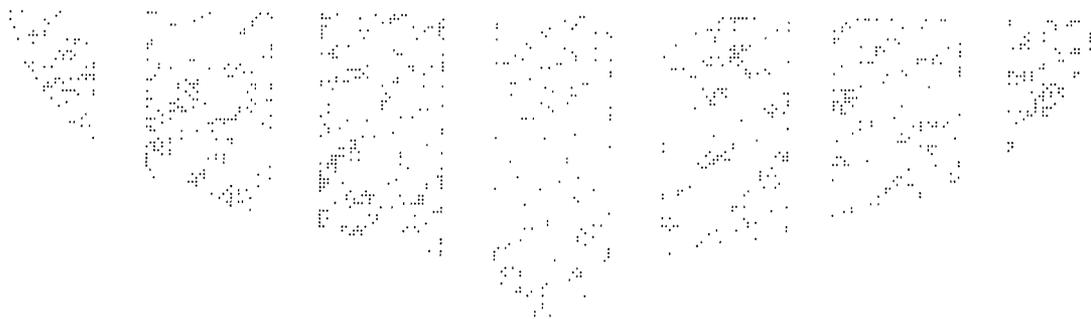


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**MISSION TO PAKISTAN AND AFGHANISTAN**

**PROJECT ASSISTANCE COMPLETION  
REPORT**

**Management of Agriculture Research and  
Technology  
(391-0489)**



*Submitted by Agriculture and Rural Development Division  
October 1994*

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## LIST OF ACRONYMS

ACE	Agricultural Commodities and Equipment project
AERU	Agricultural Economic Research Unit
ARI	Provincial Agricultural Research Institute
ARP	USAID Agricultural Research project, 1969-1984
ARP-I	World Bank First Agricultural Research project
ARP-II	World Bank Second Agricultural Research project
AVC	Directorate of Audiovisual Communications
AZRI	Arid Zone Research Institute, Baluchistan
BOSTID	Board of Science and Technology for International Development
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Wheat and Maize Improvement Center, Mexico
COP	Chief of Party
FSR	Farming systems research
GOP	Government of Pakistan
IARC	International Agricultural Research Center
ICARDA	International Center for Agricultural Research in Dry Areas, Syria
LEMRU	Laboratory Equipment Maintenance and Repair Unit
LOE	Level of effort
LOP	Life of project
MART	Management of Agricultural Research and Technology project, USAID
NARC	National Agricultural Research Center
NCRP	National Coordinated Research Program
NWFP	North West Frontier Province
PACD	Project assistance completion date
PACSC	Provincial Agricultural Communication Support Cell
PARC	Pakistan Agricultural Research Council
PIL	Project implementation letter
PITC	Provincial Information Transfer Committee
PP	Project Paper
ProAg	Project Agreement
Rs.	Rupees, Pakistani monetary unit (US\$1.00 = Rs. 24 during 1990-93 and Rs. 19 during the period 1984-87)
SAU	Sindh Agricultural University
TA	Technical assistance
TITC	Technical Information Transfer Committee
USAID	Agency for International Development

## PROJECT ASSISTANCE COMPLETION REPORT

### MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY PROJECT (391-0489)

#### I. BASIC PROJECT DATA

Project Title	:	Management of Agricultural Research and Technology (MART)
Project Number	:	391-0489
Date of Authorization	:	August 08, 1984
Date of Original Agreement	:	August 09, 1984
Original PACD	:	September 30, 1989
Revised PACD	:	August 07, 1994
Amount Authorized	:	\$38,000,000
Amount Obligated (as of 9/30/94)	:	\$11,500,000 - ESF <u>\$21,250,000</u> - DA \$32,750,000 - Total
Amount Expended (as of 9/30/94)	:	\$32,034,389
Grantee's Representative	:	Dr. Zafar Altaf, Chairman Pakistan Agricultural Research Council, Islamabad
Implementing Agencies	:	- Pakistan Agricultural Research Council, Islamabad - National Agricultural Research Centre, Islamabad - Arid Zone Research Institute, Quetta - Agricultural Research Institutes at Faisalabad, Sariab, and Tandojam - Sindh Agricultural University, Tandojam - University of Agriculture, Faisalabad - NWFP Agricultural University, Peshawar
Contractors	:	Winrock International, CIMMYT
Grantees	:	ICARDA, BOSTID
USAID Project Officer	:	Mohammad Khalid

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## **II. PROJECT GOAL AND PURPOSE**

The goal of the MART Project was to improve the income of small farmers, sustain an increase in food and fiber production and conserve the natural resource base. The purpose was to:

- i. develop and disseminate improved technology and information through key research institutions; and
- ii. foster a collaborative relationship whereby research institutes serve private agribusiness and farmers and use the private sector to disseminate marketable, improved technologies.

## **III. BACKGROUND**

USAID/Pakistan has included agricultural research as a priority program in its agriculture and rural development portfolio since late 1960s. Under the Agricultural Research (391-0296) Project, support was provided to the institutional development of the Pakistan Agricultural Research Council (PARC) and the National Agricultural Research Centre (NARC) during the period 1973 to 1984. That project strengthened the national coordinated research programs by bringing together scientists from provincial institutions and from the national level to share their expertise on various aspects of a commodity in an integrated fashion. Another major activity of the project was the construction of office and laboratory facilities at NARC, one of the few federal agricultural research institutions in Pakistan. In developing national coordinated research programs, constructing NARC facilities, providing training, lending technical assistance, and supplying commodities, USAID strengthened Pakistan's agricultural research program.

A comprehensive evaluation of the on-going Agricultural Research Project conducted in October 1983 concluded that a sound basis had been laid for an effective national research program. The evaluation, however, identified several key areas where improvements were required before the agricultural research system could achieve its full potential to contribute to Pakistan's agricultural production goals. The major problem areas identified were as follows:

- a diffusion of research organizations, whose activities were often compartmentalized and duplicative;
- uneven distribution of resources throughout the agricultural research network;

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- research activities that are frequently carried out without adequate concern for priorities, planning or proper methodology;
  - less than rational allocation of and inadequate accounting for research resources;
  - inadequate linkages among research entities, between research and extension agencies, between research and agricultural education institutes, and between public sector research agencies and the private sector;
  - lack of facilities and appropriate technology for packaging and transfer of research-generated information;
  - shortages of adequately trained personnel in key management and scientific research categories; and,
  - major gaps in selected commodity and disciplinary research programs.

Based on recommendations made in the Agricultural Research Project evaluation, the Management of Agricultural Research and Technology (MART) Project was initiated in 1984. In contrast to the earlier project, which emphasized collaboration with the Pakistan Agricultural Research Council and the development of the National Agricultural Research Center, the MART Project focused on strengthening the research capabilities of the principal provincial agricultural research institutes, including the agricultural universities. Activities were divided into the following five components:

- i. Research Management and Administration;
- ii. Information Transfer;
- iii. Training for the Agricultural Research Network;
- iv. Arid Zone Research; and
- v. Wheat and Maize Coordinated Programs

The first three components were designed to strengthen and expand the human, physical and technological resources available within the national agricultural research network and to improve the management of the system at the federal and provincial levels. Participating entities included: the Pakistan Agricultural Research Council, the National Agricultural Research Center, The Arid Zone Research Institute, agricultural research institutions and training facilities in all four provinces and the agricultural universities in the Sindh, Punjab, and the Northwest Frontier provinces.

The fourth component addressed the substantial gap that has existed in arid high altitude agricultural research for non-irrigated areas, which is especially important for the western

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regions of the country. This component was designed to strengthen the capabilities of the Arid Zone Research Institute, which is located at Quetta, to generate and disseminate quality and relevant technologies applicable to the arid, non-irrigated areas of the country, which represent 47 percent of the total land area.

The fifth component was designed to enable Pakistan to sustain and build on the impressive gains achieved in wheat and maize production by improving the research and outreach activities carried out through its Nationally Coordinated Wheat and Maize Programs.

An external evaluation conducted in early 1989 found that the project provided necessary and desired support to the national agricultural research system to meet the national mandate for increased production of food and fiber. However, the evaluators determined that without a substantial reduction in scope and modification, the purpose was not likely to be fully achieved. In addition, it was determined that the public sector needs encouragement and experience to foster linkages and collaboration with Pakistan's emerging private agribusiness sector. Therefore, the project was modified to focus on ensuring the responsiveness of research to client demand; developing usable technologies to address recognized problems; and ensuring dissemination of research results to include important user groups such as agribusinesses and input manufacturers, which are, in their own right, potential effective disseminators.

Concomitant to this focus on research relevance was a narrower institutional focus. Under this approach only nine research institutions would be targeted for USAID assistance rather than the entire universe of 250 research institutions included in the original project. The amended project had three components: Ensuring the Responsiveness of Research, Technology Development, and Dissemination.

#### **IV. PROJECT COMPONENTS**

##### **A. Ensuring Research Responsiveness**

Two significant problems were identified in the area of research planning. First, little was being done to obtain client input in developing the research agenda to ensure the relevance of the research. No effective mechanisms existed (a) to gauge farmers' problems that could be solved through improved, practical technologies; and (b) to harness selected national research programs to address problems brought forward by private agribusiness. Second, there was insufficient correlation between the actual funding needs of research activities and budget allocations, and between the process of prioritizing research activities and availability of funds. Budget allocations were not based on given research project requirements, and conversely, research agenda makers did not realistically take into account budgetary limitations, resulting in inadequate funds to carry out the research. Furthermore, full

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advantage was not being taken of potential savings that would accrue from implementing more joint public sector - private sector research activities, which, at the same time, would yield a high relevancy dividend.

## **B. Technology Development**

The development of technology relevant to the needs of the agriculture sector (i.e. production, processing and marketing) requires attention to developing the necessary research skills as well as institutionalizing revised management methods, including a greater focus on seeking practical solutions to specific, client-selected problems and enlisting the private sector to share in research endeavors. The primary problem is to apply research to specific constraints and extract solutions relevant to agriculture. Several problem areas were identified that especially require technological attention. Although related, the areas were separated because of the existing structures, personnel and activities within each activity.

Problem-oriented research rather than research by individual discipline (breeding, pathology, soil science, etc.) was deemed essential. The training and experience of most scientists had been discipline oriented. Academic training had seldom been sufficiently accompanied by practical on-farm experience. An interdisciplinary, problem-oriented farming systems research (FSR) perspective and approach was necessary to focus on the problems and interrelationships between the various enterprises with which each farmer is involved. Improvements in a specific commodity, such as an improved variety of wheat, for example, may not be adopted by the farmer because he may have a need to produce fodder or may have a labor constraint that prevents him from growing that crop.

Another area of concern was the lack of funds to support joint research activities between public sector programs and private commercial businesses. The latter can more efficiently develop the commercial and employment growth potential generated by synergistically designed technology packages in key research areas.

An additional area of concern that had not been adequately addressed pertained to social science factors, particularly economics. Since agricultural research had been dominated by the investigation of biological constraints, there had been limited attention on the broader issues concerning production, distribution and consumption. This may well have resulted in a smaller increase in production than expected from improved crop varieties and production methods.

Lastly, arid and semi-arid, non-irrigated land constitutes about two-thirds of the total land mass of Pakistan. The problems for development and judicious exploitation of this vast resource are different from those of irrigated lands. Research specific to dry areas and the livestock that are produced on those lands had been inadequately addressed in Pakistan because resources had been allocated elsewhere. There was a continuing need for personnel,

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facilities and equipment that can implement a long-term strategy for the development of arid zone research.

### **C. Dissemination**

Research findings must reach politicians, agribusiness and planners as well as farmers and technicians. Accordingly, a good communications system is crucial to ensure that research needs, findings, and implications are spelled out in terms that all can understand. The research methods incorporated in the project extend technological developments to small groups of farmers through demonstrations and field trials. However, the larger audience of private farmers, extension services, educational institutions, agribusinesses and private agricultural input producers was not yet being reached to the extent required for the newly developed technologies to impact optimally on the economy. Development and use of multimedia packages were identified as a means of communication between researchers and farmers, other researchers, agribusiness firms, educators, politicians and policy planners. Moreover, there was a need to fully tap the considerable potential for dissemination of research through private "extension" networks. Better linkages needed to be forged to channel improved technologies to farmers via agribusinesses engaged in, for example, contract farming. Finally, a smoother, more effective mechanism was needed to ensure the ready availability of research undertaken in relevant areas to private firms for commercialization, for the widest possible dissemination.

### **V. INPUTS**

The MART Project was authorized on August 8, 1984 involving planned obligations of \$30 million in grant funds over a period of 5 years. The project was amended increasing the authorized obligation to \$38 million in grant funding and life of project of 10 years. The total obligation during the LOP was limited to \$33 million because of the Pressler Amendment enacted in 1990. \$250,000 was deobligated immediately after the completion of the Project. Therefore, the obligated amount as of 9/30/94 (as shown below) is \$32,750,000. The MART Project received laboratory, field, computer and library equipment worth \$6.8 million from the Agricultural Commodities and Equipment (ACE) Project (391-0468). Host country contributions during the LOP amounted to \$10.5 million in cash and in-kind. The contributions of CIMMYT and ICARDA to the MART Project totalled \$0.75 million. A summary of USAID's expenditures over the LOP is set forth in the following table:

**MART Project**

Project Element	Obligations (as of 9/30/94)	Expenditures (as of 9/30/94)
Technical Assistance	13,331,375	13,302,096
Training	8,842,915	8,239,196
Commodities	3,689,654	3,689,654
Other Costs	6,725,761	6,643,148
Evaluation	160,295	160,295
<b>Total:</b>	<b>32,750,000</b>	<b>32,034,389</b>

**ACE (391-0468)**

6,766,000

- Computers, laboratory, field and  
library equipment

Details are given in the following paragraphs. Cost summaries are presented in Annexes 1 through 5.

**A. Technical Assistance**

Technical assistance was provided under long-term contracts or grants with Winrock International, CIMMYT, ICARDA and BOSTID.

**1. Winrock International**

The cost-reimbursable contract for Winrock International to provide technical assistance in research management and administration, information transfer, and training was initiated on April 1, 1986, and completed on August 31, 1993. The following five long-term expatriate advisor positions were funded under the project:

- Chief of party/research management and administration advisor
- Training advisor
- Information transfer advisor
- Farming systems research advisor
- Provincial research advisor

Winrock International provided 242 person-months of short-term technical assistance; of this, 151 person-months have been used for 102 consultancies in federal and provincial activities.

Winrock's long-term advisors did an excellent job in documenting their work with PARC, NARC and the provincial institutions, and their end-of-tour reports are well presented, informative and forward looking. The end-of-contract report provides an excellent overview of the project and summarizes its achievements, areas where less progress was made than desired, problem areas and visions of the future.

## 2. ICARDA

ICARDA provided a number of experts in critical fields, under contract and later as a grantee:

<u>Position</u>	<u>Specialty</u>	<u>LOE, Person-months</u>
Chief of Party-I	germplasm	48
Chief of Party-II	range & livestock	31
Agronomist	soil and water	48
Range Scientist	range & livestock	36
Farming System Research	(resigned)	24
Extensionist	communication	36
Agronomist	water harvesting	15
Agricultural Economist		13
	Total:	251

The COPs under both the contract and the grant were paid from ICARDA's own budget.

The ICARDA component of MART project was tied to the development of AZRI in Baluchistan. AZRI was originally given the responsibility for arid zone research throughout Pakistan, with substations in other provinces. In practice, its activities have been confined to the highland arid zone near Quetta because it lacked the resources to supervise work at other stations.

## 3. BOSTID

The Board of Science and Technology for International Development (BOSTID) is a unit of the U.S. National Research Council (NRC) that arranges for scientists to work with USAID on scientific problems. MART funds were granted to BOSTID for the development of a three-year competitive grants pilot program involving Pakistani and U.S. scientists. The program objective was "the development of technologies...into marketable products which are environmentally sound and promote the sustainability of Pakistan's agricultural system." An unstated objective was the demonstration of a model for international scientific

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collaboration with public-private sector involvement to solve problems of environmentally stressed areas.

The \$3 million grant included \$1.44 million for competitive research grants plus \$1.56 million for BOSTID administration and international travel for U.S. scientists. PARC provided a program coordinator and staff to facilitate this work. The first 12 months of this project were devoted to advertising for and competitively selecting research grants from the 117 proposals received. A review committee of six Pakistani and six U.S. scientists helped rewrite these grant applications, compared them, and finally funded 25, seven of which were small grants of less than \$30,000. The grants covered research expenses, minor immediate equipment needs, and international travel. The 25 grants were formed into five groups, overseen by six U.S. scientists who came to Pakistan periodically to review work on site.

The grant was amended in 1993 to provide additional funds to BOSTID to assist PARC in developing a strategy to foster closer collaboration between agricultural research and the private agribusiness sector.

#### 4. CIMMYT

CIMMYT provided continuous advisory services to the coordinated wheat and maize programs for many years before MART and helped develop the professional capabilities of scientists engaged in these programs. CIMMYT also supplied considerable technical assistance and training from its own budget, in addition to that provided under host-country contract with MART.

The host-country contract with CIMMYT became effective October 1, 1984. It funded a maize agronomist (10/84 to 11/87), a wheat agronomist (10/84 to 9/87), an on-farm research specialist (11/85 to 11/87), plus 18 months of a regional agricultural economist on a half-time basis (10/84 to 9/87), and 8 person months of short-term advisory services.

The contract was amended in 1987 to terminate three specialist positions. This amendment also extended the contract to August 1990. CIMMYT provided a full-time resident economist to work with PARC primarily on wheat and maize economics. The no-cost extension provided short-term advisors as well as in-service training for 12 scientists at CIMMYT/Mexico.

#### B. Training

##### 1. Long-term international degree training

A total of 96 degree training slots were allocated among the federal and provincial research and education institutions, largely on the basis of population. Of these, 91 were filled; those

unused were generally the result of an inability to meet academic and/or language requirements. Nearly all of the long-term slots were for the Ph.D. degree, requiring a four-year training period, but a few were for the M.Sc., usually acquired in less than two years.

Soils/Agronomy	23 percent
Animal Science	18 "
Plant and Biological Science	22 "
Range Mgmt, Forestry, Fisheries	15 "
Social Sciences and Education	15 "
Engineering and Irrigation	7 "

## 2. Short-term international non-degree training

All 183 short-term slots, totalling more than 600 training months, were subscribed. Thirty-four training slots (one-fifth) focused on research management and methodology, project management, or administration; most of the remainder was directed at agricultural production or biological sciences, with a sprinkling of social sciences and training coordination.

## 3. International observation visits

Fifty individuals made a total of 59 observation visits of a few days to a few weeks each under the MART project. The primary objective of these visits was to participate in conferences, workshops, or seminars in their specialties on the invitation of international agencies and research organizations.

## 4. In-country short course training

MART financed 146 short courses for a total of 4,760 persons, about eighty percent of whom were from the provinces. A significant number of these courses were offered in the provinces.

## C. **Facilities and Equipment.**

### 1. Laboratory and field equipment

MART provided laboratory and field equipment valued at more than \$4 million, most of which went to provincial universities and agricultural research institutions. A Laboratory Equipment Maintenance and Repair Unit (LEMUR) was established at NARC to keep the equipment in running condition. LEMRU provides its services to agricultural research organizations country-wide.

## 2. Computers

The MART project has had a pervasive effect on computerizing the Pakistan agricultural research system, including the accounting systems at PARC and NARC; introducing CD-ROM technology and machine readable agricultural databases on compact discs in 17 agricultural libraries; and massive distribution of personal computers, software, and peripherals throughout the system.

Computers were distributed widely not only to scientists, but also to administrators in research and education institutions and to provincial Secretariats of Agriculture and some decentralized stations. The bulk of the computers were general purpose desktop models, but 10 desktop publishing machines with computer graphics were provided primarily to the PACS, as were most of the nine laptops. PARC and NARC received 53 machines, including 10 for the computer training lab. Sindh, which received 102 computers (80 of which went to SAU), beat out the Punjab with 49 and NWFP and Baluchistan with 13 apiece.

## 3. Vehicles

MART financed a varied lot of 88 vehicles which were distributed throughout the project and to long-term advisors. Most vehicles were pick-ups, land cruisers, or station wagons, but there were also a few small buses and light sedans. The vehicles we saw and travelled in were in good condition and well maintained. However, these vehicles are aging and will need replacement over the next few years.

## 4. Buildings

MART financed the construction of the AVC (audiovisual communications) and training building, which is now complete except for air conditioning (now being installed) and has been occupied.

## VI. PROJECT ACCOMPLISHMENTS

The basic structure of the Pakistan Agricultural Research System is well-established and productive. Its main components, which MART supported, are four provincial research institutes, three provincial universities, a national center (NARC) and at least one outlying federal institute (AZRI), coordinated by a national research council (PARC). These major institutions are also responsible for the performance of a large number of outlying sub-centers, field stations, and experimental farms. The system is well staffed with 4015 professionals, including 460 with doctorates and 2851 with master's degrees. A core of extraordinary scientists in key disciplines is supported by competent scientists in virtually all subjects.

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The Pakistan agricultural research agenda is highly endogenous, since most scientists have limited direct contact with farmers or agribusiness. There is little doubt that a closer relationship with farmers and agribusiness would keep them better informed about the constraints, parameters, and opportunities perceived by these clients, and perhaps improve the effectiveness of their research. The FSR program and the agribusiness relations directorate are MART-inspired efforts to facilitate such participation.

The project has been more successful in accomplishing its goals in some activities than others; the more straightforward areas (Farming Systems Research and Information Transfer) were more successful than the areas dealing with management (Research Management and Administration and Training for the Agricultural Research Network). The major accomplishments of the MART Project in improving Pakistan's agricultural research system are outlined in the following paragraphs.

#### **A. Research Prioritization and Master Plan Implementation**

NARC has developed its master plan for 1988-2000, developed through an interactive process including scientists, administrators, and policy makers. Priorities were established, staffing and financial requirements determined, and research topics specified. ARI, Baluchistan has also prepared a research master plan with assistance from Winrock International.

The NARC master plan is a well-written document reflecting the very considerable effort required to complete it. The plan probably lists many more priorities than can be managed with available resources and proposes a complete research program covering many topics that should be the responsibility of provincial agricultural research. NARC was established to be a center of excellence in agricultural research and therefore should limit its research to those areas that cannot be covered by provincial institutions or are best controlled at the federal level. In this regard, a national agricultural research center generally controls plant and animal germplasm introduction, storage and maintenance of plant germplasm, plant and animal quarantine, a national agricultural library, and specialized laboratories that are central to the provinces and can provide services to all institutions without duplication.

Ten Technical Committees of NARC/PARC hold their annual meetings regularly to discuss research agenda. Meetings are frequently held between those involved in research programs and the related agribusiness firms in order to develop common strategies to address problems faced by the industry. The Directorate of Agribusiness Relations at PARC assists the research managers in holding these meetings.

## **B. Coordinated Research**

National Coordinated Research Programs (NCRPs) in Pakistan were started with the idea of bringing together all concerned federal and provincial research programs and to afford opportunities for exchange of breeding material and ideas to accelerate the pace of agricultural development. In wheat and maize, the program included mainly the import of genetic material from CIMMYT, FAO and other sources, and their screening by PARC; passing on promising lines to provinces for exploitation in the breeding programs; country-wide testing of varieties and strains evolved by research centers and discussion of results obtained; and formulating recommendations for adoption in various ecological zones. NCRPs have played a significant role in screening wheat and maize nurseries and in varietal development of these two as well as other crops. In a larger perspective, the concept of NCRP generated cooperation of federal and provincial research organizations in achieving the common goal of agricultural development through complementary efforts.

The wheat program resulted in the introduction and adoption of high-yielding varieties responsive to the application of fertilizer. The research strategy emphasized improving production through intensified use of inputs i.e. modern high yielding varieties, water, fertilizer and pesticides. This strategy was successful. As a result, the production of wheat in the country rose from about 4 million metric tons in 1967 to about 16 million metric tons in 1993. The yields of wheat and maize, however, have been static for the last several years, which required more site-specific research to develop recommendations to improve the efficiency with which farmers use available inputs. This led to the inclusion of farming systems and socio-economic research activities.

## **C. Farming Systems Research**

Farming systems research is more of an approach to research than research itself. It attempts to look at farmers' systems as a whole, emphasizing multidisciplinary research, and to involve the farmer so that his/her needs and limitations are understood. Once the problems are identified, research focuses on resolving the problems or available results are introduced that are applicable to the situation.

Under the MART project, farming systems research has been introduced in each of the provinces and a national coordinating unit has been established within PARC. In each province, target areas have been identified for activities in the FSR program. Very little research is evident in resolving agricultural problems in farming systems in the target areas; rather, the work is essentially an extension of recommendations already in hand from previous research.

FSR teams introduced 46 interventions out of which 12 have been adopted by farmers. More than 21,300 farmers participated in the FSR program during the period 1987 to 1994.

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Farmers applied the improved production technologies on more than 40,800 acres of land and 20,700 farm animals. Farmers accrued an additional benefit of Rs. 56.5 million over their conventional practices. Some of these technologies such as rural poultry and grain storage were aimed at improving the financial position of rural women.

The farming system teams in the provinces and the coordination unit at the national level are highly motivated and have demonstrated an excellent rapport with the farmers with whom they work. However, there are some significant issues that must be addressed in looking to the future of the FSR program. First, there is the question of necessity. The extension service staff operating in each of the provinces have a responsibility to carry out the activities associated with FSR. Also, research scientists themselves should understand the problems of the clients they serve and should ascertain that their research results are applicable, economically viable, and socially acceptable. They should not require an intermediary in the form of a farming systems team. Further, there is the question of sustainability. The financial costs incurred in each of the target areas are very high and well beyond the capability of provincial governments. More economical means have to be found for problem resolution at the farm level, and the most obvious step is to motivate extension staff and provide modest additional support to bring about a more effective relationship between farmers and researchers through this staff. PARC is addressing these issues. To enhance sustainability, FSR program has been merged into the newly created Institute of Sustainable Agricultural Research at NARC.

#### **D. Economic and Social Science Program**

Social scientists have played an important role in monitoring farmer's acceptance of research results and measuring the impact of research. The Agricultural Economic Research Units (AERUs), established at federal and provincial levels, now conduct annual surveys which document the varieties grown in Pakistan's major cropping systems. These surveys have produced recommendations to broaden the genetic diversity of varieties and to speed varietal replacement as a way of insuring against disease epidemics. The social scientists have also assessed the impact of introducing improved rice and cotton varieties, not only in terms of greater crop productivity, but also in terms of improvement in the planting dates of wheat crop due to earlier maturity of newer rice and cotton varieties. The AERUs are playing an important role in keeping the focus of research activities towards increasing agricultural productivity.

A study conducted by PARC's social scientists concluded that the marginal rate of return on investment in agricultural research in Pakistan was about 60%, far higher than the 10 to 15 percent return that would be considered good in public and private investments in Pakistan. This piece of research has been very effective in attracting increased investment in Pakistan's agricultural research system.

### E. Arid Zone Research

This research is the responsibility of the Arid Zone Research Institute (AZRI) headquartered in Quetta, Baluchistan. The MART project has supported development of the technical and human resources of the institute. In addition to its center in Baluchistan, AZRI has substations at Umerkot in Sindh, at Bahawalpur in the Punjab, and Dera Ismail Khan in the North West Frontier Province. While the geopolitical and ecological mandate of AZRI covers 47 percent of the country's land area, it involves only about 10 percent of the human population. Its scientific mandate includes livestock management, range management, crop management, and agricultural economics.

Since 1981, AZRI has received technical assistance from the International Center for Agricultural Research in Dry Areas (ICARDA). However, starting in 1985 and up to July 1994, with support under the MART project, assistance was intensified and has been extremely beneficial. Staff from ICARDA have been supported under the project, long-term training for selected AZRI staff has been provided, and significant program support costs have been covered. As a result, AZRI, while still in the early stages of development, has demonstrated its potential in range and livestock management and agricultural economics. In crop management, there remains a need to establish a closer relationship with the provincial agricultural research institutes to assure complementarity and eliminate potential duplication. AZRI has developed several varieties of wheat resistant to yellow rust, barley and lentil. Four-wing saltbush has been introduced as a source of forage as well as fuel wood. Catchment-basin water harvesting technique has been demonstrated on farmer fields for efficient utilization of limited rainfall. Flock management and improvement of the marketing system of sheep and goat have also been addressed by AZRI.

While research continues on the institute premises, AZRI is implementing a package of improved technologies on farmer fields on an area of 125 acres of a valley in Baluchistan. This package of technologies includes conservation of rainfall, improved crop varieties, nutrition and health care of small ruminants, and range development. AZRI has established a nursery for mass production of saltbush seedlings. Baluchistan Agriculture Department and several NGOs are collaborating with AZRI in large scale planting of the saltbush.

An issue that needs to be resolved is AZRI's geographic mandate. As a federal institute it has substations in the Sindh, Punjab and North West Frontier Province, but does not have the resources (human or financial) to support research work at these substations. Additional resources are required from the federal government or the provinces will need to take up the costs for the stations.

AZRI has made good progress but is still a fragile institution and will require substantial support for a number of years. Fortunately, at least some of this support may come from ICARDA, which has an interest and a responsibility in the region.

## **F. Research-Agribusiness Linkages**

One of the important changes of the MART amendment in 1990 was to give priority to the interface between public sector agricultural research and dissemination and private agribusiness. The goal was to involve agribusiness institutions in determining the research agenda and for support and collaboration in carrying out research, and disseminating the information resulting from this research.

PARC has established a Directorate of Agribusiness Relations led by a director and deputy director. Under the MART project, a limited amount of technical assistance was provided by one advisor contracted through Winrock. A number of short-term consultants under a grant to BOSTID have also provided inputs to assist in the development of the Directorate's program.

Twenty six agreements of technical collaboration have been completed between the directorate and agribusiness firms, 5 in the area of training in the manufacture of quality agricultural machinery, 4 in the area of poultry health care, 11 in the manufacture of agricultural machinery, 2 each in seed potato and cattle feed production, and one each in insecticide evaluation and vegetable production. Private firms have committed more than Rs.27 million for collaborative efforts with PARC. Further, PARC has helped the private sector in the establishment of a marketing cooperative for honey, cheese making and several mini livestock feed mills. Other research commercialization mechanisms are being explored to commercialize new and improved technologies. This includes a proposal, under consideration by the Government of Pakistan, for the establishment of an agro-industrial development board.

A study has been completed by the Directorate to document agribusiness institutions in Pakistan. PARC publishes a news letter "TECHNOLOGY REPORTER" to disseminate news about Pakistan's agribusiness sector and the cooperative activities between the public and private sectors. A comprehensive strategy has been developed by PARC to foster closer collaboration between the public agricultural research and the private agribusiness sectors in consultation with the leading businessmen. The objective is to bring to the attention of those firms with agribusiness interests in Pakistan the opportunities for mutual benefit from collaboration in research and development activities.

Little understanding or interest in the provincial institutions has been seen in this part of MART. Further, there is little evidence of any significant inputs by the private sector in research planning. However, the work in this area was only begun in 1990 so it is too early to expect significant support. The concept is excellent and timely and has been effective in many countries, and Pakistan needs to gain further support for its research and dissemination activities. Collaboration with agribusiness is a proven way to obtain such support.

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### **G. Commercialization of Technologies Developed**

The private sector is marketing 15 products which were produced on the basis of technologies developed at PARC. These include the Reaper-Windrower for wheat and rice, sugarcane planter, hydropericardium vaccine for poultry, seed potato, groundnut digger, groundnut thresher, cattle feed, low-cost wheat combine, hybrid sorghum seed, no-till drill, rice thresher and soybean thresher, row-crop planter, canola edible oil, and vegetable seed. The retail value of these products was Rs.163 million during the fiscal year 1993-94. An estimated 54,750 farmers and house-holds are using these products.

### **H. Private Sector Information Dissemination**

Private sector dissemination of research information is in its infancy in Pakistan in terms of disseminating the results of joint research or work other than product research. However, an excellent beginning has been made relative to the cotton crop which is so vital to Pakistan's economy. In this regard, Pakistan Agricultural Research Council and leading pesticide manufacturers are implementing a common strategy to educate the farmers on cotton pest management through television and radio programs.

Dissemination is an area where cooperation and research achievements between scientists and institutions in the national agricultural research network and agribusiness enterprises must be attained before any significant progress may be expected. It has potential for the future but will require greater collaboration than is evidenced at present.

### **I. Research Grants Program**

The competitive research grants program, jointly coordinated by PARC and the BOSTID, was successfully completed. Grants for Pakistani scientists to conduct research focused on increased productivity of environmentally stressed lands linked awardees with outstanding U.S. scientists and institutions with similar interests and provided interaction on scientific issues.

Although the program had a short life, it has already aroused much enthusiasm and scientific support from U.S. and Pakistani sources. The program is seen as a mechanism to foster scientific interaction at individual and institutional levels at costs well below the very large programs carried out in the past. Support will be needed for a number of years for the research grants in order to gain lasting benefits. The benefits from this program were substantial in relation to their financial cost; the program provided an excellent means to continue to gain benefits from past program investments in training and institutional development.

## **J. Audiovisual Production**

New agricultural technologies and farming techniques are continuously being developed by Pakistan's agricultural research system. Information related to these developments must be disseminated quickly and effectively so that it is not only understood by the target audience but also properly used by them. Realizing the role of communication technology, modern multi-media facilities were developed both at NARC and the provincial agricultural research institutes.

The Audio-Visual Communications Directorate at NARC has audio and video production studios; art, design and computer graphic rooms; field recording, production and projection equipment and vehicles; and photography laboratory. The provincial audio-visual cells are also adequately equipped to undertake audio-visual production work. All audio-visual production cells regularly feed agricultural information to the television and radio stations. So far, these cells have produced 62 video documentaries/programs and more than 390 radio programs dealing with different agricultural topics. These programs have been broadcast more than 4000 times on the three television and several radio stations.

## **K. National Network of Agricultural Communicators**

The Pakistan national agricultural research system includes many documentation, publication, and information units. Under MART the network of communicators was supported and brought into a more effective and cohesive arrangement. The National Technical Information Transfer Committee (TITC), composed of leading agricultural communicators from private and public organizations (both federal and provincial), was established. In his end of tour report, the information transfer advisor noted that the TITC's leadership role was not sustained. As a result, Provincial Information Transfer Committees (PITCs) were organized to do at the provincial level what the TITC and PARC were to do nationally.

The PITCs gave direction for the establishment of the Provincial Agricultural Communication Support Cells. PACSCs were established in Faisalabad, Lahore, Peshawar, Quetta, and Tandojam, and MART provided each with the same equipment and training. The equipment, for the most part, is for audiovisual production work. The PACSCs are linked to the Multimedia Studio at the NARC, which was also developed (including its building) under the project:

A good base is in place for a national network of agricultural communicators. Modest support, additional staff recruitment, and training should result in a well-recognized and productive network that will play an important role in technology transfer.

## L. Training Institute

Scientists, technicians and progressive farmers constitute a valuable human resource for national development. The agricultural production technology is advancing at such a rapid pace that even the trained manpower needs to be retrained regularly so that gap between the known and the new information is continuously narrowed down.

A significant event, designed to accelerate human resource development in the field of agriculture was establishment of the Training Institute at NARC. The NARC Training Institute is established, equipped and in operation. The Institute assesses manpower requirements in various disciplines of agricultural production; develops training modules; and provides training in farm production technologies, problem identification and project planning, extension methods, research management, professional development, etc. This institute is playing an important role in training agricultural scientists, research managers, extension workers, educationists, farmers, and agribusinessmen. More than 7,000 persons have received training at this institute during the last 10 years.

## VII. LESSONS LEARNED

The most significant lessons learned have to do with improving the realism of program expectations relative to resources, time, and political constraints. The centerpiece of the MART project was management, yet management of research received far less attention than technological aspects. Perhaps administrators and advisors alike were disheartened by the difficulty of securing major changes in attitudes; and government rules, regulations, and procedures. Some lessons learned are summarized below:

- The implementing government agency and the donor organization should agree beforehand, on project objectives and implementing strategy. For successful implementation, project objectives should be achievable.

The MART Project Paper was viewed by PARC as a general guideline and the technical assistance teams spent considerable time in developing acceptable implementation plans. In several instances, the senior management and the program leaders differed on implementation strategy which kept the foreign consultants on the run between the two.

Example: The PP called for PARC to provide 14 additional staff for the expanded NARC Training Institute. PARC's management had no intention of adding 14 staff to the Institute. In their view this was an excessive number of staff. This was not a case of not being able to provide the staff; it was a case of not agreeing with the implementation plan described in the PP.

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Example: One of the systems analyses to be carried out in the first few months of the project was described in the PP as an in-depth study of, " Organization and Administration: methods of financial and personnel allocations, decision making, administrative reporting, and channels of communication between research entities at the federal and provincial levels, among those at the provincial level, and among units within individual research organizations." There were four other equally comprehensive system analyses described in the PP. Even if the PARC Chairman had not declined to undertake the system analyses, it is doubtful that these could have been carried out simultaneously in the first 12-18 months of the project as described in the PP.

Example: Project output in the PP included the following:

"managing improvement interventions designed and implemented throughout the national agricultural research system in the areas of research planning, research methods, organization and administration, information flow, and financial management;"

and,

"a revised and improved financial records maintenance and reporting system established at PARC and the provincial agricultural research institutes;"

The MART contractor was capable of designing improved procedures, in identifying management practices that need to be changed and in recommending changes that would improve the management system but clearly was not in a position to implement those changes.

- It takes time to change a government's management practices.

The difficulty of effecting changes in the management of a large research program conducted by geographically dispersed entities in a federated system, while recognized, was inadequately addressed. PARC's role is primarily coordinating and supportive; it does not command. This requires development of a consensus in a system where participants are accustomed to seeing resource allocation as a zero-sum game. Change does occur, but slowly and with greater effort than anticipated.

- Improved management within a highly structured system is generally improved *at the margin* when additional resources reward better planning, execution and implementation of research. This requires liberation of the creative energy of

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scientists, with appropriate recognition *and resources* for innovation and excellence. Examples include the successful implementation of the Productivity Enhancement and Research Grants programs.

- The critical nature of time lags becomes apparent when a long term program nears completion with little probability of being extended.

Half of the long term training participants did not return to the project in time to contribute to its purpose during LOP. The last tranche of commodities (primarily computers, databases, and audio-visual equipment), while invaluable for future productivity, did not materially impact research output during the last two years of the project. The benefits of these and other MART contributions will continue to permeate the research system, so their impact is not lost, just delayed.

- The host-country personnel must want to accomplish, and must believe it is possible to accomplish, whatever is being attempted.

The implementing agency should secure concurrence of its senior and middle-level research managers and administrators on new projects by involving them in the project formulation phases. This view stems from the fact that some personnel in Pakistan's agricultural research system acted as though they thought they were carrying out the research work for USAID. They did not see it as development work carried out by Pakistanis for Pakistan with facilitation by USAID.

Most proposed management interventions, especially those pertaining to financial and personnel management, were perceived by most Pakistani research managers to be impossible to bring about, with the result that only USAID and contractor staff pushed these reforms. On the other hand when changes were seen to be possible and when these were desired and needed, Pakistani managers aggressively sought them. Examples: computerizing PARC financial accounts; computer training; and provision of new physical facilities and equipment for the AVC and the Training Institute at NARC.

- High quality and seasoned expatriate consultants, who do not get bogged down by the indifferent attitude of host-country counterparts, are critical for success of the development projects. Weak expatriate advisors get manipulated by their shrewd host-country counterparts and are reduced to the level of technical staff officers.

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Example: A long-term advisor worked hard to put together a package of equipment for the development of the new audio-visual facility at NARC. The Pakistani counterpart, rather than appreciating his efforts, keeps on moaning about the obsolete and inadequate equipment specified and procured by the advisor. Apparently, the advisor pushed ahead alone as his counterpart was not providing any input at the planning stage. Had the issue been handled sternly by the advisor, the counterpart would have not had any chance to malign the advisor.

## VIII. SUSTAINABILITY

The most important critical elements of sustainability in the MART project involve:

- Maintaining integrity of the agricultural research system
- Assuring availability of adequate and appropriate resources
- Providing for continuity and refinement of concepts
- Encouraging scientific excellence throughout the system
- Encouraging responsiveness to client needs

Many different groups are participants in the operations and/or products of the Pakistan agricultural research system, and as such hold a stake in the continuity and effectiveness of the system's operations. Farmers, agribusinessmen, scientists, universities, provincial agricultural research institutes, the National Agricultural Research Centre and the Pakistan Agricultural Research Council are the major stakeholders and must be active participants in the system's development, both as contributors and as beneficiaries. This is the only way in which their respective interests can be properly represented.

### A. Maintaining an Integrated Federal System

A long-term objective of MART was to help Pakistan establish an integrated federal system by strengthening both central (federal) and provincial research and professional education facilities. MART provided international and domestic training, technical assistance and consultancies, and commodity support. This system is not perfect, but is well structured to continue the development of its separate parts and the relationships among them. These relationships are sensitive, and require careful handling. They will be easier to handle if adequate resources are available.

PARC cannot and should not try to mandate or control provincial research. Its efforts should be directed towards raising the competence and productivity of scientists throughout the system. To this end, it should use professional excellence and financial support as principal means of program guidance. PARC has adequate tools to encourage a collaborative research

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effort, e.g., supplementary support, mentorship, formal collaborative programs, and research support activities. It should use great care to select top provincial as well as federal scientists to serve on its boards and committees. It should promote and support provincial leadership of research activities for which the provinces are qualified, while avoiding preemption of this responsibility.

Part of this process of integrating the system consists of finding a precise role for NARC that supports provincial research without competing with it. NARC should not be doing research that can be done by decentralized institutions. It should become a mentor organization whose worth is measured by the success of those it tutors. As a national center, it can provide real economies of scale in the collection and distribution of germplasm, in providing databases and other scientific information, in arranging coordinated programs of mutual interest to multiple research institutes, in maintaining a database of research in progress, in equipment maintenance and provision of spare parts, and in facilitating international scientific interchange.

#### **B. Assuring Adequate Resources**

The GOP appropriated Rs 569 million for agricultural research at federal level for the fiscal year 1992/93, an increase of more than 180 percent over the Rs 203 million average of the prior two fiscal years. The GOP also provided another allocation of Rs 200 million for the year 1992/93 under the Productivity Enhancement Programme, a level which exceeds that formerly provided by donor agencies. The system is fully sustainable in terms of its financial resources, and is strengthened by the GOP's prompt assumption of direct responsibility for its support. The GOP has made consistent efforts to fill any financial gaps created by reduction or withdrawal of donor support.

The Pakistan agricultural research system needs other resources, not all of which can be readily supplied by the GOP. Sophisticated scientific equipment and spares, for example, must be acquired abroad with scarce foreign exchange. Pakistani educational institutions are now awarding doctorates, but products of both national and international training claim that international training offers an additional level of sophistication. Some institutions, notably SAU, are now experimenting with joint doctoral degrees involving training and research conducted at home and abroad. This arrangement provides significant economies while assuring maximum benefits to Pakistan in research and training.

The research system has suffered at all levels from its inability to establish and maintain appropriate priorities for allocation of funding. Establishment costs have exceeded those for operations, reducing research efficiency and productivity. Pakistan has relied on donor assistance to make up the shortfall in investment and operating funds. New programs have been financed by donors with non-recurring contributions, creating an unfunded obligation.

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PARC has dealt with the first problem by creating the Productivity Enhancement Programme, which provides additional operating funds to selected activities to improve their productivity. This is an excellent program, if it can be maintained, since it allocates funds where they are most needed and useful.

The loss of USAID funding for Pakistan agricultural research is being offset by the World Bank's \$80 million Second Agricultural Research Project (ARP-II). This project's main objectives are:

- i. Improve and strengthen research capabilities in the provinces;
- ii. Consolidate and complement the advances achieved under ARP-I at the federal level, that is, with PARC and NARC;
- iii. Support high priority research programs at the federal and provincial levels;
- iv. Improve and strengthen research/extension linkages; and
- v. Strengthen linkages with eminent overseas research institutes.

Inputs to be financed include training, technical assistance, equipment and machinery, vehicles, operating costs, and staff costs. It thus appears that this activity will render the same general types of continuing assistance as might have been anticipated from USAID, but at higher levels.

### **C. Providing Sustainability of Concept**

The MART project introduced a number of facilities intended to strengthen perceived weaknesses in the national agricultural research system. Among these were international training, buildings, laboratory equipment, computers, audio-visual equipment, modern library equipment and databases, and pilot (demonstration) activities such as farming systems research, provincial agricultural communications support cells, and the agribusiness relations support cell. Each facility not only represents resources, but reflects a concept of how to meet a need of the system. The fact that the resources have been spent does not mean that the concept has terminated. For example, training, more than merely benefiting an individual, strengthens the excellence of the system. Sustainability of the training concept requires continual attention to making the optimal utilization of the training and spreading the knowledge acquired, so that the entire system benefits.

The library facilities are immediately useful to scientists, but must be maintained and updated periodically if they are to retain their utility. Laboratory equipment and computers are not just tools needed to perform traditional experiments at existing levels, but enable a scientist

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to perform more effective research, and stimulate the need for better science and more sophisticated tools. While the equipment needs to be maintained, the embodied concept is a continued pursuit of excellence. Similarly, maintenance, adaptation, and spread of the concepts included in pilot activities are ultimately more important to the issue of sustainability than continued financing of the pilot activity itself.

This vision of shared facilities as a sustainability concept is shared by a few Pakistani scientists at all levels. However, it needs to be nurtured to continue to optimize the utilization of facilities which were provided by MART. Individual pieces of equipment or an advanced degree awarded to a participant are less important to the institution than the continued pursuit of ways to utilize equipment and training to improve the research system. Only the future will demonstrate whether this vision has been internalized.

#### **D. Encouraging Scientific Excellence**

The 25-year USAID program of assistance to Pakistan agricultural research had the underlying objective of fostering good science as an open, international collaboration. This has been a key feature of U.S. international scientific liaison for more than five decades. It has been institutionalized in the underwriting by the U.S. of 25 percent of the CGIAR budget for International Agricultural Research Centers. A number of centrally funded USAID projects, including the BOSTID/NRC program and multiple Collaborative Research Support Programs are directed at establishing and maintaining collaborative research among international scientists. Pakistani students have established links with individual scientists and their institutions which may eventually become formalized in joint degree programs or joint research activities.

International training and specialized technical assistance provided by MART supported the operations of IARCs such as CIMMYT and ICARDA. These and similar donor programs provide a natural link with the international scientific community, and have enabled individual scientists as well as Pakistan agriculture to benefit from expertise not otherwise available. Pakistan will continue to participate in these IARC programs, but not at the level permitted with MART funding.

International collaboration between U.S. and Pakistani scientists may thus be expected to continue under various forms. What is lost by cessation of assistance is the facilitation of these forms, and the encouragement by the staff of a foreign donor located in Pakistan. Sustainability without that particular foreign contribution will depend, like all other issues, on the capacity and desire of the Pakistani scientists and their organizations.

**E. Encouraging Responsiveness to Client Needs**

Farmers and agribusiness are the primary clients for the system's output. The research system should strive to identify client needs and provide practical solutions so that research findings can be converted into financially attractive and environmentally friendly farming practices and marketable products. Likewise, the agribusiness sector must adopt improved technology generated by the system, or its output will not contribute to the nation's agricultural and industrial economy. Their active participation is essential for defining research problems, adapting their solutions, and rapidly adopting them. Thus, sustainability of the research system and the clients is inter-linked.

Annex 1

**MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY (391-0489)**

**Technical Assistance**

<u>Activity</u>	<u>TA Team</u>	<u>Cost</u>
Research management and administration; information transfer; farming system research; training	Winrock International (Contract) Consultants: - Long Term 309 p-months - Short Term 123 p-months - Local 119 p-months	\$6,889,970
Coordinated wheat and maize research program	CIMMYT (Host Country Contract) Consultants: - Long Term 152 p-months - Short Term 14 p-months	\$2,206,037
Arid agricultural research	ICARDA (Contract) Consultants: - Long Term 192 p-months +59 under grant - Short Term 13 p-months	\$2,263,906
Research-agribusiness	BOSTID/NRC (Grant) Consultants: - Short Term 2 p-months	\$ 168,516
Computer expert		\$ 40,505
Research manager for PARC		\$ 50,000
Architectural services		\$ 56,671
Study tours		\$ 28,957
Research grants		\$ 64,364
Logistic support and miscellaneous		\$1,533,170
	<b>Total:</b>	<b>\$13,302,096</b>

Annex 2

MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY (391-0489)

Training

Overseas Training

Cost: \$7,389,670

Contractors:	AED	\$6,989,670
	Winrock	30,000
	ICARDA	223,500
	CIMMYT	146,500

Number of trainees: 331

Doctor of Philosophy:	77
Master of Science:	12
Short-term Training:	183
Observation Visits:	59

In-Country Training

Cost: \$ 849,526

Contractor: Pakistan Agricultural Research Council

Number of training courses: 146

Total number of participants: 4760

**Total cost: \$8,239,196**

Annex 3

MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY (391-0489)

Commodities

Office and laboratory equipment:	\$1,325,095
Audio-visual equipment:	\$ 384,407
Computers:	\$ 367,865
Tools and spares for 3 computer repair and maintenance shops:	\$ 23,457
Vehicles	\$ 556,721
Agricultural machinery:	\$ 130,410
Poultry disease diagnostic equipment:	\$ 77,181
Spares for laboratory equipment:	\$ 46,157
House-hold furniture for consultants:	\$ 695,986
Miscellaneous:	\$ 82,375
<b>Total:</b>	<b>\$3,689,654</b>

## Annex 4

### MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY (391-0489)

#### Other Costs

Farming systems research, executed by the Pakistan Agricultural Research Council:	\$ 576,547
Arid agricultural research, under a grant to ICARDA:	\$1,907,080
Competitive research grants, under a grant to BOSTID/NRC:	\$2,999,000
Construction of audio-visual centre:	\$ 934,450
Procurement of farm machinery:	\$ 37,384
Evaluation of the project:	\$ 38,056
Miscellaneous:	\$ 150,631
<b>Total:</b>	<b>\$6,643,148</b>

Annex 5

**MANAGEMENT OF AGRICULTURAL RESEARCH AND TECHNOLOGY (391-0489)**

**Evaluation**

Evaluation of the project:	\$ 111,050
Audit of contract with ICARDA:	\$ 49,245
<b>Total:</b>	<b>\$ 160,295</b>