benefits and costs and production/market risk analysis; greater recognition of local conditions and constraints faced by farmers in developing extension messages as well as participation by farming communities in managing the system; limited involvement of the private sector; and the need to develop a stronger M&E system to support the extension service management.

- The Bank-supported research (NARP II) and extension (NAEP I, II and III) projects have come to an end. These projects and past interventions were mainly focused on SAUs and state extension services, but did not address constraints impacting on effectiveness of the technology development and dissemination system as a whole. As a result, while the lower end of the system dealing with adaptive research and extension received support, the institutes financed by the center, which mainly undertake basic and applied research, did not receive sufficient attention. In addition, the overall management approaches and priorities have not been adjusted sufficiently to respond to the changing demands of a large system serving heterogeneous farming communities. The design of the proposed project benefits from IDA’s considerable past experience in this field and draws on detailed analytical work undertaken during project preparation, as well as past studies financed by IDA and GOI (see list in Annex 8). Overall the consensus of these reports was that the revitalization of the research system would require a comprehensive program that: increases funding; makes the system demand driven, increases availability of relevant technologies; strengthens the capacity for basic and applied research; improves efficiency of the system through interrelated changes in organization and management, incentives and skills of scientists through training and closer ties with the international...
science. To meet the emerging challenges in technology dissemination to farmers, the focus needs to be on: broad-basing both coverage of disciplines and of clientele, especially women; more effective use of information technology; staff training in technical as well as social and farm management issues; reduction in the costs of public extension by taking advantage of private sector technology and information resources; and introduction of farmer participation in extension planning and management.

4. Indications of borrower commitment and ownership:

India's commitment to improving the technological base of its agriculture is indicated by steady increases in research funding as a proportion of Agriculture GDP since the 1950s: a further large increase, greater than given to most other government programs, is envisaged under the ninth Five-year Plan (1997-2002). The ongoing program of ICAR reform now shows a resolve, absent until recently, to tackle the institutional, managerial and human resources constraints which have undermined the effectiveness of past investments, as well as to develop ICAR's leadership role in further development of the national agricultural research system. Likewise, although states are increasingly restricted in what they can spend on public extension by pressures to contain public expenditures, many have experimented with new technology dissemination methods or transfers of financial responsibility out of the public sector which have provided replicable positive experience that have influenced the design of this project.

A further indication of GOI commitment is the creation of a National Steering Committee and a National Preparation Core Team of senior officers which oversaw preparation of the project proposal. Both groups worked intensively and fulfilled their roles satisfactorily. More recently, a Project Management Committee (PMC) and Project Implementation Unit (PIU) has been established to coordinate the project activities in which Core Team members are also expected to play a leading role. Similarly, DAC, through its extension management institute MANAGE has developed detailed implementation plans for the Technology Dissemination component in the pilot districts. Wider ownership of the project - by national research institutes, participating states, researchers at local level, stakeholders (public and private) in districts, and farmers themselves - is being developed by workshops, seminars and PRA exercises to establish priority needs of farmers during the pre-project effectiveness period.

5. Value added of Bank support in this project:

There are a number of areas where IDA/Bank brings added value to this development activity. IDA/Bank has:

(a) wide experience in helping governments improve and reform their agricultural research systems, including experience from the earlier research and extension projects in India;

(b) a unique association with the Consultative Group for International Agricultural Research (CGIAR) system which expands the experience and provides opportunities for development of linkages with international science;

(c) a large portfolio of projects in India which provide a thorough understanding of the interplay between issues affecting the efficiency and effectiveness of the technology system and overall growth of the sector;
(d) an on-going Agriculture and Human Resources Development Project which is helping to improve the quality of scientists joining the research system and is tackling a number of issues related to the management of State Agriculture Universities;

(e) capacity to tackle the short, medium and long term management reform and sectoral sustainability issues in a comprehensive and coordinated manner necessary to address needs of a large Indian system; and

(f) a strong relationship with the management of ICAR and MOA which provides good opportunity for implementation of a far reaching reform program necessary for such an important project.

E: Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (supported by Annex 4):

[ ] Cost-Benefit Analysis: NPV=US$ million; ERR= 35%  [ ] Cost Effectiveness Analysis:
[ ] Other (Specify)

The project is expected to give an Economic Rate of Return of about 35 percent (see Annex 4). The analytical approach itself has been broad with respect to methodology but selective with respect to component cases analyzed. It has followed five main directions:

- Simple aggregate ex ante rate of return estimates, without economic adjustments, for major commodities or commodity groups to indicate rates of return achievable if research were to give output increments of one tenth of one percent, which is well below the margin of error of ex ante researcher estimates of benefits. Rates of Return from this lie in the range of 25 percent to 50 percent. The very high returns for very small increments reflects the scale of Indian agriculture.

- System-specific ex ante rate of return analysis using a methodology incorporating elasticities of Supply and Demand covering the rice/wheat system and the components of it, including varieties, tillage, weed control, and nutrient management; also, following a similar methodology, an ex ante analysis for a specific technology - hybrid rice. In the main rice/wheat system analysis the rates of return ranged from 26 to 46 percent with an aggregate of 49 percent and an overall ERR including the pro-rata share of the project overheads, of about 35 percent.

- A preliminary priority setting exercise, incorporating Participatory Rural Appraisal techniques undertaken during the project preparation phase, a component of which was a cost benefit analysis for each research activity being proposed. This was the first attempt in India at such an exercise related to agricultural research. The methodology used needs improvement and, following deliberations on priority setting at a three day workshop held during the appraisal mission with international participation, is being refined further. This refinement is being done under the guidance of NCAP taking a sample of case studies to further test practical methodologies before wider replication later in the project period.

- A review of ex post evaluations of research in India over the last 15 years covering a number of commodities, sectors and sub-sectors. These gave rates of return ranging from 38 percent to 218 percent. At the lower end these are consistent with the ex ante analyses outlined above.

- A review of 'congruence' comparing values of output for commodities and proposed incremental project research investments for those commodities. While these have to be
interpreted with great care, the results indicated a reasonably good match but suggested that research expenditures proposed under the project may be somewhat high for fish and sugar and low for oilseeds, rice, coarse grain and plantation crops. This will be taken into account in the research proposals review process.

Given the very high rates of return and the very speculative nature of projecting economic returns to individual research components, limited sensitivity analyses has been undertaken. The ERR of the analyzed components are quite insensitive to changes in parameters.

A number of broader aspects of the economic assessment are covered in Annex 4, most of which are covered in other sections of this PAD. The most important of the broader aspects is the question of the justification for public rather than private investment. India has not lagged behind other IDA eligible countries in the percentage of agricultural research funding coming from the private sector, particularly in the area of development and production of improved seed varieties. The percentage of private sector research in the total is currently estimated at 16 percent. While this percentage is lower than Philippines, Mexico and Ecuador it is higher than Argentina, Brazil, Chile, Columbia, Peru and Venezuela, which, in this sample of countries, puts India well up in the ranking in terms of percentage of private research related to country per capita income levels. The project is designed to help advance this privatization further but takes an evolutionary, rather than revolutionary, approach. More specifically, the rationale for further substantial levels of public investment is the following:

(a) To better address the poverty issue. The benefits from a substantial proportion of the priority research areas identified (e.g., on marginal areas, dryland soil and moisture conservation, etc.) cannot be readily appropriated by the private sector. We expect the private sector to focus almost entirely in the easier irrigated areas rather than the relatively neglected areas of research that are the predominant focus of this project.

(b) To better address the environmental issues. Again, the benefits from this work often cannot be appropriated by the private sector (e.g. Integrated Nutrient Management, Integrated Pest Management, etc.).

(c) To accelerate the development of private-public partnerships. The project represents a medium term step towards greater privatization in the longer term.

(d) To address the scale of the technology needs in India, especially for strategic research such as biotechnology. This is so huge that only very large firms or the public sector can make significant impacts quickly.

(e) To address the uncertainties of outcome in research. Uncertainty is particularly related to the riskier rainfed areas, uncertainty inhibits rapid and significant entry by the private sector.

(f) To ensure improved basic and strategic research and whole farm systems research. This provides a secure base and opens up opportunities for private research which typically picks up single commodity, quick return areas but may often ignore within farm system linkages.

(g) To ensure a sound national information system for technology information exchange to support all players.
(h) To support collaborative research-cum-training with foreign institutions. This, initially, will require public expenditure such as travel and 'bench fees' to give the incentive for participation and to demonstrate possible areas of mutual benefit. Later these would be expected to evolve into more commercial relationships.

(i) To test out alternative systems of increasing the private role in extension (about 20 percent of project costs) and increasing farmer feedback to research.

(j) To continue to support a valid regulatory role in certain areas.

(k) To improve the level of skills in the sector which will continue to need substantial public support for some time.

2. Fiscal impact:

ICAR expenditures over 1993-97 have increased from Rs 3.6 billion to Rs. 5.5 billion, representing an annualized growth rate in nominal terms of 11 percent. Adjusting for inflation, the expenditure growth in real terms is 2.5 percent. Expenditure on research itself increased by only 0.3 percent in real terms whereas extension and education increased at 10.3 percent. However, the imbalance is expected to change over the project period with a significant cut-back on extension expenditure. Based on the limited data for 1993-96, crop sciences and soil agronomy and agro-forestry appear to have grown at less than 10 percent per year in nominal terms and agriculture engineering increased at 22 percent. All India Coordinated Research (AICR) projects have grown at 8.3 percent, less than the aggregate rate of 11 percent per year. Expenditure on externally aided projects did not show any significant trend. In terms of category of expenditures, based on four year data to FY 1996, recurrent costs, which include establishment charges, contingencies, and recurrent costs, which include establishment charges, contingencies, and recurrent expenditure on publications and education components, grew at 19.3 percent per year, well over the 13.6 percent for aggregate expenditures, and accounted for 70 percent of total ICAR expenditures. ICAR capital investments grew at a mere 2.6 percent, and were only 11 percent of total expenditures. Expenditure on AICR projects, World Bank and other externally aided projects grew at 4.9 percent.

As the ICAR allocations for the Ninth Five Year Plan are not yet finalized, it is difficult to accurately give ICAR's share of project expenditures compared to its aggregate budget. However, based on anticipated expenditures and disbursement by IDA/Bank, ICAR would be required to allocate about five percent of its expected annual budget of around Rs. 6-8 billion during the peak years of the project period. This estimate is conservatively high because agriculture research is also carried out in 29 State Agriculture Universities (SAUs), 120 Zonal Research Stations and 222 sub-stations. Expenditure by SAUs is Rs 6,000 million per year, but this includes research, extension and agricultural education; a separate estimate for research costs alone is not available.)

Recurrent costs during the project period are expected to be around 15 percent of base costs. Adjusting recurrent costs which will have to be incurred in the post-project period for inflation, ICAR would be required to allocate around Rs 320 million in FY 2002. Assuming the historical 11 percent annual growth rate during 1993-97, ICAR budget for FY 2002 would be around RS 9.3 billion. On this basis, the post-project period recurrent costs would be less than four percent of the ICAR budget in that year. This should not be difficult for ICAR to meet out of its resources.
With respect to financial sustainability of the technology dissemination component, since it is a series of small pilots, the issue is not a concern about overall resources, but whether the strategy for pilots would succeed in their objective to develop both an effective and financially sustainable system in the longer term and enable the participating states to adopt the new approach on a wider scale. The increasing non-governmental participation in technology dissemination could be expected over time to reduce the financial burden on government.

3. Technical:

The research under NATP would have a strong emphasis on location-specific interdisciplinary work programs by inter-institutional teams. Three different modes of research would be supported. First, the project would finance location-specific production systems research to improve productivity, stability and sustainability of the major systems identified by ICAR under different agro-ecosystems. Second, for needs that appear in several production systems and span more than one agro-ecology, the project would support cross-cutting research themes in a mission mode (time-bound applied research), e.g. land capability assessment/management studies, hybrid development, mechanization, protected agriculture, biotechnology, biodiversity, conservation, etc. Third, the project would support upstream strategic research to address constraints to greater productivity of the production systems. The leadership of strategic research programs would either be linked to one prominent individual or group within an existing institution. Teams are expected to achieve excellence in the mandated areas and in their research outputs and would be provided additional administrative and financial autonomy to draw in new ideas from national and international sources. In addition, the creation of a competitive grant program for Agricultural Research and wide-ranging support for human resource development would promote entry of other institutions (general universities, foundations, NGOs, farmer organizations and the private sector) outside the ICAR/SAU system to work jointly or independently on eco-regional problems. To promote partnerships between public and private institutions, it is also intended to provide grants, mostly on a cost-sharing basis, for pre-commercial technical development, pilot manufacturing, market development of products or processes originating from public research. It is expected that support to different modes of research would result in availability of appropriate technologies that suit the agroclimatic and socioeconomic situation of small farmers. At the same time, strengthening of research-extension-farmer linkages and introduction of participatory methodologies would help to improve relevance of research and extension activities to be supported under the project.

4. Institutional:

Both ICAR and DAC, MOA have successfully implemented IDA assisted projects in the past and are familiar with administrative requirements with regards to procurement, disbursements, accounts and audits. However, to expedite project implementation, a decentralized management structure has been proposed along with up-front completion of a number of actions likely to delay implementation, e.g. establishment of PIU, staff re-deployment/recruitment and training, preparation of procurement plans, including bid documents, and commencement of project implementation in pilot locations during the pre-project period.

5. Social:

A large number of research activities to be supported under the project would focus on the needs of small and marginal farmers, who represent a large percentage of the poor especially in rainfed areas. The research and extension agenda would be defined through participatory approaches. ICAR proposes to establish a network of social scientists at the various centers who would be responsible for conducting ex-ante assessment of feasibility, appropriateness and social impact of research activities to be supported under the project. A special task force would be established to review gender issues in agriculture to define the technology development and dissemination agenda for the project. The project would also
finance training programs in socioeconomic assessment of technologies with a special focus on gender issues. In order to facilitate active partnerships between research, extension and farmers, representatives of farmer organizations will be included in the district and block levels management committees for extension. Such an approach would facilitate early assessment of appropriateness of research and extension interventions and enhance relevance of the proposed interventions. At Negotiations assurances were obtained that by December 31, 1998 ICAR in consultation with IDA/Bank would establish a Task Force to prepare a research and extension program on gender issues and shall, thereafter, implement the program agreed with IDA/Bank.

6. Environmental assessment: Environmental Category A B C

Justification/Rationale for category rating: The project would have a positive impact on the environment. It would improve the efficiency with which farmers manage the resources available to them and by this means improve the sustainability of India's farming systems. Development of improved tillage systems and water harvesting in rainfed areas would retain more rainfall in situ, contributing to improved groundwater recharge and reducing soil erosion by runoff, as well as raising farm output. IPM and IPNM systems to be promoted under the project would reduce the use of agrochemicals along with improved choice, placement and timing of application to minimize pollution while optimizing financial and economic benefits. Promotion of agroforestry systems and R&D on improved use of plant residues and cultivated fodder of high nutritive value for animal feed would reduce pressure on natural vegetation for fuel or grazing. In the long-term, breed improvements would allow animal numbers, and hence resource consumption, to be reduced per unit of livestock productivity.

7. Participatory approach [key stakeholders, how involved, and what they have influenced; if participatory approach not used, describe why not applicable]:

<table>
<thead>
<tr>
<th>Participatory Approach:</th>
<th>Identification/Preparation</th>
<th>Implementation</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficiaries/community groups</td>
<td>x xxx</td>
<td>x xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Intermediary NGOs</td>
<td></td>
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<tr>
<td>Academic institutions</td>
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<tr>
<td>Local government</td>
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<tr>
<td>Other donors</td>
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<td></td>
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<tr>
<td>Private Sector</td>
<td>x xx</td>
<td>xx</td>
<td></td>
</tr>
</tbody>
</table>

x=limited consultation xx=strong consultation with limited collaboration xxx=strong consultation and collaboration

- Preparation has involved DAC, MOA, ICAR HQ and institutes and wide consultation with scientists and district level extension staff who would be responsible for project implementation. PRA techniques were used on a sample of proposals.

- Implementation responsibilities for production systems research and district innovations in technology dissemination would be on the basis of consensus within groups of cooperating institutions or stakeholders as appropriate to the activity.

- Planning of field programs would make extensive use of PRA and other participatory processes to ensure technical relevance and define the appropriate contributions to implementation of all those involved, within or outside the public sector.

- Operational responsibilities for execution, monitoring, reporting and accounting during implementation would be agreed for all participants during the consensus planning process.
Beneficiaries and their associations, NGOs, state- and local-level government officials, state agricultural universities and national research and training institutes would all participate in implementation, with roles appropriate to the level (national/state/district/on-farm) of activities involved.

**F: Sustainability and Risks**

1. **Sustainability:**

Institutional, financial and policy reforms to be implemented under the project would enhance efficiency and effectiveness of the participating institutions, thereby, increasing sustainability (also see Block E2). Specific actions being proposed to enhance sustainability include:

- avoiding creation of new infrastructure and staff recruitment
- facilitating devolution of R&D costs to technology users or sellers where appropriate
- introduction of mechanisms to attract more funding for agricultural R&D from the private sector
- exploring and supporting additional means for public research institutions to boost earnings from sale of products and services

2. **Critical Risks (reflecting assumptions in the fourth column of Annex 1):**

<table>
<thead>
<tr>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional and administrative complexity would impede introduction of reform and fail to capture commitment of implementors</td>
</tr>
<tr>
<td>Faltering government/implementation agency commitment to the project, more specially to introduce institutional and policy reforms</td>
</tr>
<tr>
<td>Failure of staff at middle management and working levels to implement new approaches to technology development and dissemination</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Rating</th>
<th>Risk Minimization Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Decentralization of decision making powers to lead implementors and clear identification of responsibilities along with improved systems of implementation planning, performance monitoring and reporting. In addition, provision for conducting a series of pre-implementation workshops to explain/promote project concept.</td>
</tr>
<tr>
<td>Low</td>
<td>Counterpart agencies have been intimately involved in the preparation of the project proposal, including the reform program, and have already stared to implement some of the agreed actions. In addition, regular joint government/World Bank reviews would be undertaken to identify constrains and to introduce appropriate corrective measures.</td>
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<tr>
<td>Medium</td>
<td>The project provides for improved working environment including extensive training programs,</td>
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<tr>
<td>Risk</td>
<td>Risk Rating</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>-------------</td>
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<tr>
<td>requiring new skills and greater commitment.</td>
<td></td>
</tr>
<tr>
<td>Annex 1, cell &quot;from Components to Outputs&quot;</td>
<td></td>
</tr>
<tr>
<td>Pace of O&amp;M reform being proposed would be slow to make significant impact on the system in the short to medium run.</td>
<td>High</td>
</tr>
<tr>
<td>Change over to research planning based on production systems research may take time to be fully internalized and, as a result, research proposals may not be responsive to changing priorities of major production system.</td>
<td>Medium</td>
</tr>
<tr>
<td>Coordination mechanisms for Technology dissemination activities may be constrained by inadequate support form public institutions.</td>
<td>High</td>
</tr>
<tr>
<td>Overall Risk Rating</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

3. Possible Controversial Aspects:

None
G: Main Loan Conditions
1. Effectiveness Conditions:

GOI would have signed the Participation Agreements with all Project States (Maharashtra, Andhra Pradesh, Orissa, Bihar, Himachal Pradesh and Punjab).

2. Other [classify according to covenant types used in the Legal Agreements.]:

Related to Development of ICAR Organization and Management System

(a) By January 31, 1999 ICAR would enter into consultancy agreements with internationally recognized institutions to assist in the institutionalization of Research Priority Setting, Monitoring and Evaluation and Information System Development, and provide associated skill development training to ICAR staff. (Annex 2, para. 1.) (PA Schedule 1, 1)

(b) By June 30, 1999, in consultation with IDA/Bank, ICAR would carry out a review of its personnel policies and procedures and, by December 31, 1999, would issue and implement revised personnel guidelines, including annual performance evaluation and linking such evaluation to personal and professional skill competencies and achievements. (Annex 2, para.1) (PA, Schedule 1, 2)

(c) By January 31, 1999 ICAR, in consultation with IDA/Bank, would engage consultants to develop Terms of Reference for a study on Organization and Management (O&M) reform program in ICAR and a selected number of ICAR institutes and not later than July 31, 1999 complete the study and agree with IDA/Bank on an action plan to implement its recommendations; and by March 31, 2002 ICAR would engage consultants to carry out a follow-up study to assess the overall progress and impact of the O&M reform program and agree with IDA/Bank an action plan to implement the recommendations of the study. (Annex 2, para. 1) (PA Schedule 1, 3)

(d) By June 30, 1999, ICAR would carry out, in accordance with Terms of Reference agreed with IDA/Bank, a study to examine opportunities for expansion of earnings from ICAR’s research products and services and, thereafter, in consultation with IDA/Bank, would take all necessary measures to implement the recommendations of the study. (Annex 2, para. 3) (PA Schedule 1, 4)

Related to Agro-ecosystems Research Programs

(a) ICAR would select the research proposals in accordance with criteria and operational procedures agreed with IDA/Bank. (Annex 2, para. 9) (PA Schedule 1, 5)

Related to Innovations in Technology Dissemination

(a) By June 30, 1999 TDMC would engage consultant(s) to undertake an institutional review of the Directorate of Extension, DAC and immediately, thereafter, agree with IDA/Bank on a plan for implementation of the recommendations. (Annex 2, para. 18 (i)(a))

Related to Overall Management of the Project

(a) By December 31 of each year, starting in 1998, PMC would provide to IDA/Bank for review and comments, an annual work program for the Project for the following year (Section C4) (PA Schedule 1, 7)
(b) Beginning March 31, 1999 six-monthly and annual progress reports would be submitted by PMC within thirty days of the reporting period for IDA/Bank’s review and comments, setting out the progress achieved in carrying out the project during the previous six months or year. (Section C 4) (PA Schedule 1,8)

(c) By December 31, 1999 and June 30, 2001, PMC would undertake project implementation reviews, and in consultation with IDA/Bank, develop an action plan to implement their recommendations. (Section C 4) (PA Schedule 1, 9 (a), (b))

(d) By September, 30, 1998, PMC would contract a management agency with expertise in human resource development for organizing overseas training for candidates selected by the project implementing agencies; and by December 31 each year starting in 1998 furnish an annual training plan satisfactory to IDA/Bank. (Section C 4) (PA Schedule 1, 10)

(e) By December 31, 1998, ICAR and DAC, with assistance of financial management consultants, would prepare a manual for accounting, auditing and internal financial control practices acceptable to IDA/Bank and, thereafter, commence a training program on such practices for ICAR and the other institutions participating in the implementation of the project. (Section C 4) (PA Article III, Section 3.02)

(f) By December 31, 1998 ICAR in consultation with IDA/Bank would establish a Task Force to prepare research and extension program on gender issues and shall, thereafter, implement the program agreed with IDA/Bank. (Section E 5) (PA Schedule 1, 6)

H. Readiness for Implementation

[x] The engineering design documents for the first year’s activities are complete and ready for the start of project implementation. [ ] Not applicable.

[x] The procurement documents for the first year’s activities are complete and ready for the start of project implementation.

[x] The Project Implementation Plan has been appraised and found to be realistic and of satisfactory quality.

[ ] The following items are lacking and are discussed under loan conditions (Section G):

I. Compliance with Bank Policies

[X] This project complies with all applicable Bank policies.

[ ] [The following exceptions to Bank policies are recommended for approval: . The project complies with all other applicable Bank policies.]

[signature]
Task Manager: Ashok Seth

[signature]
Sector Manager: Michael Baxter

[signature]
Country Director: Edwin Lim
Annex 1

Project Design Summary

India: National Agricultural Technology Project

<table>
<thead>
<tr>
<th>Narrative Summary</th>
<th>Key Performance Indicators</th>
<th>Monitoring and Evaluation</th>
<th>Critical Assumptions</th>
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<tbody>
<tr>
<td><strong>Sector-related CAS Goal:</strong></td>
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<tr>
<td>Accelerate sustainable agricultural growth and rural development.</td>
<td>Shifts in productivity</td>
<td>Baseline and follow up survey of farmers’ management practices and productivity, (by contracted agencies in year 5.)</td>
<td>Reoriented research and extension will enhance productivity in agriculture.</td>
</tr>
<tr>
<td></td>
<td>Changes in management practices of farmers due to new technologies and/or improved policy by farm size and type</td>
<td></td>
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<tr>
<td>Promote human capital development</td>
<td>Number and type of human resource development activities undertaken desegregated by gender</td>
<td>Review of ICAR budgets and records</td>
<td>Research and extension managers committed to maintain the pace of policy and/or institutional reforms, including increased future role of private sector and participation of women in research and extension activities.</td>
</tr>
<tr>
<td></td>
<td>Increased share of women scientists in service</td>
<td>Monitoring by PIU)</td>
<td>Sufficient technology available that can be commercialized while protecting small-farmer access to new technologies.</td>
</tr>
<tr>
<td><strong>Project Development Objective:</strong></td>
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<tr>
<td>Increased availability and adoption of appropriate technologies</td>
<td>Number of new technological packages developed</td>
<td>Baseline and follow up survey of farmers’ management practices and productivity, (by contracted agencies in year 5)</td>
<td>(Objective to Goal)</td>
</tr>
<tr>
<td></td>
<td>No. of farm demonstrations undertaken using new technologies</td>
<td>Monitoring by PIU)</td>
<td>Top research leaders continue commitment to reform process.</td>
</tr>
<tr>
<td></td>
<td>Level of adoption of new technologies</td>
<td></td>
<td>Reoriented research and extension will enhance productivity in agriculture.</td>
</tr>
<tr>
<td></td>
<td>Level of increase in productivity due to new technologies by farm size and type</td>
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</tbody>
</table>

1 Indicators in italics are the core key indicators agreed at negotiations. Baseline and targeted should be shown, with the latter divided into values expected at mid-term, end of project and full impact.
<table>
<thead>
<tr>
<th>Narrative Summary</th>
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<th>Critical Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outputs:</strong></td>
<td>1. Enhancement in the efficiency and effectiveness of the research system</td>
<td></td>
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<tr>
<td></td>
<td>Extent and levels of adoption of new priority setting mechanisms</td>
<td>Monitoring by PIU</td>
<td>(Outputs to Objective) Top research leaders and managers would continue commitment to the reform process</td>
</tr>
<tr>
<td></td>
<td>Formalization of mechanisms for consultation with the private sector to rationalize use of public funds</td>
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<td></td>
<td>Improved center management, changes in behaviour and improved staff morale</td>
<td>Management consultancy review and manager and scientists attitude survey</td>
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<td></td>
<td>Extent and nature of use of electronic connectivity in day to day management and communications</td>
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<tr>
<td>2. Improvements in</td>
<td><strong>Improved technical quality of research</strong></td>
<td>In-depth external reviews of research at 18 and 36 months, ICAR</td>
<td>Peer review of sample of program in each of the three modes of sponsored research and in Competitive Grant Research Also: (a) number of publications in international journals; and (b) internal and external technical reviews</td>
</tr>
<tr>
<td>scientific quality</td>
<td><strong>Improved quality of technical information available to farmers</strong></td>
<td>Number of new/improved technologies generated; number of technologies approaching release which have been tested on farm</td>
<td></td>
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<tr>
<td>and relevance of</td>
<td>Level of adoption of new technologies by farmers</td>
<td></td>
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<tr>
<td>research</td>
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<tr>
<td>3. Establishment of</td>
<td>Effectiveness and sustainability of district extension operations as measured by: (a) success of district technology plan; and (b) fund availability and utilization.</td>
<td>Review of extension plans and annual progress reports</td>
<td>Strong commitment from state governments to pilot test decentralized extension reforms</td>
</tr>
<tr>
<td>decentralized and</td>
<td>Level, nature and intensity of stakeholder participation in the Technology dissemination process</td>
<td></td>
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<tr>
<td>demand driven</td>
<td>Level of adoption and productivity impacts of new technologies by farm size and type (long run)</td>
<td></td>
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<tr>
<td>technology</td>
<td></td>
<td></td>
<td>NGOs and private sector organizations in place to participate</td>
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<tr>
<td>dissemination</td>
<td></td>
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<td>Leadership and capacity available to provide training in participatory approaches to developing extension plans.</td>
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<td>system with</td>
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<td>greater farmer</td>
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<td>participation in</td>
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<tr>
<td>its management</td>
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</table>
## Narrative Summary

<table>
<thead>
<tr>
<th>Key Performance Indicators</th>
<th>Monitoring and Evaluation</th>
<th>Critical Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of managers trained against targets and quality assessment of training.</td>
<td>M&amp;E and post-training evaluation reports.</td>
<td>Useful technology is available to extend.</td>
</tr>
<tr>
<td>Number of scientists trained against targets and quality assessment of training.</td>
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</tbody>
</table>

### 4. Human Resources

Development to support long-term growth of the Technology Development and Dissemination system.

- **Number of managers trained** against targets and quality assessment of training.
- **Number of scientists trained** against targets and quality assessment of training.

### Project Components/Sub-outputs

1. Development of ICAR Organization and Management System to enhance efficiency of the public research system through:

   - development of a strategic plan for ICAR, changes in
   - Strategic plan completed against target date, improved Personnel Policies in place.
   - Reviews of major ICAR institutes completed and status of implementation of recommendations.
   - Improved decision making flexibility as perceived by managers and scientists

   - M&E and Management consultant review.
   - Quinquennial scientific and management reviews of research institutes

   - Managers willing to devolve effective power and scientists willing and able to

---

2 Activities under output 1-3 include support for human resource development and would contribute to achievements of this output.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>personnel policies and decentralization an devolution of decision making authority</td>
<td>Level of expenditure authority given to production systems leaders, lead agencies and project leaders</td>
<td>Monitoring by PIU</td>
<td>accept responsibility for financial management decisions</td>
</tr>
<tr>
<td></td>
<td>Actual versus planned disbursement under project by project</td>
<td>External reviews of research programs</td>
<td>Scientific cadre responds to reforms through changes in attitudes and culture</td>
</tr>
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<td></td>
<td>Number of overdue expenditure statements</td>
<td></td>
<td>Scientists willing to base rewards on performance</td>
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<td>Number of projects with delayed implementation against plan, and tabulated breakdown of causes of delays</td>
<td></td>
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<tr>
<td>• Institutionalization of improved priority setting methods at different levels for research and Technology Assessment</td>
<td>New division for planning and priority setting successfully established</td>
<td>ICAR reports and MIS</td>
<td>Managers committed to seeking methods for improving priority setting and shifting allocations in a manner consistent with priorities.</td>
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<td></td>
<td>* Formalisation of mechanisms for consultation with private sector.</td>
<td>Industry surveys and reports</td>
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<td></td>
<td>Shift in private sector investment in technology development activities</td>
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<td>Number of research contracts and joint ventures established under the project</td>
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<tr>
<td>• Increased public-private sector interactions</td>
<td>MIS system for management and monitoring of research projects fully operational</td>
<td>M&amp;E, PIU surveys and external management reviews</td>
<td>Indian communication policy protecting public monopoly changes to allow improvements in communication infrastructure</td>
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<td></td>
<td>MIS system for financial, human and project management implemented in five institutes and plan developed for national scaling up</td>
<td>Library user and scientists surveys</td>
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<td></td>
<td>Percentage of target institutions linked to ARIS</td>
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<td></td>
<td>Effective utilization of electronic communication</td>
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<tr>
<td>2. Agroecosystems</td>
<td><strong>Within India and outside.</strong>&lt;br&gt;<strong>Improvement in library system.</strong></td>
<td><strong>M&amp;E on number of libraries linked, number of accesses and utilisation of library system through user surveys.</strong></td>
<td><strong>Managers/Scientists lack experience and/or commitment in dealing with the private sector.</strong>&lt;br&gt;<strong>Private sector has R&amp;D capacity and willingness to respond to opportunities for public-private partnerships.</strong>&lt;br&gt;<strong>Researchers have skills and incentives to carry out multidisciplinary and participatory research.</strong>&lt;br&gt;<strong>Research-extension links are adequate.</strong>&lt;br&gt;<strong>Sufficient social science capacity and integration with production systems research.</strong></td>
</tr>
<tr>
<td>Research Through Sponsored and Competitive Grants Program</td>
<td>For each technology, number and types of early adopting farmers and estimated productivity impacts&lt;br&gt;<strong>Number against targets in each of the research models and scientific quality assessment.</strong>&lt;br&gt;Progress in technology development and dissemination in relation to time-bound action plan for each approved work program&lt;br&gt;Number of visiting scientists, workshops and training courses carried out&lt;br&gt;External reviews conducted and recommendations implemented&lt;br&gt;<strong>Improved research relevance indicated by use of participatory methods. Percentage of research progress that show evidence of multi-disciplinary and multi-institutional collaboration including inputs of social scientists.</strong></td>
<td>Qualitative reviews including external reviews&lt;br&gt;M&amp;E and quality assessment through MTR.&lt;br&gt;Review of research proposals and published reports&lt;br&gt;Technology assessment and farmer adoption/evaluation surveys carried by NCAP-led social scientist network&lt;br&gt;M&amp;E and mid-term review.&lt;br&gt;M&amp;E assessment of extent and quality of participatory methodologies used in implementation.</td>
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<td>- location-specific research for major production systems</td>
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<td></td>
<td><strong>Support to strategic and cross cutting /mission mode research, where appropriate, involving international partners, and support for necessary capacity building/skill enhancement of</strong>&lt;br&gt;<strong>Percentage of research centers in strategic research mode with international linkages and review.</strong>&lt;br&gt;Number of strategic research programs linked to production systems research, as evidenced by use of findings in resolving</td>
<td><strong>M&amp;E with Mid-Term Review assessment.</strong></td>
<td><strong>Researchers have sufficient external contacts to identify relevant partners.</strong>&lt;br&gt;<strong>External organizations willing to develop research partnerships.</strong></td>
</tr>
<tr>
<td>Narrative Summary</td>
<td>Key Performance Indicators</td>
<td>Monitoring and Evaluation</td>
<td>Critical Assumptions</td>
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<tr>
<td>scientists</td>
<td>technical constraints to improved production systems research and feedback of priorities from production systems research to strategic research</td>
<td></td>
<td>Non-traditional partners have skills to prepare proposals and willing to share costs</td>
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<tr>
<td></td>
<td>Number of national and international exchanges</td>
<td></td>
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<tr>
<td>• Support to Competitive Grants Program to improve quality and competitiveness along with wider participation of and/or partnerships with institutions outside of the ICAR research system</td>
<td>Percent of resources allocated through competitive process.</td>
<td>M&amp;E</td>
<td></td>
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<td></td>
<td>Number and value of products developed for commercial ventures through public-private sector partnerships</td>
<td></td>
<td></td>
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<tr>
<td>3. Innovation in Technology Dissemination</td>
<td>Establishment of pilot district ATMA(s) with broad stakeholder participation.</td>
<td>M&amp;E - number established against target. Percentage of each stakeholder category participating.</td>
<td>Removal of administrative complexity, improved incentive structures, and participatory decision making increases is encouraged by administrators and managers</td>
</tr>
<tr>
<td>Introduction of policy, institutional and operational changes, to create a demand driven system with decentralized management (at the district level), and greater coordination and feedback between extension agents, farmers, and scientists</td>
<td>Strength of links between production systems research (undertaken by ICAR and SAUs) and the district technology dissemination system (ATMA(s)) as evidenced by number of joint training workshops, field visits and feed back from extension to research priorities</td>
<td>Contracted evaluation surveys in year 5</td>
<td>Attitudes and environment is conducive to participatory planning and decision-making at all levels.</td>
</tr>
<tr>
<td>Formation and strengthening of Farmers Interest Groups (e.g. Commodity Associations, Self-Help Groups) in all participating villages</td>
<td>Effectiveness and sustainability of district extension operations in pilot districts.</td>
<td>Monitoring by PIU</td>
<td></td>
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<tr>
<td></td>
<td>Number of effective groups formed. Extent of stakeholder participation in technology dissemination planning process.</td>
<td>Dissemination contacts by: contact type agency geographic area technical area type of farmer</td>
<td></td>
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<tr>
<td>Preparation of district technology plans using participatory methodologies to provide location specific recommendations to intensify production systems</td>
<td>Relevance and ease of access to quality technical</td>
<td>M&amp;E on success of Strategic Extension Plan including drawing from adoption surveys. Assessment by M&amp;E of ATMA fund availability and utilisation.</td>
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<td>M&amp;E plus review of Strategic Extension Plans and annual reports.</td>
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<td>information by farmers as well as number of farmer training courses conducted</td>
<td>M&amp;E - number of joint training workshops, joint field visits and extent of other feedback contacts from extension to research.</td>
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<tr>
<td>Level of adoption. Improved linkage between research and dissemination.</td>
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Annex 2
National Agricultural Technology Project
Project Description

**Project Component 1 - US$57.4 million** (total cost of component)

**Development of the ICAR Organization and Management O&M Systems**

The four sub-components to be supported would consist of:

(a) **Support for ICAR O & M Reforms.**

1. **Reforms.** A number of reforms to ICAR organizations and management would be carried forward with funding from the project for consultancies and training including improvements to staff selection and performance assessment. The operational efficiency of ICAR's headquarters would be improved through provision of civil works, equipment, consultant services and training. In addition, the project would finance reviews of organization and management of a sample of ICAR institutes to introduce actions to improve both efficiency and effectiveness. The project would finance consultants to assist in finalizing the choice of institutions and Terms of Reference for the studies as well as follow-up actions to facilitate implementation of recommendations arising out of these studies. Changes would focus on quantitative and structural aspects, behavior of staff (perceived roles, work culture, motivation, decision processes). Experience gained would be built into the training syllabus of NAARM, which would also be strengthened including expanded capability in project management, following an external review of its mandate. A list of potential monitorable indicators and benchmarks for policy and management reforms in the system is given in Annex 1. In most cases, ICAR has already initiated these reforms and implementation will be monitored under NATP. The project would finance a management consultant(s), to review progress in implementing reforms, identify emerging problems, and provide regular feedback to ICAR management. At Negotiations assurances were obtained that: (a) by January 31, 1999 ICAR would enter into consultancy agreements with internationally recognized institutions to assist in the institutionalization of Research Priority Setting, Monitoring and Evaluation and Information System Development, and provide associated skill development training to ICAR staff. (b) by June 30, 1999, in consultation with IDA/Bank, ICAR would carry out a review of its personnel policies and procedures and, by June 30, 1999, would issue and implement revised personnel guidelines, including annual performance evaluation and linking such evaluation to personal and professional skill; (c) by January 31, 1999 ICAR, in consultation with IDA/Bank, would engage consultants to develop Terms of Reference for a study on Organization and Management (O&M) reform in ICAR and selected number of ICAR institutes and not later than July 31, 1999 complete the study and agree with IDA/Bank on an action plan to implement its recommendations; and by March 31, 2000 ICAR would engage consultants to carry out a follow-up study to assess the overall progress and impact of the O&M reform program and agree with IDA/Bank an action plan to implement the recommendations.

2. **Institutionalization of Research Priority Setting Mechanisms and Improvement of the Monitoring and Evaluation (M&E) Arrangements.** The project would finance further strengthening of national institutional capacity through NCAP for: (a) more rational allocation of resources between macro-level priorities for agricultural research, e.g. different production systems, commodities, target socio-economic groups; and (b) framing of localized micro-level priorities for technology development programs of greater relevance to the needs of target beneficiaries. At the program/institute level, benefit-cost methods for ranking applied research projects and programs would be tested. At the project level, priorities would be developed through participatory methods involving beneficiaries, and scoring/checklists. To operationalize the agreed priority setting mechanisms the project would finance local and international consultancies, review of NCAP’s mandate, training workshops, and provision for equipment and vehicle.

3. **Cost Recovery of ICAR Services.** Expansion of ICAR’s earnings from products and services, including activities of ICAR’s Directorate of Publications whose capacity to operate on commercial lines would be enhanced through provision of consultancies and training. At Negotiations assurances would be sought that by June 30, 1999, ICAR would carry out, in accordance with Terms of Reference agreed with IDA/Bank, a study to examine opportunities for expansion of earnings from ICAR’s research products and services and, thereafter, in consultation with IDA/Bank,
would take all necessary measures to implement the recommendations of the study.

(b) **Human Resource Development for Research Management.**

4. The project would enhance the managerial skills of staff of NARS through provision of study tours, training, and funds for managerial exchanges between research institutions. The sub-component would be administered by PIU.

(c) **Information Systems Development.**

5. **Hardware.** The project would support expansion of electronic connectivity of Agriculture Research Information System (ARIS), initiated under NARP II, down to divisional level within all ICAR Institutes. These institutes would be provided access to worldwide web, link all SAUs with their ZRSs, and develop electronic linkages between and amongst the concerned units of the Directorate of Extension (DOE) and MANAGE. The electronic connectivity would also be extended to the extension units at the State and districts participating in the project. The project would finance consultancies, training for staff including new computer users, and workshop costs associated with setting up the expanded system and its operation.

6. **Library Information Systems.** Using the enhanced connectivity the project would improve on-line access by Indian scientists in the ICAR and SAU systems to (a) international databases and scientific literature held centrally within the country; (b) new databases on Indian agricultural and socio-economic research and development to be created with project support; and (c) external databases accessible through the worldwide web. Funding would cover subscriptions to some technical and scientific journals; the acquisition of reference material and abstracting journals in CD-ROM format to be made available through ARIS and a number of remote-access CD-ROM readers; and consultancy and training support for modernization of the library systems and procedures. Four major national research centers would be equipped as hubs for the strengthened library and information system. In addition, a selected number of central research institutes and SAUs would be linked to the main libraries. The project would support establishment of a network of library information system specialists and provide training in library information systems. These improvements would be executed under the overall guidance of the Information System Development (ISD) cell in ICAR.

7. **Management Information System.** Steps would also be taken to further develop ICAR's embryonic Agricultural Project Information System (APIS). APIS would eventually aim to record research resource allocations between commodities, disciplines, production factors, research categories and institutes/levels within the national system. Ready availability of such information to all concerned would help to avoid duplication of work or overlaps. Data recording would cover ongoing and completed projects and provide the information necessary to assess congruence with national priorities and optimize future resource allocations. Funding would be provided to assist institutes with further development and expansion of the system. In addition, training would be provided to prepare a few staff in each participating unit to operate and maintain record-keeping in the APIS system, as well as for sensitization of research managers. The evolution of the system would be the responsibility of ISD cell in ICAR. Starting with research funded under NATP, by the end of the project installation of APIS would have begun in most ICAR institutes and SAUs.

(d) **NATP Project Implementation Unit (PIU).**

8. PIU, which has been set up in ICAR Headquarters, would be answerable to the NATP Project Management Committee (PMC). PIU would be headed by a National Director with the status of an ICAR Deputy Director-General. The PIU would be responsible for overseeing implementation of the project. It would coordinate, and collate document information on budget, financial operations, procurement, training and preparing progress reports on the project financed activities. PIU would also provide secretariat for the NATP National Steering Committee (NSC). The National Director would be assisted by a Director of Finance, a Director (Administration), four Under-Secretaries, a Procurement Officer and four National Coordinators for the Sponsored (production system, cross-cutting, strategic) and Competitive Grant elements of the project and appropriate supporting staff. Staffing level of PIU would be kept under review and, if necessary, increased in relation to expanding work program. PIU would adopt computerized project management systems and engage professional management consultants to ensure timely and efficient implementation of the project. Funds would be provided for civil works, equipment, travel and communications, workshops, consultancies and contractual services, training and incremental staff.
Project Component 2 - US$139.4 million (total cost of component)
Support for Agro-Ecosystems Research Through Sponsored and Competitive Grants Program

9. Under the project, all research funding would be made available through a S&CGP. This program would fund high quality, collaborative research designed to provide solutions to specific problems confronting Indian farmers within their production systems and back-stop this work by supporting strategic/mission mode research. Funds for sponsored research would be largely utilized by institutions within the ICAR system. Competitive Grants Program, on the other hand, would be open to all public and private institutions with capacity to undertake research on identified priorities. All research, whether sponsored or advertised, would be reviewed for technical quality by the same processes, overseen by the Research Program Committee (RPC). Different modes of research to be financed under the project and criteria to be used to evaluate proposals under the production systems research are described in Attachments I and II respectively. Accordingly, the priority research themes included in the preparation report would be reviewed against criteria as the detailed proposals are developed and submitted for approval. Attachment 2 gives a proposal version of the criteria which will be refined and agreed following some further review. At Negotiations assurances would be sought that ICAR would select the research proposals in accordance with criteria and operational procedures agreed with IDA/Bank.

10. A brief description of different modes of research to be financed under the project is given below:

1. Sponsored Research
   
   (a) Production Systems Research.

11. In a major shift away from research based on individual commodity, the project would finance location-specific research to improve the productivity, stability and sustainability of major production systems under five broad agro-ecosystems (intensive irrigated, rainfed, hill and mountain, coastal, and arid). The research themes to be supported would be those considered crucial to maintain/accelerate food security, sustainability, economic growth, equity or rural welfare. Support for production system research would also provide opportunity for the integration of biological sciences with the contributions of social and economic sciences. Eligible programs in priority areas would be those involving multi-disciplinary approaches and promoting greater integration of the contributions of ICAR institutes, SAU HQ and Zonal Stations and other public and private agencies with necessary infrastructure and staff. Work on at least one production system within each agro-ecosystem would start in the first year of project disbursement. Work on the remaining systems would start during the second or third hear of disbursement period. The first set of research themes for the production systems has been selected by discussion as self-evident general targets for initial project work, on the basis of accumulated experience and consensus between technical specialists. Further participatory exercises would be carried out at zonal level, in many cases with beneficiary participation, to finalise research plans for each production system.

12. Initially, the research activities would be grouped around the following general themes, their individual prominence depending on the setting: natural resource management (soil, water or vegetation); application of biotechnology or other frontier sciences; post-harvest value-addition; integrated pest management (IPM); integrated plant nutrient management (IPNM); socio-economic research on tribal and gender issues; and conservation or exploitation of agro-biodiversity. During later years of the project research priorities would begin to be influenced by the priority setting mechanisms to be developed and adopted under the project.

13. The project would support the incremental costs of participatory rural appraisals and other field diagnostic work, new or replacement equipment, vehicles and other travel costs, necessary rehabilitation of infrastructure, training/re-training, workshops and seminars, consultancies, temporary contractual employees and operating expenses. SAU ZRSs would play an important role in conducting production system research, including technology assessment and refinement work. Accordingly, funds would be allocated to strengthen their capacity to participate in the project.

14. The research needs that appear in several production systems and in some cases span more than one agro-ecosystem, would be supported through (time bound and target oriented) research to provide central backing to location
specific research, e.g. land capability assessment, hybrid development, mechanization, protected agriculture, etc. Cost items to be financed under the project would be similar to those involved in location specific production systems research. During the preparation phase ICAR had identified about 15 topics (described in the preparation report) for possible financing under this category. These would be subjected to the peer review process under the project prior to commencement of work.

(c) Strategic Research Through Teams/Centers of Excellence.

15. To back-stop the production systems research, the project would support strategic or upstream research. These programs would be linked to one prominent individual scientist or a group of scientists within existing institutions (Teams/Centers of Excellence). They would be provided with additional administrative and financial autonomy to facilitate contracts both to draw in new ideas and to disseminate them within India, as well as to pilot new forms of decentralized management of research units/activities. A selected few of these teams of excellence would have specialized mandate for human resource development in their field of specialization. During this period of rapidly advancing frontiers of science strengthening of international linkages would be an important instrument in improving both the quality of science as well of scientists in the system. Accordingly, funds have been allocated under this sub-component to promote need-based linkages with institutions having complimentary interests/expertise. The strategic research programs would be subject to regular external reviews, and would close once it was considered they had achieved their objective, or earlier if they lose their intellectual leadership or innovative nature. Funding would be provided for study tours and communications, holding of workshops and seminars, equipment, vehicles, necessary infrastructure rehabilitation, visiting fellows and other ‘twinning’ costs with outside institutions, temporary employees and incremental operating expenses.

2. Competitive Grants Program for Agricultural Research.

16. To draw participants outside the ICAR/SAU system into national agricultural research and fill gaps in important areas related to the production systems research program, such as location of specific research on natural resource and/or pest management for small farmers, and to encourage linkages between research and development activities of public and private organizations, the project would establish a Competitive Grants Program with two funding windows. These would include support for: (i) innovative research initiatives or partnerships on topics related to improving the productivity and sustainability of production systems on a time bound mission mode or location specific research, especially those of marginal farmers, women and other disadvantaged groups; and (ii) pre-commercial technical development, pilot manufacturing, market research or development of products or processes originating from public sector research. Outside partners to work with public institutions would be expected to be mainly from the corporate sector, in which case costs would be shared. A Competitive Grants Unit would be created in the PIU to implement the sub-component as per guidelines and criteria prepared for the scheme.


17. Staff development support/training would be directly linked to the needs and demands of research activities to be supported under the project. Each year the project would finance short study tours, both within and outside India, for NARS scientists, post doctoral training or sabbaticals, and faculty exchanges to allow skill enhancement and/or to underpin collaborative research programs. The overall aim of this sub-component would be to import into India, and then diffuse within the country, new knowledge and skills related in particular to frontier science and in social and economic sciences related to eco-regional research objectives. Topics, destinations and exchange institutions would be chosen accordingly. The sub-component would be administered by the PIU.

Project Component 3 - US$42.8 million (total cost of component)

Innovations in Technology Dissemination

18. This component would address identified constraints within the existing service to transform it into a knowledge-based demand-driven technology dissemination system through policy reforms, institutional changes, adjustments in operational procedures and human resource development. These changes would be introduced both through the national as well as state level institutions/activities. A flow diagram illustrating primary activities and
conceptual approach of a “reformed” system are shown in Chart 3. Funds would be provided for pilot testing of new approaches in 24 districts in a phased manner, in six states. In the first instance one district each in the participating states with an active KVK would be selected. During the next stage of the project, to commence following the first major review of the project about 18 months after effectiveness, additional 12 districts would be brought under the project. Remaining districts would be added to the project following a second review to be undertaken 36 months after commencement of the project. At both stages in the expansion of the pilot program there would be flexibility to adjust the design and scope of the work based on implementation experience. The project would finance civil works, computers, equipment, consultancies, workshops, training and exchange visits with other centers of excellence in Technology dissemination. Specific activities to be supported would include:

(i) **Support to the National Level Agencies**

(a) *Strengthening of Coordination Mechanism through Technology Dissemination Management Committee (TDMC) and Technology Dissemination Unit (TDU).* At the National Level, TDMC established under the project would provide a mechanism for more effective coordination of technology dissemination activities being financed by ICAR and DAC. As TDMC would include representatives of NGOs, women’s organizations and the private sector, it would provide a forum for these organizations to influence both the reform process as well as the TD agenda of public institutions. Establishment of TDMC would allow investments to be planned and reviewed in a more systematic manner and linked to extension priorities at various levels in the system, especially the district. TDMC would also be responsible for engaging the participating state governments in debate on all aspects of reform agenda related to the technology dissemination activities. In addition, a TDU would be set up in DAC which would act as the secretariat for TDMC and assist in coordinating the component implementation. TDU would be provided with an accountant, monitoring specialist and training coordinator, training, consultancies, equipment, renovated office space, and funds for M&E, workshops, seminars, travel, and development of publications. *At Negotiations assurances would be sought that by June 30, 1999 TDMC would engage consultant(s) to undertake an institutional review of the Directorate of Extension, DAC and immediately, thereafter, agree with IDA/Bank on a plan for implementation of the recommendations.*

(b) **Support to the Directorate of Extension, DAC, MOA.** The project would strengthen the Directorate of Extension in DAC to support innovations in the use of informatics and mass media in extension delivery through provision of civil works, office equipment, consultant’s services, computer hardware and software and vehicles, and carrying out a study on the long-term role of this directorate;

(c) **Strengthening of National Institute of Agriculture Extension Management (MANAGE).** The project would assist MANAGE to: (i) expand its program for training in extension management, strategic planning and PRA to train senior managers and trainers, especially from the participating states; (b) assist in the preparation of organization and management as well as strategic technology plans for initial project districts; and (c) upgrade quality and skills of its own faculty. The project support would include civil works, equipment and training of trainers and consultancies; and

(d) **Support for ICAR Division of Extension.** The project would finance strengthening of 8 Zonal Coordinating Units of the ICAR Division of Extension to oversee functioning of selected Zonal Research Stations (ZRS), especially in districts where there is a ZRS but a KVK has not been established - there are 53 such districts in the country. It is proposed to commence a long-term program of strengthening and expanding the role of ZRSs to include functions assigned to KVKs. Once fully functional these ZRSs would begin to integrate themselves into a unified extension service along the lines being proposed under the project. ICAR Division of Extension would test an additional mechanism of disseminating research findings and selling research “products” e.g. improved seed/planting material on cost recovery basis. This would involve establishment of Agricultural Technology Information Centers (ATICs) at ICAR institutes and SAUs. Some ATICs would also provide pest and disease diagnostic services
where farmers would be able to bring plant samples for identification and receive recommendations for appropriate control measures. These activities would be undertaken in a phased manner and on submission of detailed feasibility study and investment plans for review and approval by TDMC. Effectiveness of these approaches would be assessed during the overall reviews of the project planned for 18 and 36 months after commencement. These activities would be discontinued if shown not to be cost effective.

(ii) **State Level Pilot Program of Institutional and Operational Reform to Improve Efficiency and Effectiveness of the Technology Dissemination Service.**

The main goals of the pilot program to be tested under the project would include: (i) to develop an effective public Technology dissemination system that is demand driven, knowledge-based, works in close linkages with research and financially sustainable; (ii) to strengthen capacity of the system to disseminate location-specific, system-based and sustainable technologies; and (iii) utilize the expertise of NGOs to organize and empower farmers, especially resource poor families. Key changes to be tested under the project would include:

(a) **At the State Level,** an inter-departmental working group, composed of heads of relevant line departments (Secretaries), would be established under the chairmanship of the Agriculture Production Commissioner/Development Commissioner/Secretary, Agriculture. This group would provide a mechanism for interaction with TDMC, and monitoring progress of the district level program of the project. In addition, this group would help to internalize new concepts being tested under the project.

(b) **At the District Level,** an ATMA would be established with representation from all the key stakeholders. ATMAs would facilitate effective and efficient coordination and management of technology dissemination activities to farmers. In addition, they would provide a mechanism both to strengthen research-extension-farmer linkages as well as to coordinate activities of different institutions that operate at the district level. ATMAs would expand farmer training program as well as provide in-service training and technical back-stopping for the extension field staff. To enable direct transfer of project funds to ATMAs for timely implementation with operational flexibility, these bodies would be registered as societies and directed by a Governing Board composed of stakeholder representatives. To help achieve financial sustainability, revolving accounts and cost recovery mechanisms would be established and maintained by ATMA. At the same time proposed changes in operational modalities with emphasis on participatory methodologies would begin to shift the locus of control for the technology system to farmers and their organizations. **At Negotiations assurances would be sought that the participating states not later than September 30, 1998 would establish at least one district ATMA and would, thereafter, establish the remaining ATMAs in accordance with the phasing agreed with IDA/Bank.**

With project funding, ATMA would be able to bring together researchers, extension workers and other stakeholders to conduct diagnostic surveys including line department staff as well as the farming communities of the district using PRA techniques. These interactions would enable the teams to categorize the main problems currently affecting the technology dissemination system and limiting its performance or sustainability. They would also determine the main opportunities and constraints (markets, in input supplies, financial and social factors, the natural resource base, the quality and form of extension delivery) which should be taken into account to improve the local relevance and impact of adaptive research, development and information transfer programs and mechanisms. On this basis the team would be able to formulate a Strategic Technology (Adaptive/Validation Research and Extension) Plan for the district setting out technical objectives as well as innovations to be introduced into the organization and funding of technology and funding sources for these activities. Capacity to use mass media and information technology to transmit technical and market information would be expanded;

(c) **At the Block Level** line department staff would work together as an inter-linked team. With support from ATMAs, they would adopt farming systems approach to their work program.
Their capacity to operate as broad based Farm Advisors would be enhanced through appropriate training, better communications facilities, technical literature and equipment. In addition to farm visits by the extension workers, farmers would be encouraged to interact directly with the staff working at these Farm Advisory Centers through visits and personal meetings.

In selected project districts, ATMAs would promote involvement of non-governmental organizations as direct providers of extension service in association with farmer organizations. In such situations the main responsibilities of the public institutions would be to provide initial financial support for operational work, build capacity and provide technical back-stopping. Block level is being proposed for this innovation as it is a discrete administrative unit and presents a more manageable geographic area for agencies with limited out reach and/or resources. Individual proposals from NGOs, to be prepared during implementation, would be invited by ATMAs through an open competitive process. The costs of successful proposals would be incorporated into annual budgets of participating ATMAs and passed on to TDMC for review and approval. At Negotiations assurances would be sought that TDMC and the project states would take all necessary measures to ensure that, not later then December 31, 1999, extension services in at least one block of a district in each project state would be carried by NGOs in association with Farmers Organizations and technical backstopping from the line department staff.

(d) At the Village Level, farm families would be motivated to form voluntary informal Farmers Organizations (Self-Help Groups and Commodity Groups) with the help of NGOs. These organizations, in time, would be an integral part of the technology dissemination system working closely with both the public and private institutions. In addition, Advisory and Consultative Teams (ACT) of farmer representatives would be supported to provide feedback on programs and activities of extension staff. In time it is expected that ACT representatives would form a loose association to start working with government agencies and ATMAs and at the block and district levels.

Farmer Organizations (FOs) would be supported through training and logistical support to take responsibility for technology transfer activities as well as organizing input supply by training one of its member to undertake this function or hire para-technicians who can provide technical services to the members and establishing close linkages with the private sector organizations for training and sharing technical recommendations relating to inputs; and encouraging the use of contract extension by agro-processing firms.

(e) Human Resource Development for Technology Dissemination. Since an important objective of this project is to bring about institutional and operational reforms substantial resources would be allocated to training activities, both to up-grade staff and to implement new operational procedures. In this process MANAGE would play an important role both in providing training as well as building capacity in the participating states to undertake this work through their own agencies as an on-going activity. To provide greater emphasis to enhancement of the management skills as well as overall ability of the extension staff, in each of the six participating states the project would expand and upgrade existing facilities in to State Agricultural Management and Extension Training Institutes (SAMETI). Details of specific training requirements of each district would be highlighted in the district annual work plan. It is expected that activities to be financed under the project would include: managerial and technical training for KVK, ZRS and SMS personnel, training in Participatory Rural Appraisal and procedures for developing a District Technology Plan, Communications and Training skills, Computer training, Organizing farmers and participatory methodologies. Provision has been made for workshops, long-term and short-term study tours for extension workers or SMSs, post-doctoral training and staff exchanges to allow Indian extension specialists to work in an outside institution and foreign specialists to spend time in India.
DEFINITION OF AGRO-ECOSYSTEMS RESEARCH

(a) *Production Systems Research in the Program Mode*

Proposals would:
- arise from a process of identification that pays due attention to key local development needs, problems or opportunities of the target production system.
- where appropriate, incorporate PRA or other rural diagnostic techniques in their final design, and on-farm and farmer-participatory evaluations of research outputs.
- respond to requirements of circumscribed geographical areas or districts in which the targeted production system dominates.
- involve interactions between scientists from different disciplines, both in the planning and execution/reporting of research, and if possible involve synergy between institutions.
- help to create new working partnerships between institutions.

(b) *Cross-Cutting Research in the Mission Mode*

Proposal in this category would:
- have a sharp focus on concrete outputs achievable in a short to medium time frame.
- have application across several production systems and provide the prospect of enhancing the economic benefits to farmers and the sustainability of the production systems. (Under the NATP, particular emphasis is given to the development and dissemination of more environmentally sound technologies in the areas of pest and disease management, and soil and water resource management).

(c) *Strategic Research*

Proposal in this category would:
- concern a topic of high importance in relation to the pursuit of national agricultural research priorities or sectoral policies.
- involve frontier sciences, cutting-edge technology or other areas of scientific innovation such as socio-economic studies which are crucial to meeting future sectoral challenges.
- be strategic, in case of having potential to make wide contribution and impact on scientific advances relating to several production systems.
- originate from a team/center which offers a core of expertise with demonstrated comparative advantage in the topic concerned, as well as an outstanding scientist available to lead the team.
- build a critical mass of technical expertise and promote networking in the topic concerned.
- identify international networks and linkages with which the team will be collaborating in the conduct of the research.
Criteria for Research Program Evaluation

1. At negotiations ICAR presented the following documents which were broadly agreed, although some further refinements were discussed which are listed below. Following some additional interaction within the ICAR system these documents would be finalized with some adjustments/additions. It should be noted that these documents are not static they will evolve and change as experience emerges, as they have already been doing over the period of project preparation.

   (a) Format for Research Proposals for Funding under NATP
   (b) Guidelines on Strategic Research in Teams of Excellence Mode
   (c) Guidelines on Mission Mode Research
   (d) Guidelines on Production Systems Research
   (e) Guidelines on competitive Grant Program

2. The following is an agreed listing of what were considered the key questions that the research reviewers would be expected to answer indicating where in the above guidelines and formats the issue is covered and incorporating some proposals for additions/amendments.

Overall

1. How well does the proposal fit within the stated priorities and strategy for the given production system? (Format for Research Proposals - Introduction section; Guidelines on Production Systems Research - item 2.1 (a) and Relevance section 2.2).

Scientific Merit

1. Is the overall presentation and logic of the proposal sound; are the objectives and hypotheses appropriate and clear? (Format for Research Proposals - Objectives section).
2. Has a sound justification been given, in particular does the proposal provide evidence that it is addressing high priority problems. (Format for Research Proposals - Rationale section).
3. Is the work innovative? (Format for Research Proposals - Methodology section).
4. Is there evidence of relevant literature review? (Format for Research Proposals - Introduction section - item 3)
5. Are the research methods and experimental treatments appropriate to the problem? (Format for Research Proposals - Methodology section)
6. Is there an adequate implementation workplan including milestones to track progress? (Format for Research Proposals - Work Program Details section - includes a requirement for an Activity Chart)

Researchers and Research Infrastructure

1. Do the researchers have the skills to complete the research satisfactorily? (This would not be covered by the researcher in the application but would be assessed by the reviewers on the basis of their knowledge and experience of the team)
2. Is research infrastructure adequate for this proposal? (Format for Research Proposals Budget section assessed in relation to Work program Details)
3. Are the resources provided or requested adequate and realistic? (Format for Research Proposals Budget section assessed in relation to Work Program Details; also list of existing and requested equipment in Format Annex)

Evidence of New Directions

1. Does the proposal show evidence of using a multi-disciplinary approach including social scientists where appropriate?

2. Is there evidence of a systems approach involving more than one commodity or enterprise? (Format for Research Proposals - Rationale section item 2; also Guidelines on Production Systems section 2.1 - may need some rewording to directly ask this question).

3. Is there evidence of involvement of potential beneficiaries? (Format for Research Proposals - Rationale section item 3; Guidelines for Production Systems item 2.1 (h)).

Expected Impacts

1. Have the expected outputs been explicitly described and/or quantified e.g. depending on the type of research in terms of: impact on sustainability, hectares expected to be impacted, number of farm families, livestock head, etc. at realistic ultimate full adoption levels? (Format for Research Proposals - Objectives section item I (iii); Guidelines on Production Systems Research 2.3 (b) - but these two items in the Format and guideline may need some further definition).

2. To what extent have the concerns of the small and marginal farmers been taken into account, particularly with respect to Production Systems Research? (not explicitly covered in the format or guideline except to the extent that it is implicitly covered by the beneficiary assessment/PRA requirement - may be improved by a more explicit question).

3. To what extent have gender issues been taken into account in the proposal? (implicit in the beneficiary assessment requirements but could be made more explicit).

4. What is the justification for public expenditure? Is the proposal backed by economic analysis? Is it research that would be highly unlikely to be taken up or be better done by the private sector? Is it research that might be taken up or be better done by the private sector? Is it research that would be very likely to be taken up or be better done by the private sector? (Not covered in Format/Guidelines - needs to be incorporated).

5. Is there any linkage outlined in proposals on PSR about eventual dissemination of research results? (this may not be possible in many cases until near to the time of release/recommendation).

6. Are there any other unique features which justify the proposed research? (Proposed as an additional open ended criteria - to be added).
INDIA - NATIONAL AGRICULTURAL TECHNOLOGY PROJECT
Management Structure

National Steering Committee

Project Management Committee

Research Programme Committee

Project Implementation Unit

Technology Dissemination Management Committee

Components/Sub-component Managers

National Coordinators

- Mission Mode
- Competitive Ag. Res. Prog
- PSR, TAR and Training
- Strategic Res. & Int. Collaboration

Systems Directors (5)
- Production Systems and Tech. Assessment & Refinement (TAR)

Scientific Advisory Panels

Production Systems Principal Scientists

Lead Agencies
- Lead Agency
- Lead Agency
- Lead Agency
- Lead Agency
- Lead Agency

Cooperating Agencies
- Cooperating Centers
- Cooperating Centers
- Cooperating Centers

NATP Cells in ICAR Implementing Agencies
- ISD
- PME
- OTHERS
- O&M

ICAR Dissemination Initiatives
- ZRS/ATIC

State Level Institutions

District Agricultural Technology Management Agencies

Line Dept. Field Staff
- FIGs, FOs

Cooperating Agencies
- Cooperating Centers
- Cooperating Centers
- Cooperating Centers
INDIA: NATIONAL AGRICULTURAL TECHNOLOGY PROJECT
Research Review Arrangements

Project Management Committee

Research Program Committee

Project Implementation Unit

Scientific Review Panels for Production Systems Research

Agro Ecosystems Director

Principal Production Systems Scientist

Institutional Level Review

Principal Investigators of Product Systems Research and Technology Assessment and Refinement

Principal Investigators of Strategic or Mission Mode Research (Supported by an Inter-Disciplinary Team)

National Coordinators for Competitive Grants Program*

Strategic and Mission Mode Research

Institutional Level Review

Institutional Level Review

Institutional Level Review

Principal Investigators of Competitive Grants Research Program

*PSR proposals under CGP would be passed on by PIU to respective Agro-Ecosystems Directors for review and processing along with PSR proposals to be financed under sponsored research.
INDIA: NATIONAL AGRICULTURAL TECHNOLOGY PROJECT

Innovations in Technology Dissemination

Flow Diagram Illustrating Primary Activities

1. Process begins by conducting joint PRA

2. Develop strategic R-E plan for district

3. Approval by ATMA Governing Board

4. Develop annual work plans


ZRS

DOH

DOA

Farm Advisors

ATMA

KVK

DAH

6a. On-farm Research Trials

6b. FSR trials & demonstrations

7a. Dissemination of crop & livestock management practices

7b. Farmer training in systems-based technologies

Hort. mgmt. practices

Livestock mgmt. practices

AI & animal health services

Farm Households from Different Socio-Economic Groups

Farmers Interest Groups and Self Help Groups

Annex 2 Chart 3
Annex 3
National Agricultural Technology Project
Estimated Project Costs

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<th>Project Component</th>
<th>Local</th>
<th>Foreign</th>
<th>Total</th>
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<tr>
<td>Development of ICAR O&amp;M Reforms</td>
<td>28.9</td>
<td>24.9</td>
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<tr>
<td>Support for Agro Eco Systems Research</td>
<td>68.8</td>
<td>57.0</td>
<td>125.8</td>
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<tr>
<td>Innovations in Technology Dissemination</td>
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<td>7.9</td>
<td>39.5</td>
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<td>Physical Contingencies</td>
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<td>4.5</td>
<td>10.9</td>
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<tr>
<td>Price Contingencies</td>
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<td><strong>Total Project Cost</strong></td>
<td>137.6</td>
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Introduction

1. Generally agricultural research is found, both ex ante and ex post, to give very high rates of return. This is likely to be particularly the case in India where many new technologies are likely to have potentially very large coverage. This justifies an analytical approach which does not place undue emphasis on the calculation of ERRs. Also for this reason a simplified methodology has been used based on selected case studies, supporting evidence such as ‘congruence’ analyses, and the evidence from ex post analyses. The economic analysis presented in this Annex and the relevant sections of the PAD tries to answer the following broad questions: (1) What is the likely Economic Rate of Return to the project? (2) Does the project fit appropriately within the Country Assistance Strategy? (3) What are the alternatives to the project? (4) What will be the fiscal impact of the project? (5) What are the major risks and how would these impact on the Economic Rate of Return? (6) What are the institutional risks and what would be their impact on the project? (7) What is the likely impact on the poverty target group? (8) What would be the environmental impact? (9) What is the case for public investment in these activities?

Question 1: What is the likely Economic Rate of Return of the project?

2. This has been approached in three ways:

(a) The first approach uses a simple aggregate ex ante rate of return estimate, without economic adjustments, for major commodities or commodity groups to indicate rates of return achievable if research were to give output increments for the commodity of only one tenth of one percent. This is way inside the range that a scientist can estimate ex ante with any degree of confidence. Economic Analysis Tables 1-6 in the Project File give the analysis for the following groupings: the agriculture sector as a whole; the rice/wheat system; the livestock sub-sector; sugar; cotton; and the castor/sesame/sunflower grouping. These assume an eight-year average lag between the modal point of the research investment stream and the first incremental benefits. The benefits are assumed to grow by one tenth of one percent per year on a base ‘without project’ growth of four percent and then, very conservatively, revert to zero at Project Year 20. The Economic Rates of Return on these very conservative assumptions, using a productivity gain of one tenth of one percent, fall between 25 percent and 50 percent indicating that it is highly unlikely that any of the research investments in these commodities and systems would fail to achieve a break-even 12 percent rate of return. Such a poor research productivity impact is not consistent with past ex-post analyses. The individual rates of return based on this very low level of productivity gain are as follows:

<table>
<thead>
<tr>
<th>Commodity Grouping</th>
<th>Rate of Return</th>
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<tbody>
<tr>
<td>Agriculture/Livestock Sector</td>
<td>31%</td>
</tr>
<tr>
<td>Wheat/Rice</td>
<td>50%</td>
</tr>
<tr>
<td>Livestock</td>
<td>38%</td>
</tr>
<tr>
<td>Sugar</td>
<td>32%</td>
</tr>
<tr>
<td>Cotton</td>
<td>38%</td>
</tr>
<tr>
<td>Castor/Sesame/Sunflower</td>
<td>25%</td>
</tr>
</tbody>
</table>

(b) The second approach uses two case studies carried out by NCAP using a version of the Alston et al 1995 methodology: (i) an ex ante rate of return analysis incorporating elasticities of Supply and Demand covering the rice/wheat system and the components of it, including variety, tillage, weed control, and nutrient management (see ‘Ex Ante Economic Evaluation of the National Agricultural Technology Project: The case of Rice-Wheat System Research by Suresh Pal, Ramesh Chand and S. Selvarajan, National Center for Agricultural Economics and Policy Research (NCAP), March 1997’); (ii) an ex ante analysis following a similar methodology for hybrid rice (see ‘Ex Ante Economic Evaluation of Hybrid Rice Research in India by Suresh Pal and Dayanatha Jha, NCAP, March 1997.

   (i) The Economic Rates of Return from the Rice/Wheat System analysis, assuming Elasticities taken from Kumar and Rosegrant 1994, are as follows:
Economic Rate of Probability of Farm Gate prices Return Success or Adoption down 20% (%) Rate halved or costs up 50%

<table>
<thead>
<tr>
<th>High Productivity Region:</th>
<th>Economic Rate of Return (%)</th>
<th>Probability of Success or Adoption Rate halved or costs up 50%</th>
<th>Farm Gate prices down 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice variety</td>
<td>39</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>Wheat variety</td>
<td>36</td>
<td>30</td>
<td>34</td>
</tr>
<tr>
<td>Tillage and Residue Management</td>
<td>46</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Weed Control</td>
<td>39</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>Water Management</td>
<td>32</td>
<td>24</td>
<td>29</td>
</tr>
<tr>
<td>Nutrient Management</td>
<td>34</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Low Productivity Region:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice variety</td>
<td>41</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>Wheat variety</td>
<td>46</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td>Weed control</td>
<td>31</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>Water management</td>
<td>28</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Nutrient management</td>
<td>26</td>
<td>19</td>
<td>24</td>
</tr>
</tbody>
</table>

The above ERR, the aggregate of which is 39 percent, are generally high and quite insensitive to changes in assumptions. They indicate that, for the proposed Rice/Wheat System research program under the project, it would be highly improbable that the ERR would fall below a 'break-even' level of 12 percent. Assumed elasticities of supply (ranging from 0.2 to 0.54) and demand (ranging from 0.19 to 0.24) were used. The model has been run with a range of elasticities and the results show low sensitivity to changes in this parameter as has been found in other studies since changes in Producer and Consumer Surpluses tend to cancel out. An intermediate import/export parity border price of Rs 7397 per ton at farm gate for rice was used and an import parity of Rs 7406 per ton for wheat were used. These are based on Year 2000 price forecasts. In the main scenario quoted above (many different scenarios were run) variety improvement was assumed to give 15 percent yield increases but management practices were assumed only to give cost savings at a range of percentages not going above 10 percent. Probabilities of research success assumptions were conservative and ranged from 0.3 to 0.5 and ceiling adoption rates ranged from 50-80 percent with research plus adoption lags ranging from 9-15 years, 9 years for research on husbandry practices, 11 in Low Productivity areas and 15 for improved varieties. Degeneracy periods assumed for the technologies analyzed ranged from 8-15 years, 8 for improved cultivars and 15 for improved practices. An ERR was run which included in the costs the rice/wheat program pro-rata share of all project supporting costs including extension, training, management, reorganization, information services etc. covering both the research and the extension components, the ERR was 35 percent. This is considered representative of the project as a whole.
(ii) Results from a similar analysis of Hybrid Rice are as follows:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>North</th>
<th>South</th>
<th>East</th>
<th>Internal Rate of Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenario I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield Advantage (%)</td>
<td>14</td>
<td>27</td>
<td>44</td>
<td>66</td>
</tr>
<tr>
<td>Year of Initial Adoption</td>
<td>2002</td>
<td>2001</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>Degeneracy Period</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Scenario II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield Advantage (%)</td>
<td>14</td>
<td>27</td>
<td>35</td>
<td>133</td>
</tr>
<tr>
<td>Year of Initial Adoption</td>
<td>1997</td>
<td>1997</td>
<td>1997</td>
<td></td>
</tr>
<tr>
<td>Degeneracy Period</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Scenario III (Scenario II +)</strong></td>
<td></td>
<td></td>
<td></td>
<td>135</td>
</tr>
<tr>
<td>Yield Advantage (%)</td>
<td>23</td>
<td>27</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Again, this analysis gives high rates of return. A number of alternative scenarios were run.

(c) The third approach uses a review of ex post evaluations of research in India over the last 15 years covering a number of commodities, sectors and sub-sectors. A number of such ex post evaluations of rates of return to agriculture research in India have been done over the last 25 years but few in the last 5 years. As with most studies from other countries, the results have suggested generally very high rates of return. The following is a summary of the main findings:

<table>
<thead>
<tr>
<th>Authors</th>
<th>Rate of Return (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jha and Evenson 1974</td>
<td>40</td>
<td>All India agriculture</td>
</tr>
<tr>
<td>Bal and Kahlon 1976</td>
<td>72</td>
<td>All India agriculture</td>
</tr>
<tr>
<td>Evenson and McKinsey 1989</td>
<td>51</td>
<td>Wheat</td>
</tr>
<tr>
<td>ditto</td>
<td>156</td>
<td>Rice</td>
</tr>
<tr>
<td>ditto</td>
<td>117</td>
<td>Sorghum</td>
</tr>
<tr>
<td>ditto</td>
<td>218</td>
<td>All crops</td>
</tr>
<tr>
<td>Ribeiro 1989</td>
<td>38-176</td>
<td>Plant Breeding (private investment)</td>
</tr>
</tbody>
</table>

The results match the findings of the ex ante studies and again imply that investment in research has probably not reached its optimum level. However, the ERR is not a suitable measure to compare investments of different scales. Note also that such ex post studies generally do not adequately assess maintenance research, such as wheat rust resistance, where a failure to keep up with evolving rust challenge, while not increasing yields, may prevent catastrophic yield decline, in other words a rapidly changing 'without project' situation.

**Question 2. Does the project fit with the Country Assistance Strategy? What about the private sector policies?**

3. Briefly, yes. While agricultural research is not mentioned specifically in the CAS document, three key objectives of the CAS are: accelerating agriculture policy reforms, poverty support, and capacity building. The NATP strongly supports these three objectives through: (i) accelerating the flow of technologies to give the technological base for the policy reforms, without which agricultural growth will grind to a halt; (ii) addressing long neglected areas of research of relevance to poorer areas e.g. dryland farming, livestock, integrated intensive farming systems and extension for women; and, (iii) capacity building in certain essential parts of the public sector research institutions while at the same time initiating the process of passing research on to the private sector and supporting that capacity too.
4. With respect to the *policy framework*, broadly the sector conditions are satisfactory, or will be with the reforms agreed under the project. There is now a need to shift the share of research towards the private sector and the project aims to do this through various interventions including the competitive grants program and the technology dissemination pilots. Private sector agriculture R&D expenditure in India is now estimated at 16 percent of the total. While this percentage is lower than Philippines, Mexico, and Ecuador, it is higher than Argentina, Brazil, Chile, Colombia, Peru and Venezuela. Against these comparators, India, in relation to its position in the per capita GDP tables, is well ahead of many other countries in moving into private agricultural research. This trend is to be enhanced under the project.

5. With respect to *private sector policies*, India has an active and growing private R&D sector. The private sector currently invests about US$ 35 million in agricultural R&D in India. This is equivalent to about 15 percent of total agricultural R&D and relatively high for a low income country. These investments are concentrated in seed, pesticides and food processing.

6. Private R&D has been stimulated by a series of economic reforms over the past decade beginning with liberalization of seed laws in the late 1980s and relaxation on investment by foreign companies and other liberalizing reforms in the 1990s. A strong public R&D sector has also been important in stimulating private R&D by providing inbreds and other intermediate research inputs to the private sector. Available evidence indicates high pay offs to private R&D efforts.

7. One of the most dynamic sectors for private R&D in recent years has been the seed sector. Since 1987, for example, private R&D in the seed sector has more than tripled, with the number of scientists employed increasing from 70 to 250. In some commodities, especially sunflowers, millet, and maize, sales of proprietary hybrids now exceed those of publicly developed hybrids. The sector involves participation of several multinational seed companies. Local companies, which control the bulk of the seed trade, also have various joint ventures with foreign companies, especially in biotechnology.

8. Private R&D is expected to continue to expand strongly, especially in the seed sector, where hybrids have been developed for other crops (e.g., rice), and in biotechnology, where bio-safety regulations for testing and release of genetically transformed varieties are now in place.

9. Despite progress to date and a number of reforms under consideration, there remain significant constraints to private investment in R&D. These are expected to be reduced over the project period. These include:

   - *Restrictions on seed imports and exports.* Under the 1988 Seed Law, imports of seed require government approval and in many cases have to be imported by government agencies. Imports of rice and wheat seed is prohibited. More importantly, exports of seeds require permission from the Ministry of Agriculture. Given that India likely has a comparative advantage in the growing world seed market, this regulation is a potentially important constraint to expansion of the sector.

   - *Intellectual property rights (IPR):* India does not yet have plant varietal protection (PVP). However, it is required to legislate PVP under the terms of the GATT agreement. ICAR has been at the forefront in drafting and promoting PVPs and is now in the process of submitting the draft legislation to cabinet. While, to date, the view of private companies interviewed has been that IPRs have not been a major constraint on private sector R&D, they will be important in the future with increased emphasis on biotechnology. Also legislation on general patent protection will have to be reviewed in terms of its relevance to protection of biotechnology processes and products; however, patent legislation is tied to much wider issues outside agriculture, especially in the pharmaceutical industry.

   - *Regulations on imports of research products:* There are other regulations that sometimes constrain private initiative in R&D. One of these is the requirement that samples of imported germplasm for research be deposited with the National Plant Genetics Bureau. In addition, implementation of quarantine regulations is a long and tedious process and is considered to be stricter than international norms. During project implementation it is proposed to review with Government ways to rationalize procedures.
10. NATP will provide a number of initiatives to further support private R&D and the reform process. ICAR is committed to developing an overall strategic plan in which the role of the public sector will be rationalized in light of the maturing private sector. In particular, a workshop with the private sector will be held to formalize mechanisms for regular consultation between ICAR and private companies on policies and regulations affecting private R&D as well as to identify potential areas of collaboration. In addition, a national competitive grant scheme specifically encourages proposals from private companies to test and develop markets for technologies developed by the public sector, based on cost sharing by private companies. Already there is an increasing trend in the number of intersections between ICAR and the private sector. Bank staff have also met with a number of interested parties. Finally NATP is also providing resources to help train scientists in the public and private sector in the implementation of IPRs.

**Question 3. What are the alternatives to the project?**

11. This has been looked at from several angles. First, with respect to alternatives within the overall scope of project design, during the project preparation stage, there was a priority setting exercise undertaken for a selection of zones covering a wide range of potential research components (i.e. alternatives within the overall project design). The objective of the exercise was more to test out a methodology and train staff to think in terms of priority setting and economic impact than to finally set research priorities, or to reach some optimal combination of research programs, but to some extent it served both purposes. Briefly the steps followed, under the guidance of the NATP Preparation Team, were:

- **(a)** a Participatory Rural Appraisal exercise by members of the Zonal Research Priority Setting Team was undertaken to understand local perceptions of problems;
- **(b)** a workshop including farmers, landless laborers, input suppliers, NGOs, scientists, extension staff, etc. was held to complete a ‘problem definition’ exercise;
- **(c)** the array of researchable problems or opportunities was categorized and prioritized;
- **(d)** possible ‘spill in’ effects from research in other similar zones/topics was accounted for;
- **(e)** ‘root cause’ analysis with the researchers was then undertaken to trace the real cause of the identified problems (which often may not be obvious without careful probing);
- **(f)** data for each research program was then developed to obtain the following: quantity of commodity; price; cost of research; time required; expected unit cost reduction or yield gain or improvement of quality; probability of success; expected adoption pattern; ceiling level of adoption; technology degeneration period; weights to be applied to accommodate multiple objectives e.g. poverty, sustainability, etc.; expected impact of research on employment, environment, etc.

12. In this last exercise Net Present Values were calculated for a selection of programs and proposals were ranked both by NPV and by the other criteria such as sustainability. In this way alternatives were reviewed. Further work is still being done and will continue under the project to improve this evolving prioritizing methodology. During appraisal a two day workshop was held on this topic. For future analysis a C:B measure for ranking will be tested on a sample basis since NPV is inappropriate for ranking purposes, although the C:B flow data itself can be readily adapted from the data for the NPV calculation. The results of the prioritizing exercise described above contributed to, but by no means wholly determined, the priorities under the project.

13. The second approach to looking at alternatives within the overall project design was a congruence analysis. In fact two congruence analyses have been undertaken, one in 1997 by a Bank mission and an earlier one in 1995. Congruence analysis calls for comparing indicators, usually the value of output of a commodity, with the cost of proposed research on that commodity. It is only of value as one component of an analysis to signal research topics that might warrant further review with respect to priority since obviously one could easily have a situation where a currently very low volume commodity justifying, on that basis, a very low level of research investment, would actually have enormous potential should a major research effort be undertaken and a breakthrough achieved.
14. The more recent 1997 congruence analysis results are contained in the following table. This gives the rank order of value of output by main commodity and the rank order of research investment proposed under the project. (A number of rather arbitrary assumptions had to be made about proportions of systems research allocated to component commodities. This was necessary because the aggregate output data is available only on a commodity and not on a system basis.)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Proposed Research Expenditure (Rs m)</th>
<th>Value of Output (Rs b in 1997 prices)</th>
<th>Ranking Ratio</th>
<th>Points Showing Possible Lack of Congruence</th>
<th>Research Expenditure as % of Value of Output (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock</td>
<td>739</td>
<td>679</td>
<td>1</td>
<td>*</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>328</td>
<td>195</td>
<td>2</td>
<td>*</td>
<td>0.17</td>
<td>too high allocation?</td>
</tr>
<tr>
<td>Rice</td>
<td>320</td>
<td>499</td>
<td>3</td>
<td>6</td>
<td>0.06</td>
<td>low for the major crop?</td>
</tr>
<tr>
<td>Fruits/Nuts/Veg</td>
<td>309</td>
<td>273</td>
<td>4</td>
<td>5</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>234</td>
<td>297</td>
<td>5</td>
<td>4</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>130</td>
<td>47</td>
<td>6</td>
<td>14</td>
<td>0.28</td>
<td>too high allocation?</td>
</tr>
<tr>
<td>Fibers</td>
<td>99</td>
<td>100</td>
<td>7</td>
<td>8</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>90</td>
<td>136</td>
<td>8</td>
<td>7</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>81</td>
<td>42</td>
<td>9</td>
<td>13</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td>56</td>
<td>313</td>
<td>10</td>
<td>3</td>
<td>0.02</td>
<td>too low allocation?</td>
</tr>
<tr>
<td>Plantation</td>
<td>55</td>
<td>65</td>
<td>11</td>
<td>11</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Coarse Grains</td>
<td>25</td>
<td>98</td>
<td>12</td>
<td>9</td>
<td>0.03</td>
<td>too low allocation?</td>
</tr>
<tr>
<td>Poultry</td>
<td>25</td>
<td>68</td>
<td>13</td>
<td>10</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Tea/Coffee</td>
<td>0</td>
<td>28</td>
<td>14</td>
<td>15</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Spices</td>
<td>0</td>
<td>60</td>
<td>15</td>
<td>12</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: The research expenditure shown above is only that which could be identified as going to that commodity.

15. The above table suggests that rice, oilseed and coarse grains may be getting inadequate resources and fish may be getting too much. These findings are being fed back into the priority setting system but are only one of many factors to be considered.

16. The 1995 congruence analysis was more comprehensive, incorporating poverty, regional equity, sustainability and export potential adjustments. This study (Policy Paper 3 - ‘Research Priorities in Indian Agriculture’ by Dayanatha Jha, Praduman Kumar, Mruthyunjaya, Suresh Pal, S. Selarajan, and Alka Singh, May 1995, published by NCAP in collaboration with IARI) suggested the following broad recommendations:

(a) somewhat increased share of research resources should be directed at the Eastern States;

(b) somewhat increased share of research resources should be directed to the drier areas of Andhra Pradesh, Madhya Pradesh and Karnataka;

(c) somewhat reduced share should be allocated to Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Gujarat, Kerala and Goa;

(d) research shares, if they were to follow the dictates of congruence (but see the caveats discussed above), should be at approximately the following by sub-sector/commodity:

- cereals - 26% (26%)
- livestock - 23% (30%)
- fruit and vegetables - 13% (12%)
- oilseeds - 10% (2%)  
- fisheries - 8% (5%)
- plantation crops - 8% (2%)
17. The figures in parenthesis indicate the approximate actual percentage allocation (of those costs which can be directly allocated) that are proposed under the project at this stage. A reasonable level of ‘congruence’ is exhibited except perhaps for oilseeds (possibly too low), plantation crops (possibly too low), pulses (possibly too low) and sugar (possibly too high). Again these findings are being fed back into the further prioritizing exercise but do not, in themselves indicate the need for major changes in shares.

18. With respect to the overall project design alternatives at a broader level the options considered were:

(a) a traditional old-style research project that simply supported the research system in its present form without any significant move towards privatization of research or extension and without any reforms in the way the public sector research operated. This was rejected as being inefficient, unlikely to foster the needed creativity, and not initiating a move towards desirable long term divestiture of many research activities;

(b) a project focused solely on privatization of research with the majority of funds allocated to competitive grants. This was rejected as being unlikely to address the major problems including the need for greater research focus on poor rainfed areas, the need for attention to longer term environmental sustainability issues, and the need for improvement in several fully or partially public good areas such as integrated pest management, nutrient management, phytosanitary regulation, biodiversity conservation, soil conservation, etc.

(c) a smaller project addressing only a very limited part of the overall research effort in India, perhaps in selected research areas such as drylands. For the research component this was rejected on the grounds that the research system still needs major redirection not simply fine-tuning in a limited number of areas. There is still a need to further consolidate the move towards farm systems approaches and to improve prioritization and management across the board. For the extension component a small project was accepted and a very selective component aimed at demonstrating, in a few Districts, a new approach moving towards greater privatization and community involvement has been designed.

19. The proposed project makes a major contribution to setting the research system in India on a new path. In doing so it draws a pragmatic balance between private and public roles, falling between alternatives (a) and (b) above. The design balances the long term aims against the current reality which is that there remain very large numbers of extremely poor farm families facing sustainability issues who have so far not been adequately served by research. The main contributions the project makes in this direction are:

(a) to fund Production Systems Research, as opposed to commodity-based research, backed up by strong Strategic Research aimed at finding solutions to thematic and long-term technical constraints;

(b) to channel all research funding through either a sponsored or competitive grants program, with all proposals to be peer reviewed for technical quality by the same process;

(c) to develop a strategy and to set in motion a process that would lead to the withdrawal of ICAR from direct technology transfer and a re-establishment of the focus on basic and applied research;

(d) to change organizational arrangements to improve farmers influence on research;

(e) to substantially increase outside international linkages;

(f) to improve research prioritization setting mechanisms;

(g) to establish a mechanism for dialogue with the private sector on collaborative research areas;
(h) to develop overall human capital for research, an increasing number of whom can be expected to be sources of recruitment for the private sector;

(i) to test approaches to reducing the public sector role in extension;

(j) to put in place mechanisms to improve management of research, both human resource management and financial.

20. Finally, with respect to the without project alternative, this would be one of only modest achievement by public sector research in which there would be a substantial element of business as usual similar to alternative (a) above but probably with declining funding allocation and a further cutting back of the essential operating funds. It would probably also be a scenario with limited expansion of private capacity because of the complementarities between private and public investment and there would be a lack of cross-fertilization from the Bank’s international experience.

Question 4. What will be the fiscal impact of the project?

21. See PAD Block E2 for details. Fiscal impact is expected to be manageable.

Question 5. What are the major risks and how would these impact on the Economic Rate of Return?

22. Given the high rates of return found it would appear highly unlikely that the impacts of research programs on production would be so low that an economic rate of return below 12 percent would be likely. (see the Risks section of the PAD for more detailed review). Nevertheless, there are a number of performance sensitive points in the project which could have significant impacts on economic performance and efficiency relative to what has been projected. Among the most important are: the overall rate of implementation including procurement; the functioning of the competitive grant scheme, the rate at which the training program can get going; the reorientation of the extension service towards higher grade staff, private and NGO participation, and the linking into farmers groups. If these areas fail then projected benefit streams will be reduced. More specifically ERR in the main case study on the wheat/rice system and its components exhibits the following sensitivities:

- Adoption Rate: for most components ERR falls by about 20 percent with a halving of the adoption rates
- Research Success: a halving of the probability of success of research has the same impact as a halving of the adoption rate, about a 20 percent fall in the ERR.
- Research Costs: with a 50% increase in research costs ERRs fall by about 20%.
- Farm Gate Prices: with prices down by 20% ERRs fall by about 10%.

Question 6: What are the institutional risks?

23. There are three main institutional risks which, if they impact more than anticipated, would reduce the economic returns to the project and generally impact on its efficiency and performance:

- (a) the ability of ICAR to handle the procurement and overall implementation within a research system with a large number of players who have to work together in teams. It is for this reason that a lot of attention has been put into the establishment of the PIU, the design of the processes, and the procurement and accounting staffing and mechanisms;

- (b) ICAR have limited experience in public/private partnership areas so this represents largely an unknown area for them.

- (c) ICAR and the research system as a whole, i.e. including SAUs, have limited experience with Production Systems Research, much of the past work has been more narrowly focused on single commodities.
Question 7: What is the likely impact on the poverty target group?

24. A main objective of the project is to redirect research and extension to poorer rainfed areas therefore the impact on the target group is expected to be very significant and should, through changed processes, extend outside the immediate impact area of project financed research investments. Findings indicate that earlier Green Revolution era technology was relatively neutral with respect to its poverty impact, not being biased away from the poor, although also not being biased towards the poor. It is expected that the farmer participation and rainfed and sustainability areas of focus in this project will direct research more towards the poor than in the past. One area under the project that will particularly assist the poor and also women is the research and extension on livestock which is a priority area in the project. Models done for Uttar Pradesh suggest that poor farmers on marginal holdings of 0.7 hectares with full adoption of packages of anticipated new technology, including diversification, could be expected to raise their incomes by almost 100 percent although clearly this would not represent an average across the whole project nor a projection within the project time period.

Question 8: What are the environmental costs and benefits?

25. The impact on the environment is expected to be positive for the following reasons: (i) there is a strong focus within the research on sustainability; (ii) integrated pest management is a high priority investment; (iii) integrated nutrient management is a high priority; (iv) gains in yield will reduce pressure for expansion into marginal areas that are very sensitive to erosion. The integrated pest management work of the project is expected to result in a lower trend line in the use of pesticides than would have occurred without the project.

Question 9: What is the case for public investment?

26. The following are the main reasons for continuing with substantial levels of public investment in Indian agricultural research and technology dissemination:

(a) To better address the poverty issue. The benefits from a substantial proportion of the priority research areas identified (e.g., on marginal areas, dryland soil and moisture conservation, etc.) cannot be readily appropriated by the private sector. We expect the private sector over the next decade to focus almost entirely in the easier irrigated areas whereas it is the relatively neglected areas of research that is the predominant focus of this project.

(b) To better address the environmental issues. Again, the benefits from this work often cannot be appropriated by the private sector (e.g. Integrated Nutrient Management, water management, etc).

(c) To accelerate the development of private/public partnerships. The project represents a medium term step towards greater participation by the private sector in the longer term.

(d) To address the scale of the technology task in India. This is so huge that only very large firms or the public sector can make significant impacts quickly.

(e) To address the uncertainties of outcome in research. Uncertainty is particularly related to the riskier rainfed areas, uncertainty inhibits rapid and significant entry by the private sector.

(f) To ensure improved basic and strategic research and whole farm systems research. This provides a secure base and opens up opportunities for private research which typically picks up single commodity, quick return areas which ride on a sound basis of basic and strategic research.

(g) To ensure a sound national information system for technology information exchange to support all players including private.

(h) To support collaborative research-cum-training with foreign institutions. This, initially, will require public expenditure such as travel and 'bench fees' to give the incentive for participation and to demonstrate possible areas of mutual benefit. Later these would be expected to evolve into more commercial relationships.
(i) To test out alternative systems of increasing the private role in extension (about 20 percent of project costs) and increasing farmer feedback to research.

(j) To continue to support a regulatory role, in some areas calling for increased capacity as private sector expands, in areas of public interest e.g. phyto-sanitary regulation etc.

(k) To improve the level of skills in the sector which, even with increasing input from the private sector, will continue to need strong public support for some time.
Annex 5

National Agricultural Technology Project

Financial Summary

Bank Financial Year

(US$ million)

<table>
<thead>
<tr>
<th></th>
<th>Implementation Period</th>
<th>Operational Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>99  00  01  02  03  Total</td>
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<tr>
<td><strong>Project Costs</strong></td>
<td></td>
<td></td>
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<tr>
<td>Investment Costs</td>
<td>20.3 49.1 49.3 45.2 42.0 206.0</td>
<td></td>
</tr>
<tr>
<td>Recurrent Costs</td>
<td>3.9  5.2  7.3  8.6  8.8  33.7</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24.2 54.3 56.6 53.8 50.8 239.7</td>
<td></td>
</tr>
<tr>
<td><strong>Financing Sources (% of total project costs)</strong></td>
<td></td>
<td>100.0</td>
</tr>
<tr>
<td>IDA</td>
<td>10.3 23.2 23.8 22.5 20.2</td>
<td></td>
</tr>
<tr>
<td>IBRD</td>
<td>9.9  22.4 23.1 21.8 19.5 96.8</td>
<td></td>
</tr>
<tr>
<td>Co-financiers</td>
<td>4.0  8.7  9.7  9.5 11.1 42.9</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>239.7</td>
</tr>
</tbody>
</table>
Annex 6
National Agricultural Technology Project
Procurement and Disbursement Arrangements

Procurement

1. **Civil Works (US$ 13.8 million).** Civil works in the project consist mainly of the rehabilitation/refurbishment of existing offices and laboratories; construction of some additional office facilities and farm building renovation and development. Works would be procured following National Competitive Bidding (NCB) or Force Account procedures as follows:

   NCB. Works to an aggregate value of US$ 7.0 million equivalent would be procured under contracts awarded on the basis of NCB procedures acceptable to IDA/Bank. The justification for the proposed NCB for civil works is that they consist of buildings in widely scattered locations. The works would be grouped together into convenient packages for bidding, but the largest contract is likely to be less than US$100,000, so it is unlikely that foreign firms would find such contracts attractive. Nonetheless, bids from foreign contractors would not be precluded.

   Force Account/Direct Contracting/Quotations. Works estimated to cost the equivalent of US $20,000 or less per contract and farm development works up to an aggregate amount not exceeding US $6.8 million may be undertaken by: (i) direct contracting; including unit rate/piece rate system to qualified contractors or registered NGO’s or local community organizations; (ii) on the basis of comparison of price quotations obtained from at least three qualified contractors eligible under the Guidelines or registered NGO’s or local community organizations; or (iii) by force account, in a manner satisfactory to the Association. These works are not suitable for competitive bidding due to small amounts and remoteness of location.

2. **(i) Goods, Equipment, Furniture and Supplies (US$63.0 million).** Goods, consisting of communications equipment and computers, audio visual, office equipment, and some scientific equipment etc., would be procured using International Competitive Bidding (ICB) procedures. However, equipment estimated to cost less than US $200,000 per contract up to an aggregate of US $10.0 million would be procured using NCB procedures acceptable to IDA/Bank. Small items of equipment, computers, furniture, some field and laboratory supplies etc. would be procured by the various ICAR institutions and SAU’s in small lots over the five year period. Individual contracts are not expected to exceed US $20,000 and as such will be procured using national or international shopping procedures satisfactory to IDA/Bank, up to an aggregate amount of US$10.0 million. Rate contracts of Director General of Supplies and Disposals (DGS&D) would be acceptable as a substitute for shopping. Satellite imagery, data, aerial photography, maps and research data valued at about US $1.0 million, would be procured following direct contracting procedures from organizations such as the National Remote Sensing Agency or the Survey of India and other research organizations. Similarly books, subscriptions to periodicals, extension and publicity materials, software, proprietary equipment and spares, valued at about US $9.9 million would be obtained under direct contracting procedures since each contract would be small averaging less than $10,000 per item, with an individual ceiling of $20,000 per item.

   (ii) Vehicles (US $6.9 million). The requirement of vehicles which covers the 59 zonal research stations, 28 SAUs and institutes of ICAR is spread over the project period and thus would not be amenable to central and lumped procurement. Individual contracts are not likely to be more than US $100,000. Hence, these would be procured using shopping procedures/DGS&D rate contracts. However, if bulked purchases over $100,000 are undertaken, then they would be done using ICB procedures.

3. **Consultancies, NGOs, Studies, Contracts for Placement and Support, Training, Training Travel (US$60.4 million).** Technical Assistance and consultancy services for studies (including the Procurement Agency services) estimated in the aggregate at US$19.8 million would be contracted on terms and conditions in accordance with IDA/Bank Guidelines for the use of consultants (January 1997). Contracts for TA or training costing less than $100,000 will be awarded following QCBS procedures. Training (aggregating to a total of US$40.6 million) would be procured in two ways: first, a service contract for placement and support of trainees, would be procured/arranged following QCBS procedures with consultants requiring to demonstrate substantial local presence and experience;
second, the training itself would consist of placement and support of research and technology dissemination staff for short or long duration courses and fellowships in identified foreign and local institutions. A formal procedure for selection of staff for training acceptable to IDA/Bank would be established.

4. **Research Services (US$61.9 million).** (a) **Sponsored Research** (US$45.6 million) would be procured through a sole source “contract” under the consultants guidelines, the contract being with the lead institute for each approved proposal. This is to avoid IDA/Bank becoming involved with procurement monitoring of a very large number of small purchases in institutes spread across the whole country. There are existing procurement procedures at these institutes which are mandated by government, in most cases, involving competitive procedures. These would be kept under review by IDA/Bank. The lead institute proposal would consist of a Work Program Agreement (WPA) with specified benchmarks/deliverables against which initial, interim and final payments would be made. More specifically, the WPA would cover three main areas: (i) the research proposal itself based on the agreed criteria; (ii) the reporting deliverables; and, (iii) the financing plan setting out the benchmarks/milestones against which payments would be made and justifying them against the budget. Payment terms would be clearly spelled out in the agreement between the project authorities and the participating institute. However, notwithstanding this arrangement, where individual purchases of equipment and materials under the WPA do exceed $20,000 equivalent, then the institute would be required to follow national shopping procedures under IDA/Bank Procurement Guidelines for such purchases. (b) **Competitive Grants Program** (US$16.3 million). This Program would also follow a similar review process, criteria and operational procedures to develop WPAs to those described above under the Sponsored Research (but using a separate set of forms to maintain distinction between the Sponsored and Competitive research). However, in this case WPAs would be finalized based on a competitive process open to both ICAR and non-ICAR (private sector, regular universities, NGOs and others with capacity to undertake agricultural research) institutions. For this sub-component Bank consultants guidelines do not apply. The process to be used for agreeing WPAs through the Competitive Grants Program has been appraised by IDA/Bank and would be kept under review.

5. **Recurrent costs: (US$33.7 million).** These would be financed on a declining basis and would cover incremental costs of operation and maintenance of additional equipment, vehicles, and buildings and salaries of additional staff (all excluding Research Services covered items).

6. **Civil Works, Goods, Equipment Contract Review:** All civil works, goods and equipment contracts valued at US $200,000 equivalent and above would be subject to prior review by IDA/Bank. In addition, the first two contracts between US$20,000 and US$200,000 for goods and the first two contracts between US$20,000 and US$200,000 for works would be subject to prior review.

7. **Consultancy Contracts:** Prior review for consultancy contracts would be as follows:

   (a) With respect to each contract estimated to cost the equivalent of $100,000 or more, the procedures set forth in paragraphs 1, 2 (other than the third sub-paragraph of paragraph 2(a)) and 5 of Appendix 1 to the Consultant Guidelines shall apply; (b) with respect to each contract estimated to cost the equivalent of $50,000 or more, but less than the equivalent of $100,000, the procedures set forth in paragraphs 1, 2 (other than the second subparagraph of paragraph 2(a)) and 5 of Appendix 1 to the Consultant Guidelines shall apply and (c) with respect to each contract for the employment of individual consultants estimated to cost the equivalent of $50,000 or more, the qualifications, experience, terms of reference and terms of employment of the consultants shall be furnished to the Association for its prior review and approval. The contracts shall be awarded only after said approval shall have been given.

In addition, Annual Procurement Plans would be reviewed by IDA/Bank. This would result in a prior review of about 30 percent of all contracts awarded under competitive bidding. Selective post review of awarded contracts below the threshold levels would be carried out by visiting Bank review missions.

8. **Procurement information:** Procurement information would be collected and recorded as follows:

   (a) Prompt reporting of contract award information by PIU.

   (b) Comprehensive semi-annual reports by PIU indicating:
Annex 3  
National Agricultural Technology Project  
Estimated Project Costs

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Local</th>
<th>Foreign</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Development of ICAR O&amp;M Reforms</td>
<td>28.9</td>
<td>24.9</td>
<td>53.7</td>
</tr>
<tr>
<td>Support for Agro Eco Systems Research</td>
<td>68.8</td>
<td>57.0</td>
<td>125.8</td>
</tr>
<tr>
<td>Innovations in Technology Dissemination</td>
<td>31.5</td>
<td>7.9</td>
<td>39.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>129.2</strong></td>
<td><strong>89.8</strong></td>
<td><strong>219.0</strong></td>
</tr>
<tr>
<td><strong>Total Baseline Cost</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Physical Contingencies</td>
<td>6.5</td>
<td>4.5</td>
<td>10.9</td>
</tr>
<tr>
<td>Price Contingencies</td>
<td>1.9</td>
<td>7.9</td>
<td>9.8</td>
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<tr>
<td><strong>Total Project Cost</strong></td>
<td><strong>137.6</strong></td>
<td><strong>102.2</strong></td>
<td><strong>239.7</strong></td>
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</tbody>
</table>
Introduction

Generally agricultural research is found, both ex ante and ex post, to give very high rates of return. This is likely to be particularly the case in India where many new technologies are likely to have potentially very large coverage. This justifies an analytical approach which does not place undue emphasis on the calculation of ERRs. Also for this reason a simplified methodology has been used based on selected case studies, supporting evidence such as 'congruence' analyses, and the evidence from ex post analyses. The economic analysis presented in this Annex and the relevant sections of the PAD tries to answer the following broad questions: (1) What is the likely Economic Rate of Return to the project? (2) Does the project fit appropriately within the Country Assistance Strategy? (3) What are the alternatives to the project? (4) What will be the fiscal impact of the project? (5) What are the major risks and how would these impact on the Economic Rate of Return? (6) What are the institutional risks and what would be their impact on the project? (7) What is the likely impact on the poverty target group? (8) What would be the environmental impact? (9) What is the case for public investment in these activities?

Question 1: What is the likely Economic Rate of Return of the project?

2. This has been approached in three ways:

(a) The first approach uses a simple aggregate ex ante rate of return estimate, without economic adjustments, for major commodities or commodity groups to indicate rates of return achievable if research were to give output increments for the commodity of only one tenth of one percent. This is way inside the range that a scientist can estimate ex ante with any degree of confidence. Economic Analysis Tables 1-6 in the Project File give the analysis for the following groupings: the agriculture sector as a whole; the rice/wheat system; the livestock sub-sector; sugar; cotton; and the castor/sesame/sunflower grouping. These assume an eight-year average lag between the modal point of the research investment stream and the first incremental benefits. The benefits are assumed to grow by one tenth of one percent per year on a base 'without project' growth of four percent and then, very conservatively, revert to zero at Project Year 20. The Economic Rates of Return on these very conservative assumptions, using a productivity gain of one tenth of one percent, fall between 25 percent and 50 percent indicating that it is highly unlikely that any of the research investments in these commodities and systems would fail to achieve a break-even 12 percent rate of return. Such a poor research productivity impact is not consistent with past ex-post analyses. The individual rates of return based on this very low level of productivity gain are as follows:

- Agriculture/Livestock Sector 31%
- Wheat/Rice 50%
- Livestock 38%
- Sugar 32%
- Cotton 38%
- Castor/Sesame/Sunflower 25%

(b) The second approach uses two case studies carried out by NCAP using a version of the Alston et al 1995 methodology: (i) an ex ante rate of return analysis incorporating elasticities of Supply and Demand covering the rice/wheat system and the components of it, including variety, tillage, weed control, and nutrient management (see ‘Ex Ante Economic Evaluation of the National Agricultural Technology Project: The case of Rice-Wheat System Research by Suresh Pal, Ramesh Chand and S. Selvarajan, National Center for Agricultural Economics and Policy Research (NCAP), March 1997’); (ii) an ex ante analysis following a similar methodology for hybrid rice (see ‘Ex Ante Economic Evaluation of Hybrid Rice Research in India by Suresh Pal and Dayanatha Jha, NCAP, March 1997.

- The Economic Rates of Return from the Rice/Wheat System analysis, assuming Elasticities taken from Kumar and Rosegrant 1994, are as follows:
<table>
<thead>
<tr>
<th>Region</th>
<th>Economic Rate of Return (%)</th>
<th>Probability of Success or Adoption Rate halved or costs up 50%</th>
<th>Farm Gate prices down 20%</th>
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</thead>
<tbody>
<tr>
<td><strong>High Productivity Region:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice variety</td>
<td>39</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>Wheat variety</td>
<td>36</td>
<td>30</td>
<td>34</td>
</tr>
<tr>
<td>Tillage and Residue Management</td>
<td>46</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Weed Control</td>
<td>39</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>Water Management</td>
<td>32</td>
<td>24</td>
<td>29</td>
</tr>
<tr>
<td>Nutrient Management</td>
<td>34</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td><strong>Low Productivity Region:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice variety</td>
<td>41</td>
<td>35</td>
<td>39</td>
</tr>
<tr>
<td>Wheat variety</td>
<td>46</td>
<td>39</td>
<td>44</td>
</tr>
<tr>
<td>Weed control</td>
<td>31</td>
<td>23</td>
<td>28</td>
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<tr>
<td>Water management</td>
<td>28</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Nutrient management</td>
<td>26</td>
<td>19</td>
<td>24</td>
</tr>
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</table>

The above ERR, the aggregate of which is 39 percent, are generally high and quite insensitive to changes in assumptions. They indicate that, for the proposed Rice/Wheat System research program under the project, it would be highly improbable that the ERR would fall below a 'break-even' level of 12 percent. Assumed elasticities of supply (ranging from 0.2 to 0.54) and demand (ranging from 0.19 to 0.24) were used. The model has been run with a range of elasticities and the results show low sensitivity to changes in this parameter as has been found in other studies since changes in Producer and Consumer Surpluses tend to cancel out. An intermediate import/export parity border price of Rs 7397 per ton at farm gate for rice was used and an import parity of Rs 7406 per ton for wheat were used. These are based on Year 2000 price forecasts. In the main scenario quoted above (many different scenarios were run) variety improvement was assumed to give 15 percent yield increases but management practices were assumed only to give cost savings at a range of percentages not going above 10 percent. Probabilities of research success assumptions were conservative and ranged from 0.3 to 0.5 and ceiling adoption rates ranged from 50-80 percent with research plus adoption lags ranging from 9-15 years, 9 years for research on husbandry practices, 11 in Low Productivity areas and 15 for improved varieties. Degeneracy periods assumed for the technologies analyzed ranged from 8-15 years, 8 for improved cultivars and 15 for improved practices. An ERR was run which included in the costs the rice/wheat program pro-rata share of all project supporting costs including extension, training, management, reorganization, information services etc. covering both the research and the extension components, the ERR was 35 percent. This is considered representative of the project as a whole.
(ii) Results from a similar analysis of Hybrid Rice are as follows:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>North</th>
<th>South</th>
<th>East</th>
<th>Internal Rate of Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yield Advantage (%)</td>
<td>14</td>
<td>27</td>
<td>44</td>
<td>66</td>
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<tr>
<td>Year of Initial Adoption</td>
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<td>Degeneracy Period</td>
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<td>5</td>
<td></td>
</tr>
<tr>
<td>Scenario II</td>
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<td>133</td>
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<tr>
<td>Yield Advantage (%)</td>
<td>14</td>
<td>27</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Year of Initial Adoption</td>
<td>1997</td>
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<td>1997</td>
<td></td>
</tr>
<tr>
<td>Degeneracy Period</td>
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<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Scenario III (Scenario II +)</td>
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<td></td>
<td>135</td>
</tr>
<tr>
<td>Yield Advantage (%)</td>
<td>23</td>
<td>27</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

Again, this analysis gives high rates of return. A number of alternative scenarios were run.

(c) The third approach uses a review of ex post evaluations of research in India over the last 15 years covering a number of commodities, sectors and sub-sectors. A number of such ex post evaluations of rates of return to agriculture research in India have been done over the last 25 years but few in the last 5 years. As with most studies from other countries, the results have suggested generally very high rates of return. The following is a summary of the main findings:

<table>
<thead>
<tr>
<th>Authors</th>
<th>Rate of Return (%)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jha and Evenson 1974</td>
<td>40</td>
<td>All India agriculture</td>
</tr>
<tr>
<td>Bal and Kahlon 1976</td>
<td>72</td>
<td>All India agriculture</td>
</tr>
<tr>
<td>Evenson and McKinsey 1989</td>
<td>51</td>
<td>Wheat</td>
</tr>
<tr>
<td>ditto</td>
<td>156</td>
<td>Rice</td>
</tr>
<tr>
<td>ditto</td>
<td>117</td>
<td>Sorghum</td>
</tr>
<tr>
<td>ditto</td>
<td>218</td>
<td>All crops</td>
</tr>
<tr>
<td>Ribeiro 1989</td>
<td>38-176</td>
<td>Plant Breeding (private investment)</td>
</tr>
</tbody>
</table>

The results match the findings of the ex ante studies and again imply that investment in research has probably not reached its optimum level. However, the ERR is not a suitable measure to compare investments of different scales. Note also that such ex post studies generally do not adequately assess maintenance research, such as wheat rust resistance, where a failure to keep up with evolving rust challenge, while not increasing yields, may prevent catastrophic yield decline, in other words a rapidly changing 'without project' situation.

Question 2. Does the project fit with the Country Assistance Strategy? What about the private sector policies?

3. Briefly, yes. While agricultural research is not mentioned specifically in the CAS document, three key objectives of the CAS are: accelerating agriculture policy reforms, poverty support, and capacity building. The NATP strongly supports these three objectives through: (i) accelerating the flow of technologies to give the technological base for the policy reforms, without which agricultural growth will grind to a halt; (ii) addressing long neglected areas of research of relevance to poorer areas e.g. dryland farming, livestock, integrated intensive farming systems and extension for women; and, (iii) capacity building in certain essential parts of the public sector research institutions while at the same time initiating the process of passing research on to the private sector and supporting that capacity too.
4. With respect to the policy framework, broadly the sector conditions are satisfactory, or will be with the reforms agreed under the project. There is now a need to shift the share of research towards the private sector and the project aims to do this through various interventions including the competitive grants program and the technology dissemination pilots. Private sector agriculture R&D expenditure in India is now estimated at 16 percent of the total. While this percentage is lower than Philippines, Mexico, and Ecuador, it is higher than Argentina, Brazil, Chile, Colombia, Peru and Venezuela. Against these comparators, India, in relation to its position in the per capita GDP tables, is well ahead of many other countries in moving into private agricultural research. This trend is to be enhanced under the project.

5. With respect to private sector policies, India has an active and growing private R&D sector. The private sector currently invests about US$ 35 million in agricultural R&D in India. This is equivalent to about 15 percent of total agricultural R&D and relatively high for a low income country. These investments are concentrated in seed, pesticides and food processing.

6. Private R&D has been stimulated by a series of economic reforms over the past decade beginning with liberalization of seed laws in the late 1980s and relaxation on investment by foreign companies and other liberalizing reforms in the 1990s. A strong public R&D sector has also been important in stimulating private R&D by providing inbreds and other intermediate research inputs to the private sector. Available evidence indicates high pay offs to private R&D efforts.

7. One of the most dynamic sectors for private R&D in recent years has been the seed sector. Since 1987, for example, private R&D in the seed sector has more than tripled, with the number of scientists employed increasing from 70 to 250. In some commodities, especially sunflowers, millet, and maize, sales of proprietary hybrids now exceed those of publicly developed hybrids. The sector involves participation of several multinational seed companies. Local companies, which control the bulk of the seed trade, also have various joint ventures with foreign companies, especially in biotechnology.

8. Private R&D is expected to continue to expand strongly, especially in the seed sector, where hybrids have been developed for other crops (e.g., rice), and in biotechnology, where bio-safety regulations for testing and release of genetically transformed varieties are now in place.

9. Despite progress to date and a number of reforms under consideration, there remain significant constraints to private investment in R&D. These are expected to be reduced over the project period. These include:

   • Restrictions on seed imports and exports. Under the 1988 Seed Law, imports of seed require government approval and in many cases have to be imported by government agencies. Imports of rice and wheat seed is prohibited. More importantly, exports of seeds require permission from the Ministry of Agriculture. Given that India likely has a comparative advantage in the growing world seed market, this regulation is a potentially important constraint to expansion of the sector.

   • Intellectual property rights (IPR): India does not yet have plant varietal protection (PVP). However, it is required to legislate PVP under the terms of the GATT agreement. ICAR has been at the forefront in drafting and promoting PVPs and is now in the process of submitting the draft legislation to cabinet. While, to date, the view of private companies interviewed has been that IPRs have not been a major constraint on private sector R&D, they will be important in the future with increased emphasis on biotechnology. Also legislation on general patent protection will have to be reviewed in terms of its relevance to protection of biotechnology processes and products; however, patent legislation is tied to much wider issues outside agriculture, especially in the pharmaceutical industry.

   • Regulations on imports of research products: There are other regulations that sometimes constrain private initiative in R&D. One of these is the requirement that samples of imported germplasm for research be deposited with the National Plant Genetics Bureau. In addition, implementation of quarantine regulations is a long and tedious process and is considered to be stricter than international norms. During project implementation it is proposed to review with Government ways to rationalize procedures.
10. NATP will provide a number of initiatives to further support private R&D and the reform process. ICAR is committed to developing an overall strategic plan in which the role of the public sector will be rationalized in light of the maturing private sector. In particular, a workshop with the private sector will be held to formalize mechanisms for regular consultation between ICAR and private companies on policies and regulations affecting private R&D as well as to identify potential areas of collaboration. In addition, a national competitive grant scheme specifically encourages proposals from private companies to test and develop markets for technologies developed by the public sector, based on cost sharing by private companies. Already there is an increasing trend in the number of intersections between ICAR and the private sector. Bank staff have also met with a number of interested parties. Finally NATP is also providing resources to help train scientists in the public and private sector in the implementation of IPRs.

Question 3. What are the alternatives to the project?

11. This has been looked at from several angles. First, with respect to alternatives within the overall scope of project design, during the project preparation stage, there was a priority setting exercise undertaken for a selection of zones covering a wide range of potential research components (i.e. alternatives within the overall project design). The objective of the exercise was more to test out a methodology and train staff to think in terms of priority setting and economic impact than to finally set research priorities, or to reach some optimal combination of research programs, but to some extent it served both purposes. Briefly the steps followed, under the guidance of the NATP Preparation Team, were:

(a) a Participatory Rural Appraisal exercise by members of the Zonal Research Priority Setting Team was undertaken to understand local perceptions of problems;

(b) a workshop including farmers, landless laborers, input suppliers, NGOs, scientists, extension staff, etc. was held to complete a ‘problem definition’ exercise;

(c) the array of researchable problems or opportunities was categorized and prioritized;

(d) possible ‘spill in’ effects from research in other similar zones/topics was accounted for;

(e) ‘root cause’ analysis with the researchers was then undertaken to trace the real cause of the identified problems (which often may not be obvious without careful probing);

(f) data for each research program was then developed to obtain the following: quantity of commodity; price; cost of research; time required; expected unit cost reduction or yield gain or improvement of quality; probability of success; expected adoption pattern; ceiling level of adoption; technology degeneration period; weights to be applied to accommodate multiple objectives e.g. poverty, sustainability, etc.; expected impact of research on employment, environment, etc.

12. In this last exercise Net Present Values were calculated for a selection of programs and proposals were ranked both by NPV and by the other criteria such as sustainability. In this way alternatives were reviewed. Further work is still being done and will continue under the project to improve this evolving prioritizing methodology. During appraisal a two day workshop was held on this topic. For future analysis a C:B measure for ranking will be tested on a sample basis since NPV is inappropriate for ranking purposes, although the C:B flow data itself can be readily adapted from the data for the NPV calculation. The results of the prioritizing exercise described above contributed to, but by no means wholly determined, the priorities under the project.

13. The second approach to looking at alternatives within the overall project design was a congruence analysis. In fact two congruence analyses have been undertaken, one in 1997 by a Bank mission and an earlier one in 1995. Congruence analysis calls for comparing indicators, usually the value of output of a commodity, with the cost of proposed research on that commodity. It is only of value as one component of an analysis to signal research topics that might warrant further review with respect to priority since obviously one could easily have a situation where a currently very low volume commodity justifying, on that basis, a very low level of research investment, would actually have enormous potential should a major research effort be undertaken and a breakthrough achieved.
14. The more recent 1997 congruence analysis results are contained in the following table. This gives the rank order of value of output by main commodity and the rank order of research investment proposed under the project. (A number of rather arbitrary assumptions had to be made about proportions of systems research allocated to component commodities. This was necessary because the aggregate output data is available only on a commodity and not on a system basis.)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Proposed Research Expenditure (Rs m)</th>
<th>Value of Output (Rs b in 1997 prices)</th>
<th>Ranking Ratio</th>
<th>Points Showing Possible Lack of Congruence</th>
<th>Research Expenditure as % of Value of Output (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock</td>
<td>739</td>
<td>679</td>
<td>1</td>
<td>1</td>
<td>0.11</td>
<td>too high allocation?</td>
</tr>
<tr>
<td>Sugar</td>
<td>328</td>
<td>195</td>
<td>2</td>
<td>6</td>
<td>0.17</td>
<td>low for the major crop?</td>
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<tr>
<td>Rice</td>
<td>320</td>
<td>499</td>
<td>3</td>
<td>2</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Fruits/Nuts/Veg</td>
<td>309</td>
<td>273</td>
<td>4</td>
<td>5</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>234</td>
<td>297</td>
<td>5</td>
<td>4</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>130</td>
<td>47</td>
<td>6</td>
<td>14</td>
<td>0.28</td>
<td>too high allocation?</td>
</tr>
<tr>
<td>Fibers</td>
<td>99</td>
<td>100</td>
<td>7</td>
<td>8</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Pulses</td>
<td>90</td>
<td>136</td>
<td>8</td>
<td>7</td>
<td>0.07</td>
<td></td>
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<tr>
<td>Maize</td>
<td>81</td>
<td>42</td>
<td>9</td>
<td>13</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>Oilseeds</td>
<td>56</td>
<td>313</td>
<td>10</td>
<td>3</td>
<td>0.02</td>
<td>too low allocation?</td>
</tr>
<tr>
<td>Plantation</td>
<td>55</td>
<td>65</td>
<td>11</td>
<td>11</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Coarse Grains</td>
<td>25</td>
<td>98</td>
<td>12</td>
<td>9</td>
<td>0.03</td>
<td>too low allocation?</td>
</tr>
<tr>
<td>Poultry</td>
<td>25</td>
<td>68</td>
<td>13</td>
<td>10</td>
<td>0.04</td>
<td></td>
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<tr>
<td>Tea/Coffee</td>
<td>0</td>
<td>28</td>
<td>14</td>
<td>15</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Spices</td>
<td>0</td>
<td>60</td>
<td>15</td>
<td>12</td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: The research expenditure shown above is only that which could be identified as going to that commodity

15. The above table suggests that rice, oilseed and coarse grains may be getting inadequate resources and fish may be getting too much. These findings are being fed back into the priority setting system but are only one of many factors to be considered.

16. The 1995 congruence analysis was more comprehensive, incorporating poverty, regional equity, sustainability and export potential adjustments. This study (Policy Paper 3 - ‘Research Priorities in Indian Agriculture’ by Dayanatha Jha, Praduman Kumar, Mruthyunjaya, Suresh Pal, S. Selarajan, and Ailka Singh, May 1995, published by NCAP in collaboration with IARI) suggested the following broad recommendations:

(a) somewhat increased share of research resources should be directed at the Eastern States;

(b) somewhat increased share of research resources should be directed to the drier areas of Andhra Pradesh, Madhya Pradesh and Karnataka;

(c) somewhat reduced share should be allocated to Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Gujarat, Kerala and Goa;

(d) research shares, if they were to follow the dictates of congruence (but see the caveats discussed above), should be at approximately the following by sub-sector/commodity:

- cereals - 26% (26%)
- livestock - 23% (30%)
- fruit and vegetables - 13% (12%)
- oilseeds - 10% (2%)
- fisheries - 8% (5%)
- plantation crops - 8% (2%)
17. The figures in parenthesis indicate the approximate actual percentage allocation (of those costs which can be directly allocated) that are proposed under the project at this stage. A reasonable level of 'congruence' is exhibited except perhaps for oilseeds (possibly too low), plantation crops (possibly too low), pulses (possibly too low) and sugar (possibly too high). Again these findings are being fed back into the further prioritizing exercise but do not, in themselves indicate the need for major changes in shares.

18. With respect to the overall project design alternatives at a broader level the options considered were:

(a) a traditional old-style research project that simply supported the research system in its present form without any significant move towards privatization of research or extension and without any reforms in the way the public sector research operated. This was rejected as being inefficient, unlikely to foster the needed creativity, and not initiating a move towards desirable long term divestiture of many research activities;

(b) a project focused solely on privatization of research with the majority of funds allocated to competitive grants. This was rejected as being unlikely to address the major problems including the need for greater research focus on poor rainfed areas, the need for attention to longer term environmental sustainability issues, and the need for improvement in several fully or partially public good areas such as integrated pest management, nutrient management, phytosanitary regulation, biodiversity conservation, soil conservation, etc.

(c) a smaller project addressing only a very limited part of the overall research effort in India, perhaps in selected research areas such as drylands. For the research component this was rejected on the grounds that the research system still needs major redirection not simply fine-tuning in a limited number of areas. There is still a need to further consolidate the move towards farm systems approaches and to improve prioritization and management across the board. For the extension component a small project was accepted and a very selective component aimed at demonstrating, in a few Districts, a new approach moving towards greater privatization and community involvement has been designed.

19. The proposed project makes a major contribution to setting the research system in India on a new path. In doing so it draws a pragmatic balance between private and public roles, falling between alternatives (a) and (b) above. The design balances the long term aims against the current reality which is that there remain very large numbers of extremely poor farm families facing sustainability issues who have so far not been adequately served by research. The main contributions the project makes in this direction are:

(a) to fund Production Systems Research, as opposed to commodity-based research, backed up by strong Strategic Research aimed at finding solutions to thematic and long-term technical constraints;

(b) to channel all research funding through either a sponsored or competitive grants program, with all proposals to be peer reviewed for technical quality by the same process;

(c) to develop a strategy and to set in motion a process that would lead to the withdrawal of ICAR from direct technology transfer and a re-establishment of the focus on basic and applied research;

(d) to change organizational arrangements to improve farmers influence on research;

(e) to substantially increase outside international linkages;

(f) to improve research prioritization setting mechanisms;

(g) to establish a mechanism for dialogue with the private sector on collaborative research areas;
(h) to develop overall human capital for research, an increasing number of whom can be expected to be sources of recruitment for the private sector;

(i) to test approaches to reducing the public sector role in extension;

(j) to put in place mechanisms to improve management of research, both human resource management and financial.

20. Finally, with respect to the without project alternative, this would be one of only modest achievement by public sector research in which there would be a substantial element of business as usual similar to alternative (a) above but probably with declining funding allocation and a further cutting back of the essential operating funds. It would probably also be a scenario with limited expansion of private capacity because of the complementarities between private and public investment and there would be a lack of cross-fertilization from the Bank’s international experience.

Question 4. What will be the fiscal impact of the project?

21. See PAD Block E2 for details. Fiscal impact is expected to be manageable.

Question 5. What are the major risks and how would these impact on the Economic Rate of Return?

22. Given the high rates of return found it would appear highly unlikely that the impacts of research programs on production would be so low that an economic rate of return below 12 percent would be likely. (see the Risks section of the PAD for more detailed review). Nevertheless, there are a number of performance sensitive points in the project which could have significant impacts on economic performance and efficiency relative to what has been projected. Among the most important are: the overall rate of implementation including procurement; the functioning of the competitive grant scheme, the rate at which the training program can get going; the reorientation of the extension service towards higher grade staff, private and NGO participation, and the linking into farmers groups. If these areas fail then projected benefit streams will be reduced. More specifically ERR in the main case study on the wheat/rice system and its components exhibits the following sensitivities:

- Adoption Rate: for most components ERR falls by about 20 percent with a halving of the adoption rates
- Research Success: a halving of the probability of success of research has the same impact as a halving of the adoption rate, about a 20 percent fall in the ERR.
- Research Costs: with a 50% increase in research costs ERRs fall by about 20%.
- Farm Gate Prices: with prices down by 20% ERRs fall by about 10%.

Question 6: What are the institutional risks?

23. There are three main institutional risks which, if they impact more than anticipated, would reduce the economic returns to the project and generally impact on its efficiency and performance:

(a) the ability of ICAR to handle the procurement and overall implementation within a research system with a large number of players who have to work together in teams. It is for this reason that a lot of attention has been put into the establishment of the PIU, the design of the processes, and the procurement and accounting staffing and mechanisms;

(b) ICAR have limited experience in public/private partnership areas so this represents largely an unknown area for them.

(c) ICAR and the research system as a whole, i.e. including SAUs, have limited experience with Production Systems Research, much of the past work has been more narrowly focused on single commodities.
Question 7: What is the likely impact on the poverty target group?

24. A main objective of the project is to redirect research and extension to poorer rainfed areas therefore the impact on the target group is expected to be very significant and should, through changed processes, extend outside the immediate impact area of project financed research investments. Findings indicate that earlier Green Revolution era technology was relatively neutral with respect to its poverty impact, not being biased away from the poor, although also not being biased towards the poor. It is expected that the farmer participation and rainfed and sustainability areas of focus in this project will direct research more towards the poor than in the past. One area under the project that will particularly assist the poor and also women is the research and extension on livestock which is a priority area in the project. Models done for Uttar Pradesh suggest that poor farmers on marginal holdings of 0.7 hectares with full adoption of packages of anticipated new technology, including diversification, could be expected to raise their incomes by almost 100 percent although clearly this would not represent an average across the whole project nor a projection within the project time period.

Question 8: What are the environmental costs and benefits?

25. The impact on the environment is expected to be positive for the following reasons: (i) there is a strong focus within the research on sustainability; (ii) integrated pest management is a high priority investment; (iii) integrated nutrient management is a high priority; (iv) gains in yield will reduce pressure for expansion into marginal areas that are very sensitive to erosion. The integrated pest management work of the project is expected to result in a lower trend line in the use of pesticides than would have occurred without the project.

Question 9: What is the case for public investment?

26. The following are the main reasons for continuing with substantial levels of public investment in Indian agricultural research and technology dissemination:

(a) To better address the poverty issue. The benefits from a substantial proportion of the priority research areas identified (e.g., on marginal areas, dryland soil and moisture conservation, etc.) cannot be readily appropriated by the private sector. We expect the private sector over the next decade to focus almost entirely in the easier irrigated areas whereas it is the relatively neglected areas of research that is the predominant focus of this project.

(b) To better address the environmental issues. Again, the benefits from this work often cannot be appropriated by the private sector (e.g., Integrated Nutrient Management, water management, etc).

(c) To accelerate the development of private/public partnerships. The project represents a medium term step towards greater participation by the private sector in the longer term.

(d) To address the scale of the technology task in India. This is so huge that only very large firms or the public sector can make significant impacts quickly.

(e) To address the uncertainties of outcome in research. Uncertainty is particularly related to the riskier rainfed areas, uncertainty inhibits rapid and significant entry by the private sector.

(f) To ensure improved basic and strategic research and whole farm systems research. This provides a secure base and opens up opportunities for private research which typically picks up single commodity, quick return areas which ride on a sound basis of basic and strategic research.

(g) To ensure a sound national information system for technology information exchange to support all players including private.

(h) To support collaborative research-cum-training with foreign institutions. This, initially, will require public expenditure such as travel and ‘bench fees’ to give the incentive for participation and to demonstrate possible areas of mutual benefit. Later these would be expected to evolve into more commercial relationships.
(i) To test out alternative systems of increasing the private role in extension (about 20 percent of project costs) and increasing farmer feedback to research.

(j) To continue to support a regulatory role, in some areas calling for increased capacity as private sector expands, in areas of public interest e.g. phyto-sanitary regulation etc.

(k) To improve the level of skills in the sector which, even with increasing input from the private sector, will continue to need strong public support for some time.
# Annex 5

National Agricultural Technology Project

## Financial Summary

Bank Financial Year  
(US$ million)

<table>
<thead>
<tr>
<th></th>
<th>Implementation Period</th>
<th>Operational Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>99 00 01 02 03 Total</td>
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</tr>
<tr>
<td><strong>Project Costs</strong></td>
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<tr>
<td>Investment Costs</td>
<td>20.3 49.1 49.3 45.2 42.0 206.0</td>
<td></td>
</tr>
<tr>
<td>Recurrent Costs</td>
<td>3.9 5.2 7.3 8.6 8.8 33.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td></td>
</tr>
<tr>
<td><strong>Financing Sources</strong></td>
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<tr>
<td>IDA</td>
<td>10.3 23.2 23.8 22.5 20.2 100.0</td>
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<tr>
<td>IBRD</td>
<td>9.9 22.4 23.1 21.8 19.5 96.8</td>
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<tr>
<td>Co-financiers</td>
<td>4.0 8.7 9.7 9.5 11.1 42.9</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>239.7</td>
</tr>
</tbody>
</table>
Procurement

1. Civil Works (US$ 13.8 million). Civil works in the project consist mainly of the rehabilitation/refurbishment of existing offices and laboratories; construction of some additional office facilities and farm building renovation and development. Works would be procured following National Competitive Bidding (NCB) or Force Account procedures as follows:

NCB. Works to an aggregate value of US$ 7.0 million equivalent would be procured under contracts awarded on the basis of NCB procedures acceptable to IDA/Bank. The justification for the proposed NCB for civil works is that they consist of buildings in widely scattered locations. The works would be grouped together into convenient packages for bidding, but the largest contract is likely to be less than US$100,000, so it is unlikely that foreign firms would find such contracts attractive. Nonetheless, bids from foreign contractors would not be precluded.

Force Account/Direct Contracting/Quotations. Works estimated to cost the equivalent of US $20,000 or less per contract and farm development works up to an aggregate amount not exceeding US $6.8 million may be undertaken by: (i) direct contracting; including unit rate/piece rate system to qualified contractors or registered NGO’s or local community organizations; (ii) on the basis of comparison of price quotations obtained from at least three qualified contractors eligible under the Guidelines or registered NGO’s or local community organizations; or (iii) by force account, in a manner satisfactory to the Association. These works are not suitable for competitive bidding due to small amounts and remoteness of location.

2. (i) Goods, Equipment, Furniture and Supplies (US$63.0 million). Goods, consisting of communications equipment and computers, audio visual, office equipment, and some scientific equipment etc., would be procured using International Competitive Bidding (ICB) procedures. However, equipment estimated to cost less than US $200,000 per contract up to an aggregate of US $10.0 million would be procured using NCB procedures acceptable to IDA/Bank. Small items of equipment, computers, furniture, some field and laboratory supplies etc. would be procured by the various ICAR institutions and SAU’s in small lots over the five year period. Individual contracts are not expected to exceed US $20,000 and as such will be procured using national or international shopping procedures satisfactory to IDA/Bank, up to an aggregate amount of US$10.0 million. Rate contracts of Director General of Supplies and Disposals (DGS&D) would be acceptable as a substitute for shopping. Satellite imagery, data, aerial photography, maps and research data valued at about US $1.0 million, would be procured following direct contracting procedures from organizations such as the National Remote Sensing Agency or the Survey of India and other research organizations. Similarly books, subscriptions to periodicals, extension and publicity materials, software, proprietary equipment and spares, valued at about US $9.9 million would be obtained under direct contracting procedures since each contract would be small averaging less than $10,000 per item, with an individual ceiling of $20,000 per item.

(ii) Vehicles (US $6.9 million). The requirement of vehicles which covers the 59 zonal research stations, 28 SAUs and institutes of ICAR is spread over the project period and thus would not be amenable to central and lumped procurement. Individual contracts are not likely to be more than US $100,000. Hence, these would be procured using shopping procedures/DGS&D rate contracts. However, if bulked purchases over $100,000 are undertaken, then they would be done using ICB procedures.

3. Consultancies, NGOs, Studies, Contracts for Placement and Support, Training, Training Travel (US$60.4 million). Technical Assistance and consultancy services for studies (including the Procurement Agency services) estimated in the aggregate at US$19.8 million would be contracted on terms and conditions in accordance with IDA/Bank Guidelines for the use of consultants (January 1997). Contracts for TA or training costing less than $100,000 will be awarded following QCBS procedures. Training (aggregating to a total of US$40.6 million) would be procured in two ways: first, a service contract for placement and support of trainees, would be procured/arranged following QCBS procedures with consultants requiring to demonstrate substantial local presence and experience;
second, the training itself would consist of placement and support of research and technology dissemination staff for short or long duration courses and fellowships in identified foreign and local institutions. A formal procedure for selection of staff for training acceptable to IDA/Bank would be established.

4. **Research Services (US$61.9 million).** (a) **Sponsored Research (US$45.6 million)** would be procured through a sole source "contract" under the consultants guidelines, the contract being with the lead institute for each approved proposal. This is to avoid IDA/Bank becoming involved with procurement monitoring of a very large number of small purchases in institutes spread across the whole country. There are existing procurement procedures at these institutes which are mandated by government, in most cases, involving competitive procedures. These would be kept under review by IDA/Bank. The lead institute proposal would consist of a Work Program Agreement (WPA) with specified benchmarks/deliverables against which initial, interim and final payments would be made. More specifically, the WPA would cover three main areas: (i) the research proposal itself based on the agreed criteria; (ii) the reporting deliverables; and, (iii) the financing plan setting out the benchmarks/milestones against which payments would be made and justifying them against the budget. Payment terms would be clearly spelled out in the agreement between the project authorities and the participating institute. However, notwithstanding this arrangement, where individual purchases of equipment and materials under the WPA do exceed $20,000 equivalent, then the institute would be required to follow national shopping procedures under IDA/Bank Procurement Guidelines for such purchases. (b) **Competitive Grants Program (US$16.3 million).** This Program would also follow a similar review process, criteria and operational procedures to develop WPAs to those described above under the Sponsored Research (but using a separate set of forms to maintain distinction between the Sponsored and Competitive research). However, in this case WPAs would be finalized based on a competitive process open to both ICAR and non-ICAR (private sector, regular universities, NGOs and others with capacity to undertake agricultural research) institutions. For this sub-component Bank consultants guidelines do not apply. The process to be used for agreeing WPAs through the Competitive Grants Program has been appraised by IDA/Bank and would be kept under review.

5. **Recurrent costs: (US$33.7 million).** These would be financed on a declining basis and would cover incremental costs of operation and maintenance of additional equipment, vehicles, and buildings and salaries of additional staff (all excluding Research Services covered items).

6. **Civil Works, Goods, Equipment Contract Review:** All civil works, goods and equipment contracts valued at US $200,000 equivalent and above would be subject to prior review by IDA/Bank. In addition, the first two contracts between US$20,000 and US$200,000 for goods and the first two contracts between US$20,000 and US$200,000 for works would be subject to prior review.

7. **Consultancy Contracts:** Prior review for consultancy contracts would be as follows:

   (a) With respect to each contract estimated to cost the equivalent of $100,000 or more, the procedures set forth in paragraphs 1,2 (other than the third sub-paragraph of paragraph 2(a)) and 5 of Appendix 1 to the Consultant Guidelines shall apply; (b) with respect to each contract estimated to cost the equivalent of $50,000 or more, but less than the equivalent of $100,000, the procedures set forth in paragraphs 1, 2 (other than the second subparagraph of paragraph 2(a)) and 5 of Appendix 1 to the Consultant Guidelines shall apply and (c) with respect to each contract for the employment of individual consultants estimated to cost the equivalent of $50,000 or more, the qualifications, experience, terms of reference and terms of employment of the consultants shall be furnished to the Association for its prior review and approval. The contracts shall be awarded only after said approval shall have been given.

In addition, Annual Procurement Plans would be reviewed by IDA/Bank. This would result in a prior review of about 30 percent of all contracts awarded under competitive bidding. Selective post review of awarded contracts below the threshold levels would be carried out by visiting Bank review missions.

8. **Procurement information:** Procurement information would be collected and recorded as follows:

   (a) Prompt reporting of contract award information by PIU.

   (b) Comprehensive semi-annual reports by PIU indicating: