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Evaluation of
Management of Agricultural Research and Technology
(MART: 391-0489)

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LIST OF ABBREVIATIONS

ACE	Agricultural Commodities and Equipment Project
AED	Academy for Educational Development
AERU	Agricultural Economics Research Unit
AID	Agency for International Development
ARD	Agriculture and Rural Development Office of USAID
ARI	(Provincial) Agricultural Research Institute
ARP	AID Agricultural Research Project (1969-1984)
ARP-I	World Bank First Agricultural Research Project
ARP-II	World Bank Second Agricultural Research Project
ASSP	Agricultural Sector Support Project
ATI	Agricultural Training Institutes
AVCTI	Audiovisual Center and Training Institute
AZR	Arid Zone Research (project component)
AZRI	Arid Zone Research Institute, Baluchistan
CIDA	Canadian International Development Agency
CIMMYT	International Wheat and Maize Improvement Center, Mexico
CPS	Conditions Precedent (to disbursement)
EOP	End of Project
FERRO	Far East Region Research Office (USDA)
FSR	Farming Systems Research
GDP	Gross Domestic Product
GOP	Government of Pakistan
IBRD	International Bank for Reconstruction and Development (World Bank)

ICARDA	International Center for Agricultural Research in Dry Areas, Syria
IIMI	International Institute for Management of Irrigation
IT	Information Transfer (project component)
LEMURU	Laboratory Equipment Maintenance and Repair Unit
LOP	Life of Project
LT	Long Term
MART	Management of Agricultural Research and Technology (Project)
NARC	National Agricultural Research Center
NCRP	Nationally Coordinated Research Program
NWFP	Northwest Frontier Province
PACD	Project Assistance Completion Date
PARC	Pakistan Agricultural Research Council
PIL	Project Implementation Letter
ProAg	Project Agreement
PP	Project Paper
RMA	Research Management and Administration (project component)
Rs	Rupees, Pakistan Monetary Unit (Rs 18.50 = US. \$1.00)
ST	Short Term
TA	Technical Assistance
TARN	Training for the Agricultural Research Network
TIPAN	Transformation and Integration of the Provincial Agricultural Network (Project)
TOEFL	Test of English as a Foreign Language
USAID	AID Mission in Pakistan

USDA United States Department of Agriculture
USG United States Government
WID Women in Development
WMCP Wheat and Maize Coordinated Programs (project
component)

EXECUTIVE SUMMARY

A. Background

The tradition of agricultural science was well established in undivided India, but none of the national research institutes extant at independence in 1947 was located within the current boundaries of Pakistan; however, when MART (Management of Agricultural Research and Technology Project) was authorized in 1984, the research establishment included 65 research institutes and more than 160 stations, substations, centers and laboratories. There are three autonomous agricultural universities, and three agricultural colleges and a veterinary college, as well as technical training institutes.

The national agricultural research system is an open alliance of national and state institutions, not unlike that of the United States. Pakistan is a federation of provinces, which have significant constitutional responsibilities and authorities, including those for agriculture. The Pakistan Agricultural Research Council (PARC) was reconstituted as an autonomous federal body in 1978 to undertake, aid, promote and coordinate agricultural research. This is a vital role, but one that must be exercised by leadership and consensus, since the agricultural research organizations and universities in each of the four provinces are independent of direct federal control.

PARC does exercise dominion over NARC (National Agricultural Research Center), which it is building into a national center of excellence in agricultural research, as well as over several other specialized institutes and centers. However, the bulk of research and education infrastructure and staff are within the provincial structure.

U.S. assistance to Pakistan's research system began in 1969. The Agricultural Research Project continued for sixteen years, ending in 1985, the same year MART began. This assistance saw the creation of PARC in the mid-seventies and its reconstitution as an autonomous body. It provided support for PARC and for the initiation of NARC. In 1984, the World Bank Agricultural Research Project (ARP-I) came on stream, a \$24 million project that provided funds to construct the PARC headquarters, NARC institutes of animal husbandry and farm machinery, a sizeable amount of international training, and \$5 million for contract research in the provinces. MART was designed to build on the prior USAID experience and complement the World Bank effort. A second World Bank project (ARP-II) is being planned to overlap with MART.

MART was authorized in 1984 as a five-year \$30 million grant project with a GOP contribution of \$1.135 million. U.S.

contributions to this project have grown to \$36.360 million through allocations from AID's terminated Agricultural Research Project, the Agricultural Commodities and Equipment Project, and the Agricultural Sector Support Project. The PACD (project assistance completion date) has been extended twice, to September 30, 1991.

The project includes five components: (1) research management and administration; (2) information transfer; (3) training for the agricultural research network; (4) arid zone research; and (5) wheat and maize coordinated programs. The first three of these receive technical assistance from a contract with Winrock International. The fourth is advised by ICARDA (International Center for Agricultural Research in Dry Areas), and the fifth is advised by CIMMYT (International Wheat and Maize Improvement Center). Besides technical assistance, funds are provided for international short-term and degree training; in-country short courses; construction of a combined audiovisual center and training institute, staff housing and cafeteria at NARC and a gas line at AZRI; commodities, including audiovisual equipment, vehicles, computers, and scientific instruments and field equipment; and other costs for studies and evaluations. About four-fifths of the equipment, vehicles, computers, and training are destined for the provincial institutes and universities.

B. Evaluation Findings

This evaluation was conducted between January 5 and February 11, 1989, by a team of five professionals who visited the four provinces, interviewed federal and provincial officials and scientists, visited research institutes and field sites, and reviewed project documentation and files, work plans, reports, and other reference materials. In the process, each of the components of the MART project was evaluated separately, and these observations were applied to the national agricultural research system and MART's role in its improvement. This section summarizes our conclusions.

The project provides necessary and desired support to a national agricultural research system whose products are sorely needed to attain production targets. The project is close to schedule. Most inputs have been delivered on time, and managed to produce programmed outputs. Some delays have occurred in in-country training, which focused more on technical matters than on management improvement. The impact of new elements added by MART, e.g., FSR and communications, cannot be expected until fully integrated, nor can impact be expected from international degree training before the return of the participants. Procurement and commissioning of laboratory equipment has led to considerable aggravation because of unmet expectations, but other

procurement has proceeded without problems. The time required for review and decision on study recommendations was underestimated; formal evidence of responsive action is scarce. Otherwise, this project's implementation appears to be well managed, on track, and relatively free from implementation problems.

Nevertheless, it is very unlikely that anticipated progress will be recorded using the 12 measures of end-of-project (EOP) status by the current (extended) PACD. Most of the management problems identified stem from two sources beyond the effective influence of MART. First, the provinces' independent responsibility for agriculture represents a federal system of research, like that of the United States. It is an alliance rather than a controlled organization, so changes must be brought about by consensus, which takes considerable time and effort to develop. Second, inflexible public sector management systems are not readily modified, even by autonomy. Staff are unwilling to risk their careers by innovation in arcane areas. In this environment, MART is a necessary but insufficient response.

It should be noted that, despite these problems, Pakistan's agricultural research network has been able to produce or adapt the technology needed to keep agriculture growing at 3.6 percent per year for 25 years. Improvements in management of the research system are intended to improve its efficiency and cost effectiveness to assure continued growth.

The MART project design is seriously flawed by expectations that are quite unrealistic in light of the size and nature of the problems faced. Many of the proposed interventions (specifically the systems analyses and many of the covenanted studies) were inappropriate for attacking the type of problems described above. The indicators of EOP status were presented without baseline or targets. The level of effort allotted to management and administration was infinitely small in relation to the extent and dispersion of the system. Much of this effort is tangential to the problem, with a technical rather than a management orientation.

The sequencing, as well as the total time allowed for other project inputs to affect EOP status, are incongruous. Most degree candidates will not have returned to the project long enough for the impact of their training to be felt. Equipment provided in 1988 will have little immediate impact on science. Much of the output of the information transfer component must await the building of a center, the purchase of equipment for that center, and the hiring and training of staff upon completion of the center.

USAID, PARC, and the contractors have nevertheless managed with flexibility to achieve significant progress towards the end of the project. The fact that MART will not reach EOP status by PACD is more of a design problem than an implementation concern.

1. Research Management and Administration

It is our interpretation that the five primary management problems MART was to correct are problems associated with the dispersion of the national agricultural research system. In assessing progress towards their improvement, we looked primarily at how PARC is addressing this dispersion in order to improve the cohesion of the system and establish a collaborative mode for building consensus.

At this point in time, the Pakistan national agricultural research system continues to be a loose alliance rather than an integrated national system. PARC strategy for strengthening the cohesiveness of this alliance has three elements: (1) scientific excellence in the performance of its controlled elements; (2) the provision of useful services to other parts of the system; and (3) the ability to acquire resources for and represent the system. It is doing a good job in all three areas, and donor assistance has provided material assistance and encouragement in all three.

NARC has become a center of excellence in little more than a decade. Its laboratories, library, and equipment repair units provide needed services to other parts of the system. It has prepared a draft of a long-range research plan by involving the entire scientific staff, giving them experience in setting goals, establishing priorities, and allocating resources. Other organizations are seeking to emulate this example. PARC's computerized accounting and management information systems, when operative, are expected to become other models. Its practice of promoting scientists based on objective indicators of performance instead of seniority is an example to other organizations as well.

PARC's national coordinated research programs, usually along commodity lines, bring together researchers with similar interests to exchange information, determine priorities, and allocate responsibilities and resources. The PARC budget provides support that complements the provincial institutes' manpower and facilities. Although these programs represent a small portion of the total resources, they are particularly useful in establishing cohesiveness.

PARC has been very successful in attracting the support of donors, who share its views about the need for an integrated system. Although these donors have helped build up PARC and

NARC, significant flows of resources have also been channelled to the provinces, an indication of PARC's responsibility for aiding the system as a whole.

PARC has been less successful in raising domestic resources. While agricultural research has obtained its share, and more, of the budget, Pakistan's low revenue growth constrains research budgets as well, at both national and provincial levels. PARC must continue to campaign forcefully to inform executive and legislative decision makers and the general public of the importance of a science-based agriculture and the need to reflect this urgency in national budgets. Nevertheless, this situation is not apt to improve significantly in the near term. Although PARC's recurrent budget apparently shows substantial growth over the last five years, personnel costs and inflation have grown even faster, so that operating funds for research per scientist have actually declined by more than half. Clearly, excellence has its costs.

The disparity of financial trends and operating needs makes the strengthening of management capabilities even more important if research is to be cost effective. Management must be strengthened in all components to meet the challenge of scientific performance under continuing austerity. These components include: (1) careful allocation of resources to well-planned research programs directed at high priority problems, and elimination of repetitive studies of less importance; (2) tight management of research operations, enforced by good program monitoring and evaluation; (3) personnel management practices that reallocate and/or retrain scientists to meet program needs, and assure through job descriptions and supervision that they understand what is expected of them; (4) effective financial management so that resources flow to experiments when needed under effective controls; and (5) realignment of organizational structures for organizational development and change.

Management improvement in each of these areas is needed throughout the research network. It is particularly important that PARC concentrate its attention on the units under its direct control. PARC's leadership role in management is as important as its scientific excellence, since other organizations in the system need working models to emulate.

Three areas of great importance in this regard are: (1) relieving uncertainty through a published administrative manual and job descriptions; (2) improving agility and responsiveness in financial and personnel areas; and (3) management training at all supervisory levels. PARC should also look to its procedures for reviewing consultant reports so that action can be taken while recommendations are still current.

2. Information Transfer

This component has progressed rapidly because the goals were clearly specified, the technical assistance was of high quality, and PARC was fully committed to developing the program. The Multi-Media Production Center is under construction, the equipment is available or on order, a skeletal staff under a competent but inexperienced director is undertaking a practicum, information transfer training courses have been given to 250 individuals at national and provincial levels, and a Technical Transfer Coordination Committee is functioning. Considerable effort has also been given to improving library information search capability, including bibliographic reference summaries.

The major recommendation requiring early action is to extend the information transfer advisor's assignment at least until June 1990 to help install the equipment and develop the full staff. Some way must be found to recruit the required additional staff and provide some with international degree training in agricultural communications in the near term.

3. Training

After an uncertain start, the participant training program has moved ahead rapidly and is well ahead of schedule. The PARC Training Directorate has established a valuable computerized data base with information on participants overseas.

Work on the in-country component has been slower, largely because of unclear objectives in the PP/PC-1, the resignation after two years of the training advisor, and lack of broad understanding of the professional training/human resources development field. Nevertheless, 70 short courses have been conducted in-country under the MART project. Construction of an addition to NARC Training Institute facilities will be completed on schedule.

The issues raised and recommendations made in Frank Byrnes' report should be digested and acted upon rapidly. In particular, PARC should assume leadership in the human resources development field for the agricultural research system. High priority should be given to a reentry program for returning scholars. A consultant should be provided to help analyze accumulated survey data with priority given to institutional profiles. Planning should be concentrated on individual institutions rather than on a national training plan. A systematic in-service training program is essential.

4. Arid Zone Research

The objective of a fully functional, well-organized and well-managed Arid Zone Research Institute (AZRI), staffed with competent professionals by the end of the contract, will not be reached by PACD. Current staff lack the capacity and experience to design and manage research independently. Reduced technical assistance should continue for an estimated four to six years. Most research sections have been trying to conduct too many field trials, evaluating too many variables at too many locations for effective control. Staff competence will improve soon with two returning Ph.D.s but will still lack experience in research design and execution.

The research program should be focused on two major areas: range management/livestock and water-harvesting agriculture. The range management advisor should be retained to pursue the good program under way. The undifferentiated Agronomy Department should be reorganized into crops and soils divisions and supported by a soils specialist with field crop experience and a short-term engineer consultant with water-harvesting experience. An agricultural economist with FSR experience should replace the extensionist on the advisory team.

5. Coordinated Wheat and Maize Programs

Pakistani scientists assumed full responsibility for these programs, having demonstrated the capability for independent collection and maintenance of germ plasm, its manipulation to produce new varieties with desirable characteristics, and testing of their adaptability. There remains a serious gap between the yields obtained on station and by better farmers and national average productivity. The economics of production constraints and proposed solutions remain weaker points of this program. For this reason, it is desirable to retain the services of the CIMMYT agricultural economist throughout this project to work with the agricultural economics research units (AERUs) and help analyze the causes of the yield gap.

SECTION I
INTRODUCTION

A. Setting

Pakistan has a population of 100 million and a total land area of 300,000 square miles, of which perhaps 20 million hectares (one-sixth) are cropped. Much of the remainder is arid and/or mountainous. Crops account for close to 70 percent of the value of agricultural production, livestock almost 30 percent, and forestry and fisheries together amount to less than 2 percent. Wheat is about 35 percent of crop value, with rice, other cereals and maize, and pulses each contributing another 10 percent. Sugarcane and cotton are major commercial crops. Sheep, goats and other livestock graze the extensive uncropped area and fallow lands. Cattle and water buffalo are fed mostly on crop residues and fodder. Horses, mules, donkeys, oxen and camels, which are extensively used for draft, also receive most of their energy from residues and fodder.

Agriculture continues to dominate Pakistan's economy, providing roughly 30 percent of its GDP and 70 percent of its export earnings, and employing more than half its labor force. More than two-thirds of Pakistan's population lives in rural areas, most in some 45,000 villages. Between 1960 and 1985, the agricultural GDP grew at a rate of 3.6 percent. More significantly, the years between 1970 and 1977 were the only period when production lagged below this rate. This growth reflects an abundance of good soil, of which some 16 million hectares are irrigated, along with a steady stream of high yielding varieties of major crops and other technology. The Indus Basin is the largest irrigation system in the world, watering more than 11 million hectares. Another 5 million hectares are watered by tube wells or from smaller run-of-river or flood systems. The tremendous resource of the Indus Basin is imperiled by lack of drainage and misuse of water; a half million hectares of the canal-commanded area are waterlogged and another 3.2 million hectares are saline.

The tradition of agricultural science was well established in undivided India, but none of the national research institutes extant at independence in 1947 were located within the current boundaries of Pakistan; however, when MART was authorized, the research establishment included 65 research institutes and more than 160 stations, substations, centers and laboratories. There are three autonomous agricultural universities, three agricultural colleges, and a veterinary college, as well as technical training institutes.

The national agricultural research system is an open alliance of national and state institutions, not unlike that of

the United States. Pakistan is a federation of provinces, which have significant constitutional responsibilities and authorities, including those for agriculture. The Pakistan Agricultural Research Council (PARC) was reconstituted as an autonomous federal body in 1978, to undertake, aid, promote and coordinate agricultural research. This is a vital role, but one that must be exercised by leadership, since the agricultural research organizations and universities in each of the four provinces are independent of direct federal control. PARC does exercise dominion over NARC (National Agricultural Research Center), which it is building into a national center of excellence in agricultural research, as well as over several other specialized institutes and centers. However, the bulk of research and education infrastructure and staff are within the provincial structure.

U.S. assistance to Pakistan's research system began in 1969. The Agricultural Research Project continued for 16 years, ending in 1985, the same year in which major MART implementation began. This assistance saw the creation of PARC in the mid-seventies and its reconstitution as an autonomous body. It provided support for PARC and for the initiation of NARC. In 1984, the World Bank's Agricultural Research Project (ARP-I) came on stream, a \$24 million project that provided funds to construct PARC headquarters, NARC institutes of animal husbandry and farm machinery, a sizeable amount of international training, and \$5 million for contract research in the provinces. MART, which was authorized in 1984 but began in 1985, was designed to build on the prior USAID experience and complement the World Bank effort. A second World Bank project (ARP-II) is being planned to overlap with MART.

B. Project Description

1. Project Purpose

The project purpose is "to strengthen the performance of the national agricultural research system to generate and disseminate quality and relevant agricultural technologies to the farmers of Pakistan."

Funds provided by AID are being used to procure technical advisory assistance, training, commodities and construction services, and support field studies and demonstrations required to:

- o Increase the capacity at national and provincial levels to plan, manage, and evaluate Pakistan's agricultural research needs and priorities;

- o Strengthen the capability within the agricultural research network to manage, account for, and utilize financial resources;
- o Strengthen the operational linkages between federal and provincial research organizations and among the agricultural universities and research and extension personnel;
- o Establish long-term institutional linkages between the Pakistani national agricultural research network and selected regional and international research centers;
- o Establish a critical mass of research skills and managerial talent within the national agricultural research network;
- o Institutionalize a multi-disciplinary farming systems research program;
- o Institutionalize the capacity within the national agricultural research network to produce and disseminate new technologies responsive to the needs of client groups (farmers, agro-industry, extension, agricultural educators, research scientists, planners, and policy-makers);
- o Expand in-service training capacity at the federal and provincial levels;
- o Improve the capacity of the Arid Zone Research Institute (AZRI) to plan and carry out effective research on agricultural problems applicable to the arid and high altitude areas of Baluchistan and similar areas of Pakistan;
- o Improve the research capability for wheat and maize with expanded outreach;
- o Strengthen selected commodity research programs to enable them to generate relevant technological packages; and
- o Develop and implement mechanisms to increase the participation of the Pakistani private agribusiness sector in the identification, conduct, and dissemination of research.

2. Project Components

The project consists of five components.

a. Research Management and Administration

This component seeks to attack significant research management deficiencies identified by the evaluation of an earlier project: diffusion of research organizations; uneven distribution of resources; lack of research prioritization; irrational allocation of and inadequate accounting for resources; inadequate inter-agency linkages; major gaps in research programs; and poorly trained managers. A programmed emphasis on systems analyses to define problems and design interventions to improve management was dropped as impractical. Remaining activities include individual research management interventions in the form of special studies and long- and short-term advisory services; farming systems research interventions; bookkeeping, accounts and management information systems; and research-outreach integration.

b. Information Transfer

The objectives of this component are (1) to make research results more readily available to the general public and potential end users; and (2) to disseminate information in ways that respond to the needs of client groups. This component provided technical assistance, training in the production and dissemination of media and target-oriented technical information packages, and the construction and equipping of a Multi-media Production Center on the NARC campus.

c. Training

This component was designed to improve the capacity of the agricultural research community in Pakistan to: (a) identify personnel needs; (b) define appropriate education and skill development programs to meet those needs; and (c) develop and institutionalize in-service, in-country career development courses for existing and new personnel. Interventions contemplated include: (a) a personnel needs assessment and preparation of a long-term training plan; (b) training of training facility staff for NARC and the provinces; (c) physical expansion of the NARC training facility; (d) development and initial implementation of in-country training courses; and (e) development of guidelines for participant selection, pre-departure preparation, and academic supervision of overseas degree and non-degree training programs.

d. Arid Zone Research

This component addresses the substantial gap that exists in agricultural research for the arid high altitude zones and strengthens AZRI's capability to generate and disseminate technologies to increase agricultural production in dry areas. It finances expatriate research scientists to work with Pakistani scientists at AZRI, the provincial Agricultural Research Institute, and the provincial extension services; the conduct of research; and training programs at AZRI and the provincial training facility in research methodologies, mixed farming, and on-farm research. Specific research activities contemplated include: (a) adaptation trials of cereal grains, legumes, forage, and pasture species; (b) demonstrations and verification studies on farmers fields of high yielding experimental technologies; (c) special studies, e.g., range and livestock management, mixed farming, animal nutrition, and livestock marketing.

e. Wheat and Maize Coordinated Programs

This component is designed to help close the gap between farm-demonstrated production potential and average farm yields. It supports the following research and outreach activities: (a) continuation of efforts to produce high-yielding varieties that are adapted to Pakistani conditions; (b) the development of a detailed agro-ecological analysis to identify wheat and maize production zones; (c) the establishment of larger, more accessible on-farm research and verification areas in representative locations; (d) the increased use of farming systems research methods to ensure that new technologies are generated and extended in ways that maximize their chances of adoption by farmers.

3. Project Resources

U.S. financing of MART was authorized at \$30 million, to be incrementally funded. To date, \$25 million have been obligated, with the remainder expected in FY1989. This was budgeted in the PP/PC-1 by component and objective class (table 1).

Additional funding for equipment was provided by the Strengthening Agricultural Research Project, which terminated in 1985 (\$0.2 million) and Agricultural Commodities and Equipment (\$4.8 million). Some \$1,360,000 is to be provided for international training under the Agricultural Sector Support Project, raising total expected USAID support for MART objectives to \$36,360,000.

MART was authorized on April 17, 1984 (table 2). The project grant agreement was signed August 9, 1984, and the first

Table 1. Summary of AID Contribution to the Project
by Expense Category and Project Component

(In US \$ 000)

COMPLEMENT Expense Category	a/					PROJECT	
	b/ RMA	IT	TRAN	AZR	WMCP	Total	
Technical Assistance 11,765	4,133		1,105	1,010	3,419	2,098	
Training 9,317	5,183		963	985	1,215	971	
Commodities 2,933	642		920	435	380	556	
Construction 1,660	-		432	1,228	-	-	
Studies	600		-	-	401	299	1,300
Evaluation	150		37	38	37	38	300
Sub-total	10,708		3,457	3,696	5,452	3,962	27,275
Contingency (10%)	1,070		345	369	545	396	2,725
TOTAL	11,778		3,802	4,065	5,997	4,358	30,000

KEY:

RMA = Research Management and Administration

IT= Information Transfer

TRAN = Training for the Agricultural Research Network

AZR = Arid Zone Research

WMCP= Wheat and Maize Coordinated Programs

a/Inflation = 5 percent for all FX costs; 12 percent for local construction costs; and , 10 percent for all other local costs, all compounded annually.

b/ Does not include: (i) approximately \$2.5 million under the Agricultural Commodities and Equipment Program (391-0468) for the importation of agricultural research commodities and equipment in support of RMA (\$1.5 million), TRAN (\$250,000), AZR (\$600,000) and WMCP (\$150,000) components; and, (ii) approximately \$750,000 worth of technical advisory assistance from ICARDA (about \$550,000 for the AZR component) and CIMMYT (about \$200,000 for the WMCP component) from their core budgets.

condition precedent to disbursement was met on September 10, 1984, allowing the CIMMYT contract to be signed. The PC-1 was approved on January 24, 1985. The PACD (project assistance completion date) was extended to September 30, 1990 by project implementation letter. The third amendment to the project agreement extended the PACD to September 30, 1991.

TABLE 2. PROJECT CHRONOLOGY

17 Apr 1984	391-0489/MART authorized (5 years and \$30 million)
09 Aug 1984	Project Grant Agreement (Pro Ag) 84-17 signed
10 Sep 1984	First Condition Precedent met. PIL #1 issued.
01 Oct 1984	CIMMYT contract effective 1 Oct 84
	Amendment #1 Jan 85 (minor)
	Amendment #2 08 Feb 87 (minor)
	Amendment #3 14 Jun 87 continues project activities to Aug 90; revises LOE, no additional funding
24 Jan 1985	PC-1 approved
13 Feb 1985	First ProAg Amendment (minor)
Mar 1985	Vehicle order placed for Aug 85 delivery
1 May 1985	ICARDA contract effective 1 May 85 - 30 Nov 89
	Amendment #1 25 Jun 85 (minor)
	Amendment #2 16 Jul 85 (minor)
	Amendment #3 12 Jan 87 (minor)
	Amendment #4 01 Dec 87 revises budget
	Amendment #5 27 Jan 88 increases to \$1 917 164
	Amendment #6 31 Oct 88 increases to \$2 917 164
28 May 1985	PIL #4 extends PACD from 30 Sep 89 to 30 Sep 90
30 Jun 1985	391-0296/Agricultural Research ended
17 Nov 1985	PIL #7 extends 4.2 completion date and CP is met
10 Mar 1986	Winrock contract effective 1 Apr 86 to 30 Sep 90
	Amendment #1 31 Jul 86 (minor)
	Amendment #2 07 Oct 87 (minor)
	Amendment #3 11 Jan 89 revises LOE
26 Jun 1986	Second ProAg Amendment (minor)
04 May 1988	Third ProAg Amendment. PACD extended to 30 Sep 91.

a. Technical Assistance

Technical assistance, which was budgeted at \$11,765,000, finances three contracts: Winrock International (\$4,455,777); ICARDA (\$4,467,579); and CIMMYT (\$1,873,678 plus Rs.28,194,206 = equivalent of \$1,524,000 at Rs18.5 = \$1.00).

(1) Winrock International

The Winrock International contract is a cost-reimbursable USAID contract that is now fully funded for the period April 1, 1986 to March 30, 1991. A protest by a competing firm postponed USAID award of this contract, which was signed 14 months after the PC-1 was approved, delaying initiation of advisory services for components for which Winrock is responsible, i.e., research management and administration, information transfer, and training.

This contract finances 5 long-term advisors and 218 person-months of short-term consultants. The original five-person contract team included the research management advisor (chief of party), a training advisor, an information transfer advisor, a farming systems research advisor, and a provincial research advisor. All but the COP were budgeted for three years, the COP for four. After the training advisor resigned, the contract was revised to add a second provincial research advisor for two years, within the same total level of effort, including the unused time for the training advisor and some of the short-term consultants.

The scope of work of this contract reflects in complexity the PP/PC-1. It has not been modified in any way to reflect the Winrock proposal nor the reduced level of effort. As such, it provides no reliable guidance to the contractor nor a rational basis for evaluating contractor performance. This problem is remedied satisfactorily by the contractor's submission of work plans and their approval by USAID and PARC.

With the exception of the training advisor, who resigned at the end of his second year, the Winrock advisors are well-matched to their assignments, with personal competence, performance, and personalities well above the average of expatriate advisors. Their individual contracts will expire before the MART PACD, but the need for their services will not. Their individual contracts should be extended, and this will require a contract amendment and additional funding.

Winrock contract finds, funds and oversees the work of short-term specialists recruited to provide advice to PARC, NARC, and other national and provincial research institutes. The terms of reference of these specialists are individually agreed upon with PARC and the beneficiary institutions. Winrock follows up

on the disposition of their recommendations. These specialists are the main input to the research management component and are critical to its success. All 23 consultants used (table 3) were qualified for their assignment; many are leaders in their fields, and some are truly outstanding. PARC and other beneficiaries study their recommendations very carefully, but actual implementation has been slow.

TABLE 3. CONSULTATION SERVICES

Destination	Number of Consultants			Person-Weeks
	Mgmt	Tech	Total	
PARC/NARC	4	8	12	60
CIMMYT	1	5	6	22
AZRI	1	4	5	45
Federal/ Provincial	11	14	25	101
Punjab	2	5	7	23
Sind	1	-	1	7
Total	20	37	57	258
Percent	35	65	100	

(2) CIMMYT

CIMMYT provided continuous advisory services to the coordinated wheat and maize programs for many years before MART and helped to develop the professional capacity of scientists engaged in these programs. CIMMYT also supplies considerable technical assistance and training from its core budget, in addition to that provided under this contract.

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

The contract was amended in 1987 to terminate the three original specialists, since Pakistani scientists were competent to continue the work unaided. This amendment also extended the contract to August 1990, CIMMYT providing a full-time resident economist to work with PARC primarily on wheat and maize economics. The no-cost amendment provides for up to 12 person-months of short-term advisors, as well as in-service training for 12 scientists at CIMMYT/Mexico.

CIMMYT advisors performed satisfactorily under both phases of this contract. Continued assistance of the agricultural economist is certainly desirable, particularly for attention to the significant gap between yields obtained by the better farmers and the national average yields. His services are also needed in the complementary area of farming systems research involving wheat and maize.

(3) ICARDA

ICARDA provides advisory services to AZRI in arid zone research, under a cost-reimbursable contract funded by MART. Four long-term advisors in germplasm, agronomy, range management/livestock and extension are located at AZRI headquarters in Quetta. The agricultural economist (farming systems specialist) serving a 48-month assignment, resigned in August 1988 after 24 months.

Performance under this contract appears to be less positive than under the others, at least in part because of the weakness of the original research base and the limited availability and competence of counterparts, especially in farming systems research and extension. ICARDA staff has assumed a leading responsibility in the planning and performance of research, in cooperation with the director and deputy director of AZRI and the PARC Member, Natural Resources. This has enabled the completion of some good, publishable research. AZRI research is directed at too many subsectors, and involves too many variables at too many sites for effective management by a limited and inexperienced staff. This situation should improve when national staff under long-term training return. One local scientist who obtained a Ph.D. in range management and animal husbandry recently rejoined AZRI. A second will return in September 1989.

USAID and PARC have held discussions recently with ICARDA on a refocusing of efforts, which we endorse. Simply put, we suggest a concentration on range and livestock, and on water harvesting and soil management. Three long-term specialists are needed: a range management specialist, an agricultural economist with farming systems experience, and a soils specialist, provided the last has field research experience in crop and soil management. These three need short-term specialist back-up,

particularly in water spreading engineering, animal nutrition, and anthropology. One of these three specialists is on board, performing well, and should be retained if at all possible. Experience is particularly valuable in a situation where little reliable data exists and its interpretation must be made on the basis of anecdotal information and personal knowledge.

b. Training

The second largest component (\$9,317,000) of the MART budget was to provide international participant training (degree and non-degree) and in-country organized short course training. As of September 30, 1989, 87 percent of this budget had been expended, leaving a balance of \$1,223,000. Additional long-term international training to support MART is to be financed (\$1,360,000) under the Agricultural Sector Support Project (ASSP).

International participant training is a complex process requiring individual attention by multiple organizations to select, process, place, maintain, recover and assist in reentry of each participant. The 27 steps in the current procedure reflect that complexity, but despite complexity, this segment of the program is well ahead of schedule.

The original PP/PC-1 targets were 246 individuals, including 87 degree and 159 non-degree training slots. Degree targets were raised to 92 slots, adding a special quota of 5 for Baluchistan. To date, 61 participants are studying abroad, and 20 candidates are being processed by the Academy for Educational Development, leaving only 11 to be selected. One hundred forty (140) have gone abroad for short-term training, leaving only 24 to be programmed. This success reflects the gradual development of sound procedures for selection and processing based on experience, including publication of a "Pre-Academic Orientation Handbook," and experience in placement through the (non-MART) USAID central training contractor, the Academy for Educational Development (AED). AED's subcontract with Winrock should facilitate further the placement of MART participants.

These worthy accomplishments should not obscure major continuing issues. The complex process rejects further simplification because of the large number of institutions involved. Some provinces find it difficult to nominate candidates who are able to pass TOEFL examinations and other selection criteria. This limits the flexibility for allocation to critical technical areas. A similar intensive effort must go into maintaining contact with participants overseas and developing a reentry program for returning participants in order to maximize the utility of their training. The data base of returned participants must be maintained, and their progress

evaluated over time as a guide for balancing domestic and foreign training needs in the future.

The short-term international training should be examined for revision of content, criteria for selection, and/or improved predeparture orientation to maximize its management impact. The content of this program probably needs revision and/or improved predeparture orientation.

Seventy in-country training courses have been attended by 2119 participants against a target of 205 courses and 4705 participants. Most of these have focused on technical material, or at most, management of experiments, rather than on management of organizations, supervision, evaluation, or the like. This orientation should be revised to emphasize these other types of management. There have been nine FSR training courses or travelling seminars, and travelling seminars on other subjects. There have been no identified sabbaticals, but there has been support for attendance at conferences.

c. Commodities

The MART PP, annex A, provides an illustrative list of commodities from MART (\$2,933,000) and ACE (\$2,500,000), which includes vehicles, audiovisual equipment, household equipment, and field and laboratory equipment, broken down by project components. The MART commodity component was to fund computers, vehicles, audiovisual equipment and furniture. ACE obligations for agricultural laboratory and field equipment were raised to \$5 million, of which some \$4 million was to be for provincial institutions and \$0.8 million was for PARC/NARC.

In addition to the commodities procured under three technical assistance contracts to support those contracts, MART commodities included vehicles (\$362,500), audiovisual equipment (\$219,021), and computers and software (\$288,557). Laboratory equipment and agricultural machinery worth \$490,518 were procured under the MART Project from ACE (Agricultural Commodities and Equipment Project) for AZRI, with guidance in selection from ICARDA. All of these procurements appear to have been executed without difficulty.

In a separate procurement, laboratory and field equipment valued at \$3.8 million was supplied to various federal and provincial research institutions under the MART project from ACE, in order to strengthen the research capabilities of those institutions. The evaluation team received complaints about the procurement of laboratory and field equipment from every regional institution visited. PARC had been given responsibility for this

procurement. We therefore investigated the procurement process to see if we could identify problems and remedies to prevent future problems. The procedures were as follows.

- o A two-man USDA team was provided by USAID under MART funding to analyze the needs of provincial agricultural research institutions and make recommendations for laboratory and field equipment that would improve research capabilities. This effort was unreasonably rushed. With little advance warning, the team visited 13 provincial and federal institutions in 16 days, noting physical facilities, discussing programs, and receiving lists of equipment needs from 99 departments. They recommended a list of acquisitions by institution, which was a synthesis of their judgments, "factoring in their considerations of real need, implied capability of personnel..., amount of equipment and observed care of equipment on hand, availability of funds and their proportional distribution among provinces." They also provided equipment specifications.
- o PARC referred these back to the individual institutions with a form to be filled out and signed by the institution. The form required equipment specifications (as provided by the consultants), the number required and their priority, relevance to current research, the availability of similar equipment, the scientists who would be responsible, with their qualifications, any training needs, laboratory space availability, and remarks. This prioritization process, in which excessive requests were adjusted to reflect funding availability, appears to be part of the problem. Although a special committee of NARC scientists reviewed and prioritized the lists, and lengthy additional consultations were held with the user institutions, many end users deny involvement in the process.
- o The returned forms became the basis of an IFB (Information For Bid) which was advertised in the U.S. Commerce Business Daily.
- o Bids were received in Islamabad, evaluated jointly by PARC and USAID, and a procurement contract awarded with orders placed with U.S. suppliers per stipulation. The PARC procurement officer visited some (not all) suppliers and spot-verified the shipment, obtaining some adjustments at the source.
- o The shipments were received in Karachi and placed in the USAID Liaison Office warehouse. They were opened, and individual items were uncrated and inspected by representatives of PARC, USAID, the insurer, and the local

representative (if available) of the supplier, all of whom signed the receipt.

- o Prior to repacking, a representative of the secretary of agriculture of each province inspected the equipment, which was then repacked and shipped at USAID expense to the secretary's designate who signed for receipt and made distribution to the end user.

Following complaints about missing equipment and accessories and other inadequacies, Techno-Consult was contracted by USAID to inspect the equipment and recommend remedies. We reviewed a draft of their report, which is summarized below.

	NWFP	Punjab	Sind	Baluchistan	Total
Recipients	3	3	3	2	11
Sanctioned by AID	94	440	408	? /4	
Transferred	133 /2	330 /2	413 /2	402	1278
Undistributed*	117 /1	-	-	-	117
Distributed*	16	330	413	402	1161
In Use*	6	208	277 /3	349 /5	840
Not in Use*	10	122	88	44	264

*Determined by physical inspection

1/Stored at CCRI Pirsabak

2/Discrepancies unexplained

3/48 items could not be inspected physically

4/Number sanctioned for AZRI unknown

5/9 items could not be inspected physically

Some 1278 pieces of equipment were verified as acquired and transferred to 11 institutions in 4 provinces. Of these, 117 remain undistributed in poor storage at CCRI, Pirsabak. The remaining 1161 units were distributed among 11 institutions. Of these, the condition of 1104 (95 percent of those distributed) was verified physically. Seventy-six (76) percent of the items inspected (840) were in use and operating more or less satisfactorily. The remaining 264 items (24 percent of those inspected) were not in use. The reasons given for non-use were:

- o Item supplied without operating/maintenance manuals, hence unable to assemble, commission, or operate.
- o Item supplied without or with inappropriate essential components, accessories or supplies.
- o Item damaged or broken. No claims made against insurance and/or warranty.

- o No one trained and currently available to operate it.
- o Item meets specifications but is unsuitable or not needed or wanted.

PARC has demonstrated willingness to use its good offices to correct any deficiencies. It sought, received and distributed missing items, and it intervened with local suppliers' representatives to assemble, commission, and test equipment. It is awaiting the consultants' final report to determine what action must be taken with regard to uncommissioned items, whether this be ordering manuals, training operators, or relocating equipment.

Although some of the equipment has been damaged by misuse or poor storage, almost all of it will be commissioned and in use shortly; few, if any, items will not see useful service, although some are more complex and expensive than warranted. Examples are computer-operated atomic absorption spectrophotometers and flame photometers which are beyond both the needs and the experience of the research staff.

An unfortunate aspect of laboratory equipment procurement has been that PARC didn't get the credit it deserved for the concerted efforts made to serve the provinces in strengthening their research capability even on a preferential basis. PARC has not utilized its quota of \$0.8 million for equipment thus far. Instead the provinces remain critical, slowing the process of closer coordination between the provinces and PARC initiated under the MART project. There is need for promoting more effective two-way communication, both within the provinces and PARC. There is considerable pettiness and little initiative in many provincial institutes in correcting deficiencies. This needs looking into.

The procedures followed would have been effective for the purchase of routine stores but discounted the highly specific requirements of individual scientists for research equipment. Because of this, one of the project's main objectives--to strengthen the system's internal linkages by demonstrating in a concrete manner the coordinator's capacity to serve the provinces--was not fully achieved. In the final analysis, the administrative process overrode the consultative process and preceded the demonstration of either a link to the research or the capacity of staff to use and maintain the equipment. A more deliberate consultative process might have corrected unsuitable specifications, ascertained and offset the adequacy of training for end users and the suitability of facilities, while fixing the expectations of end users.

A lesson learned is that consultation in depth with end users is vital to assure the compatibility of the equipment with

their specific research needs, facilities, and abilities. Massive procurements that require consolidation and standardization may be unsuited to this process.

d. Other Costs

Other costs in the amount of \$4,292,000 were budgeted by MART to finance farming systems research interventions; construction; and other minor project-related activities. As of September 30, 1988, 52 percent had been expended, leaving a balance of \$2,061,000, much of which would be used in the construction of cafeteria and housing facilities at NARC, now in the design stage.

Farming systems research interventions so far have been established in nine target areas (four in Punjab, two in Sind and one each in Baluchistan and NWFP), each involving four to five villages with variable numbers of farmers and participation of scientists from NARC, universities, provincial ARIs, and agricultural extension services. Construction of gas lines to housing at AZRI is complete. The Audiovisual Centre and Training Institute (AVCTI) building is under construction and on schedule. The design contract for the NARC cafeteria and scientist housing is about to be let. All construction should be completed well before the PACD.

SECTION II

PROJECT ASSESSMENT

A. Component Assessment

1. Research Management and Administration Component

a. Descriptive Summary

(1) Project Objectives

The MART project objectives are to improve the management and administration of agricultural research throughout Pakistan, with the assistance of both long-term and short-term expatriate and Pakistani consultants. PARC is to assume the lead role for implementing and evaluating recommended interventions.

(2) Problems to be Addressed

- o The existence of many research organizations whose activities often are compartmentalized and overlapping.
- o Uneven distribution of resources.
- o Inadequate concern for establishing research priorities, systematic planning or proper research methodology.
- o Inadequate accounting procedures and methods for ensuring proper utilization of research resources.

(3) End of Project Status

In the PP/PC-1 documents, the following conditions were listed as demonstrations that MART had achieved the project purpose:

- o Operational linkages have been strengthened between federal and provincial research organizations, agricultural universities and extension agencies.
- o There is increased capacity at the national and provincial levels to plan, manage and evaluate Pakistan's agricultural research needs and priorities.
- o Strengthened capability exists in the management, accountability and utilization of financial resources within the national agricultural research network.

- o Mechanisms have been identified and are being implemented to increase the participation of the Pakistani private agribusiness sector in the identification, conduct, and dissemination of research.

b. Performance To Date

(1) Advisers

MART has provided a senior consultant of international standing as a long-term adviser at PARC headquarters. He sits with the council and with some of its senior committees. A full-time consultant based in Lahore advises the provincial research institutes and the agricultural universities.

(2) Consultants

MART has brought in a series of international consultants to study and recommend solutions for research management problems in both federal and provincial structures.

(3) Research Organization

Capital from USAID, the World Bank and other donors has created at NARC an excellent infrastructure for research, which PARC aims to develop as an institutional model for the provinces. The center had outgrown its earlier form of organization and needed restructuring. PARC initiated and supported a review by a team of one expatriate and four national consultants under the chairmanship of Dr. G.M. Khattak, vice-chancellor of Peshawar University. The Khattak report proposed a drastic revision of the organization of NARC, which had previously been under the operational control of PARC. A full-time director general with two full-time deputies, for research and administration respectively, were recommended (April 1988).

The recommendations were accepted; a full-time director general and a full-time deputy director general are now in post at NARC. A substantial reorganization of departments, which will be carried out when the deputy director general (Research) is appointed will involve the designated leaders of some 60 programs. This report when implemented will make a major contribution to the progress of NARC towards the status of a model research institute.

(4) Civil Works Planning

MART has provided an architectural planning consultant to produce a civil works plan for the physical structures of NARC. He has assisted with detailed planning of an

audiovisual training and production studio, together with operational facilities for farming experiments. The civil works master plan has required forward planning of future developments and will avoid ad-hoc constructions on a campus that now provides first-class research accommodations.

(5) Preparation of Research Master Plan

A draft for the research master plan was produced in November 1988: it is at present under discussion. The plan is based on a 10-year forward look and although it will undoubtedly be revised within this period, it represents a major advance in research management. The "bottoms up" participative enterprise of preparing this plan involved large numbers of scientists (about 200) in planning research, setting priorities and allocating resources. The planning process also involved a MART resident adviser and two senior consultants whose interventions helped focus attention on priorities within funding probabilities. The priorities were set by NARC scientists. The proposals are theirs.

Although it is forward looking, the plan is based on the views of operating scientists. Inevitably it tends to reflect priorities within current program areas rather than other problems or national goals. For example, it is somewhat anomalous that the nine objectives do not include an attack on the nation's major agricultural problem, which is the increasing loss of alluvial land commanded by canals, of which 6.6 million acres are already out of use because of salinity and waterlogging. Twenty years of well-funded engineering studies by WAPDA and other institutions have failed even to arrest the deterioration, because they have ignored agricultural management of water use. PARC is supporting small-scale efforts by IIMI and other organizations in the Punjab to address the problem, but the scale of effort is critically inadequate.

The draft master plan contains forecasts of budgets for the departments, but the relative allocation of resources to subjects is not readily seen because there is no summary table. Hopefully, the deficiencies pointed out will be effectively addressed before the master plan is finalized.

(6) Provincial Planning of Research

Baluchistan Province has expressed a desire to undertake a provincial master plan for research. Three scientists from the province have attended discussions on the NARC master plan and have been given some training in the methods of planning. The government of Punjab is preparing a provincial master plan for agricultural research in response to directions

from the National Commission on Agriculture. The government of Sind has recently expressed interest in starting the process in their province.

(7) National Coordinated Research Programs

A most important source of influence is the organization by PARC of the National Coordinated Research Programmes. MART undertook a review by a leading international research consultant, who made important recommendations for strengthening these programs, which include wheat (+ barley and triticale); maize (+ sorghum and millet); rice; oilseeds; pulses and feed legumes; fruits and vegetables; fodder and forage; sugarcane; cattle cross-breeding; reproduction in buffalo; sheep and goats; honey bees; livestock nutrition. They therefore cover all major crops except cotton, which is served by the Pakistan Central Cotton Committee.

In the initial plans to enable PARC to improve the national standards of agricultural research, a major source of influence was the flow of US-owned PL-480 funds (USDA/FERRO) supplemented by Federal grants, channeled through PARC to the provinces for contract research. The FERRO funds are now drying up while federal funding is under pressure. This problem now seems to be coming under control through authorization by GOP of a Rs.10 million replenishable fund for research contracted to provincial institutions.

(8) Management of Financial Resources

In accordance with project guidelines, the initial focus has been on PARC and NARC. An agency of computer consultants was sub-contracted by MART to computerize a system of double-entry bookkeeping, which had been devised for PARC by a company of chartered accountants. MART has provided and installed networked micro-computers with four work stations; programs for project accounting and for overall financial accounting have been set up and are under test. These systems will shortly be operational. The computer system was designed to provide a comprehensive data base to supply PARC management with an information service to support financial decisions. If funds are available, further workstations are requested to provide information services to senior PARC management. There are encouraging prospects of a quantum jump in the efficiency of accounting and financial flow through the PARC system as soon as the staff become familiar with computerized operations.

In the provinces, the long-term advisor on research operations and support has initiated local studies of financial administration but the scope of the task is formidable.

The Project Paper refers to the findings of previous review missions that "the lack of timely availability of federal GOP funds budgeted for research activities is a key constraint to effective research management." Study by a short-term consultant was proposed. This, however, is not possible without the cooperation of the federal Ministry of Finance. No progress has yet been made with this study.

(9) Participation of the Private Sector in Agricultural Research

MART engaged a national consultant who made a survey of some 480 firms engaged in a wide range of commercial activities in the agricultural sector. Although all have some technical staff engaged in sales or servicing, only 45 replied with details of any form of research. The consultant concluded that some Rs.40 million or \$2 million are spent annually, involving the employment of 16 Ph.D., 20 M.Sc. and 240 B.Sc. staff. The project paper proposes a detailed program to mobilize these small and widely scattered activities on the assumption that they could provide a strong reinforcement to public sector research. The survey shows that there is little sign of research but only selection and field testing of a pragmatic nature over such a disparate range of subjects that such an assumption is unfounded.

(10) Winrock International

The terms of reference (scope of work) accepted by Winrock appears extremely optimistic to those who are familiar with the cultural and political stresses of Pakistan and its hierarchical administrative system. All sectors of the agricultural research community, federal, provincial or university, readily accept from MART the generous grants of new equipment, but there is reluctance to reorganize research management to improve research standards. The traditional criteria for promotion by seniority still prevails, except in PARC, which is showing a good example by using its autonomy to promote on the basis of merit.

Overseas consultants appear to have been well selected and well supported. They have given sound advice, but the implementation is slow and ad hoc. The work of the provincial research organization and support specialist in following up implementation has been strenuous, but, inevitably, there has been only partial attainment of visible results. Winrock's training adviser resigned after two years in the position. A recent amendment to the Winrock contract has substituted a second provincial research O&S specialist for the departed training adviser. This reinforcement is sorely needed to lessen the extreme workload of the present specialist.

The Winrock advisers, both in Islamabad and Lahore, have been accepted by PARC and by the provincial authorities. They are invited to sit with councils and senior committees. The evaluation team has heard warm appreciation of their efforts expressed by the most senior federal and provincial officials. But four advisers, all with heavy operational responsibilities and two of them with large programs to conduct, can only have limited opportunities to change deep-seated national attitudes.

The advisory team has a number of important plans for the remainder of the MART project. These include two consultants to assist the Baluchistan government in the preparation of a provincial plan for agricultural research; two consultants recently arrived to help Faisalabad University review its soils department and, hopefully, to establish links with the University of California at Davis; and short-term consultants to help the provinces in several research subjects as well as library management, instrument repair, and farm maintenance.

Other plans include a training course on evaluation and monitoring of research, including a reference handbook on methods, and a short course on research management; the completion and publication of the NARC master plan for research; assistance to Faisalabad University on preparations for computerizing its system of financial accounting; the further development at Yale University of studies on returns to investment in agricultural research in Pakistan; and assistance to the secretary for agriculture, Punjab, in plans to open an economic development center for the southern cotton belt to serve the private agribusiness sector. The provincial adviser is also using MART funding to establish links between departments of Pakistani and U.S. universities. MART is helping two small private sector seed production enterprises with seed for parent lines of hybrid fodder. Other initiatives in private sector seed production are also being nurtured.

In summary, the Winrock team has undertaken a complex and somewhat amorphous array of tasks with commendable vigor. Although it is beyond their powers to transform Pakistan's agricultural research system in the manner so optimistically described in the Project Paper, they are making effective contributions towards this objective.

(11) Farming Systems Research

One of the four full-time advisers on the Winrock team has devoted half or more of his time to developing farming systems research activities in all three universities and in all four provinces. We found that opinions among those responsible for agriculture were sharply divided on the merits of

FSR. The main concern was that of sustainability when the MART program ceases. We were concerned to discover whether a "breakthrough" was being made in the dismal story of ineffective extension systems.

As seen by the review team, the term "research" is confusing; "study" might be more appropriate; the "interventions" are demonstrations of well-established technologies available in Pakistan for some years. Good agricultural practices are contrasted with the farmers' present methods, and yields of both are measured. Following established FSR methodology, plots are unreplicated on site, but are repeated at several sites. This is sound and necessary work.

Where problems are met, it is of great value to be able to call on interested colleagues of other disciplines. Universities have obvious advantages here, since the government extension services for livestock are, unfortunately, separate from those of crops, while a third organization deals with water management. However, the FSR pattern was seen in extreme form at Tandojam, where 20 university graduates were paying frequent visits to a group of 24 farmers, travelling some 45 miles each way. The government extension service was not included. We were told that "extension is taken care of by two university specialists." The director-general of extension, Sind, contrasted the large FSR budget affecting 24 farmers with his meager resources of one junior assistant on a bicycle serving several hundred farmers. At other sites the livestock extension service was assisted by provision of transport and supplies to take part in studies of livestock feeding by ensilage of straw.

The provincial systems of agricultural research have concentrated for 30 years on field trials of varieties and fertilizers. These trials, as seen by the review team, were carried out effectively on main stations, on substations, and on adaptive research stations. The veterinary service concentrated on its primary task of treating livestock for pests and diseases.

In contrast, the FSR program seeks to highlight the problems experienced on small farms, of the interaction of crops and livestock, the control of weeds, and the need to achieve full plant populations in both sugarcane and cereals. In the serious gap between the veterinary and the crops production extension services, the FSR program focuses on what the farmer can do to improve straw fodder by ensiling with urea, and to demonstrate the result in milk yields.

FSR is, in fact, exploring for subjects of research that are not currently being undertaken by research stations. Where the needed technologies are known, they are demonstrated. Much better public relations are needed to explain this approach. The

university staff need restraint in the tendency to dress up simple observation exercises as research projects. Much better relations with government extension services are needed and the sometimes superior attitudes of university staff towards these services needs sharp correction.

It is our opinion that FSR activities would end if funds were withdrawn, but a further extension is justified. It should, however, be well within Pakistan's capability to operate with periodic help. We suggest that the present adviser might continue to visit once or twice a year after the end of the MART PACD.

2. Information Transfer

a. Descriptive Summary from PP/PC-1

(1) Purpose

The purposes of the information transfer component are to:

- o Make research results more readily available to the general public and potential end-users; and
- o Disseminate the information in ways that respond to the needs of client groups and ensure that the information will be properly and effectively utilized.

This component assumes that a considerable amount of improved technology has been generated and must now be packaged and disseminated to appropriate client groups in a form that is most useful to them. The client groups include members of the research community, GOP policy-makers, agricultural universities, agro-industries, extension services, farmers, and the general public.

(2) End of Project Status

Only one end-of-project status indicator is included in PP/PC-1:

Capacity institutionalized within the national agricultural research network to produce and disseminate new technologies in a form and manner that responds to the needs of client groups.

(3) Component Outputs

- o A fully equipped and staffed multi-media production studio at the NARC.

- o At least 450 individuals trained in-country and 9 individuals trained in degree programs overseas in communications.
- o A Technical Information Transfer Committee established and institutionalized.
- o At least 100 video documentaries, recordings, media campaigns, and other technical information packages produced and distributed to target audiences.

(4) Component Activities

Two categories of activity are included.

- o Production Studio--Design, construct, and equip a facility that can be used as a multi-media production center (in the same building as the addition to the training facilities).
- o Information Packages--Thirty personnel will be recruited and trained to produce multi-media packages for various client groups. This activity will also involve procuring additional equipment and reference materials for the multi-media research library.

(5) Project Inputs

Implementation of this component will involve the Science Information Directorate of PARC and close work with the PARC's Technology Transfer Division and the staff of the new Multi-Media Production Center at NARC.

The PP/PC-1 lists the following inputs to be provided by USAID:

- o Thirty-six (36) person/months for a long-term information transfer specialist.
- o Approximately 26 person/months of short-term technical assistance.
- o Funds for architectural design and construction of the Multi-Media Production Center and the equipment and commodities required to make the facilities operational.
- o Nine graduate study fellowships in the United States.
- o Five in-country training courses each year for a total of 450 people trained in scientific presentations and documentaries, mass media production, and multi-media productions for target audiences.

GOP will provide:

- o Thirty (30) additional staff (17 professionals and 13 support personnel) for the Multi-Media Production Center.
- o Costs for the land for the Multi-Media Production Center and the operating and maintenance costs for the facility.

b. Performance To Date

Information transfer may be the most straightforward of any of the MART components, and therefore the easiest to manage and to evaluate. The overall assessment is that this component is one of the most successful in the project. While the Multi-Media Center is not fully operating--construction is not complete nor is staffing at full levels--the delivery levels are on schedule.

(1) Inputs To Date

The following is a summary of the inputs for this component provided to date by USAID:

- o Long-term information transfer advisor, Dr. J. Cordel Hatch, arrived on July 1986.
- o More than 3 months of TDY time has been provided, approximately 2 months for the architect and more than 1.5 years for local AV consultant.
- o No overseas graduate fellowships have occurred.
- o Construction of the AVCTI building is under way and on schedule.

The following is a summary of the inputs provided by GOP:

- o Four additional staff for the Multi-Media Production Center.
- o Land has been made available for construction of the AVCTI, which is in progress.

(2) Accomplishments/Outputs To Date

This section summarizes the accomplishments to date compared to the outputs (subsection a(3) above) and activities (subsection a(4)):

- o Construction of the AVCTI facility is under way and is scheduled to be completed in February 1990. Some equipment has been procured with the remaining to be purchased when the building is completed. The facility appears to be well designed and the construction of high quality.
- o A director of the Multi-Media Production Center and three staff have been recruited and a considerable amount of training and team building has taken place. The director has a Ph.D. in communications, but little practical experience.
- o At least 9 in-country short-courses for 243 persons have been conducted. The reports on these courses are very positive, from people both at the federal and provincial levels.
- o The Technical Information Transfer Committee has been established and has conducted several meetings. This appears to be a positive step in bringing together federal and provincial communications officers to share information. While much more is needed in establishing collaboration between these units, this is a very positive activity.
- o At least six slide and video packages have been produced as well as numerous other materials as part of the staff training activities and for ad hoc purposes.
- o Assistance to the research libraries has been provided by the information transfer advisor and an outside consultant. It has been very well received and appears to be extremely important for facilitating the flow of information among scientists within Pakistan and with technical information sources overseas.
- o A considerable amount of other assistance related to information transfer has been provided to PARC, NARC, provincial research institutes, universities and other groups, which will lead to better understanding of the role of communications programs in the technology system and will raise the communications skills of a wide variety of people in the research system. Much has also been done to clarify policy issues related to information transfer in the research network and the role of the library and information resources program, publications, the Multi-Media Production Center, training, and public affairs.

(3) Constraints to Implementation

There have been some delays in various activities of this component, but only three problems warrant comment here:

- o Recruitment of Staff--This has been a major and serious problem that will become more critical as the Multi-Media Production building nears completion. At the current time there is a freeze on hiring new personnel. A problem with the level of professional positions, implied in the PC-1, has led to inability to attract good candidates. Some of the positions are in direct competition with Pakistan TV and the private sector, which can offer higher salaries, status, and better career opportunities. This problem needs to be resolved as soon as possible in order to proceed with training of staff and development of a viable program before the information transfer advisor completes his assignment.
- o Overseas Training--Restrictions on sending individuals overseas for degree or non-degree training will cause a long-term problem. There are very few professionally trained communications specialists in Pakistan who also have a background and understanding of agriculture. The main reason for not sending people for this type of training is that they have not been recruited. Even then, there is a rule that they must be on the job for a period of time before they are eligible for overseas training.
- o Production of Audiovisual Materials--When the actual output of communications media packages is compared with the number specified in the PP/PC-1, there appears to be a major problem. However, the reason for delays is the sequencing of building construction, equipping the AVCTI, and acquiring and training staff before production of materials. This item should not have been included as an output of the PP/PC-1. The project provides the means (equipment, materials, facilities) and training of personnel to do the job. In this regard, it clearly appears that MART is making good progress. However, the media packages can't be produced because of sequencing within the original, and probably within the extended, PACD.

c. Recommendations

(1) Suggested Modifications--Current Phase

The overall assessment is that this component is on track. Therefore, the following suggestions are intended to help improve an already good program. There are a number

activities needed before the new Multi-Media Center is fully operational and the other information transfer programs are making major contributions to Pakistan's agricultural research network.

- o Information Transfer Advisor--This advisor's contract should be extended at least through June 1990 and possibly through December 1990. He is scheduled to leave before the Multi-Media Production facility is finished, equipment is installed, and staffing is complete. Immediate action is needed as the advisor must begin now to seek alternative employment if his current contract is not extended.
- o Staff Recruiting--This issue must be resolved quickly so that it does not become a constraint. One possibility is to institute a system of secondment of provincial agricultural information workers to NARC. This could be done for all areas related to information transfer, including publications, library, audiovisual, etc. for periods of two or more years, and could include overseas training as an incentive. This could make additional personnel available for NARC quickly and in the long run, it would encourage closer working relationships among agricultural communications workers at the federal and provincial levels.
- o Overseas Training--Five to nine individuals should be identified as soon as possible for M.S. degree training and short-term professional development courses in agricultural communications and related fields.
- o Agricultural Information/Communications Inventory--Work has been started, on identifying people at the federal and provincial levels who are working in various aspects of agricultural information. It is recommended that this become a formal activity of the MART information transfer component and that a computerized data base be established.
- o Provincial Communications Programs--There is great variation in the communications programs and capabilities among the provinces. The evaluation team talked with some of the provincial communications workers (publication editors, audiovisual specialists, librarians, etc.) who commented positively about the Technical Information Transfer Committee. However, it does not appear that the deliberations and concerns of that committee are being shared very widely among professional agricultural workers in the provinces. Specifically, provincial leaders and

communications workers must be advised that this component of MART was not intended to provide major inputs to the provincial institutions.

There is an urgent need to build a network of communications programs for supporting the research system which would involve building some capabilities among the major provincial research institutes and in the universities. Work has begun on building this network through the efforts of the TITC and other activities. A systematic analysis of the material and training needs of the various provincial communications programs (including library, publications and printing, etc.) should be finalized in time for including any needed assistance in an extension or new phase of the MART project.

- o Data Base Compatibility--There is a potential problem with the compatibility of computer programs for the bibliographic data base used by UAF and the one being established by the NARC and NWFP agricultural university libraries.

(2) Longer-Term Issues to Address

The evaluation team is concerned that the information transfer component of MART, as specified in the PP/PC-1, is too narrow. The primary focus is on creating an audiovisual media facility and program. While this area is important, and should exist in the research network, it is not the primary means through which scientists transmit and receive technical information, which is through printed media and computerized data bases and media such as microfiche. Since the audiovisual media capabilities did not exist in PARC/NARC, emphasis on this area was put into the MART project. Care is needed to ensure that over the long run there is a balanced focus on all the information transfer programs and their integration into a comprehensive information transfer program for the research network.

It was suggested earlier that a general review of the information transfer program begin during the current phase of MART, to provide the basis for more broadly based support in the future. This review should look into the following functions of information transfer:

- o Links with the world body of knowledge available through various information data bases, research institutions, universities, etc.
- o Service as a clearing house for Pakistani scientists for technical information received outside as well as inside the country.

- o Preparation of instructional materials for universities and training institutes at the agricultural research organizations, including textbooks, reference materials, audiovisual teaching aids, etc. Leadership in the preparation of these instructional materials must be with the universities and training institutes, with the information transfer units helping to gather the information and package it.
- o Preparation and dissemination of "packages of practices" for intermediary groups that are in contact with farmers, such as extension services, mass media, private sector/agribusinesses, primary and secondary schools, farmers associations, etc. These materials would be somewhat more simplified than those researchers use to communicate among themselves.
- o Preparation and dissemination of "extension aids" for extension workers and other field cadre to use to communicate directly with farmers. These would also include materials for the mass media to use in their programs for farmers.
- o Materials and communications activities intended to brief policy makers in government and the private sector on the research program and to enlist their support. This should be combined with a program to gather data on Pakistan's support to research as compared with other countries and international standards.
- o Information for the general public.

This broadly based program should include library and information resources activities, publications and printing, audiovisual, training (in the transfer of information to others), university instructional media units, and public information/news activities. It is recommended that these functions should in some way be represented at a senior level at PARC so that information transfer issues are considered at the policy level.

3-A. Training for the Agricultural Research Network

Project activities related to overseas participant training have been segregated in a special section on that subject (3-B). This section (3-A) focuses on strengthening the in-country training infrastructure of the research/education network and the MART concern for training researchers, technical and administrative support personnel in the research program, and managers/administrators of research organizations.

a. Descriptive Summary

(1) Purpose

To improve the capacity of the agricultural research community in Pakistan to:

- o Identify personnel needs;
- o Define appropriate education and skill development programs to meet those needs;
- o Develop and institutionalize in-service, in-country career development courses to train existing and new personnel.

(2) End of Project Status

The related end-of-project status indicator is:

Expanded in-service training capacity at the federal and provincial levels to present career development courses on a continuing basis to all levels of agricultural research, scientific support, and outreach personnel.

(3) Component Outputs

- o A personnel needs assessment for the agricultural research network over the next 10 years and a comprehensive training plan prepared;
- o At least 50 individuals from agricultural training institutions and universities trained as trainers in subjects related to (1) training needs assessment, (2) teaching methods, (3) curriculum development, and (4) training evaluation;
- o Expanded physical facilities and more staff at the NARC Training Institute;

- o Four types of in-country professional improvement programs developed and implemented for agricultural research and related personnel.

(4) Component Activities

(a) Implementation of a personnel needs assessment and preparation of a long-term training plan, including:

- o Personnel Needs Assessment. A long-term expatriate agricultural training specialist and short-term specialists will assist the PARC Training Office to conduct a comprehensive personnel needs assessment of the agricultural research network over the next 10 years for research scientists, technicians and support personnel for PARC, NARC, and all provincial agricultural research and education institutions.
- o Training Plan. Based upon the personnel needs assessment, a comprehensive training plan will be prepared. While the plan will include overseas degree and non-degree training, emphasis will be placed on in-country training, particularly at the universities and the existing training facilities at NARC and in the provinces. Funds will be provided under MART for launching this plan.

(b) Training of NARC and provincial training facility staff. Based upon an assessment of training needs for facility personnel, MART project funds were provisionally programmed for three activities:

- o Long-term graduate degrees at U.S. universities for trainers in training processes;
- o Study tours to universities, research institutions, and training facilities outside Pakistan by scientists, training officers, and administrators from agricultural universities, the provinces, and PARC/NARC;
- o Traveling seminars for the directors of the six training facilities (NARC and five provincial centers) to the National Agricultural Training Center in Thailand.

(c) Physical expansion of the NARC, specifically the NARC Training Institute, including construction and equipping of two seminar/workshop rooms, dry and wet laboratories, and three staff offices as well as a hostel and quarters for visiting scientists.

(d) Development and initial implementation of tailored in-country training courses.

- o In-service training to strengthen NARC and provincial training facilities to plan, develop, conduct and evaluate short-term career development and professional improvement seminars and workshops. Up to 10 person-months of short-term subject matter TA will be provided to help identify and design appropriate training courses. A short-term evaluation specialist will be provided to help develop a system for assessing training program effectiveness. The following four types of professional improvement training programs will be developed:

- Short courses in research methods;
- Sabbatical research programs;
- Short courses on research management and administration;
- "Traveling seminars" with research, extension and training personnel.

(5) Project Inputs

Implementation of the training component will involve primarily the PARC Training Office, the NARC Training Institute, and the five provincial training facilities. The last are actually two-year agricultural extension training institutes, not part of the research network.

USAID will provide:

- o Thirty-six (36) person/months for a long-term training specialist.
- o Thirteen (13) person/months for a short-term evaluation specialist and subject matter specialists.
- o An A&E consultant, local A&E firm and local contractor for the media and training facilities.
- o Equipment and commodities for the expanded NARC Training Institute and the five existing provincial training facilities.

GOP will provide:

- o Fourteen (14) additional staff at the NARC Training Institute (6 scientific officers--2 each in English

language, evaluation and training), 2 administrative assistants, 2 junior assistants, and 4 drivers.

- o Operations and maintenance of training facilities.

b. Performance

The training component of MART, outside the overseas participant training program, has probably made less overall progress to date than the other components. Still, good progress has been made in some activities. The PARC Training Directorate has established a very valuable computerized data base with information on participants overseas and information on American universities. Work is under way in constructing an addition to the NARC Training Institute facilities. During this phase 70 in-country short courses have been conducted. A considerable amount of documentation has been prepared to brief participants going to the United States for degree programs.

Some significant gaps still exist, especially in addressing in-country in-service training needs, strengthening in-country training capabilities, and moving towards a broadly based human resources development focus for increasing productivity in the research network. This component focuses on the heart of the research network--human resources accounting for roughly 70-80 percent of Pakistan's investment in agricultural research. Improving the performance of the people involved--researchers, technical and administrative support personnel, and managers/administrators--should receive high priority from PARC, donors, and provincial officials.

(1) Project Inputs Provided To Date

The following is a summary of the inputs provided to date by USAID:

- o Twenty-four (24) person/months of long-term TA--an agricultural training specialist who resigned before completing his 36-month assignment and will be replaced by another provincial research operations and support advisor for Sind and Baluchistan provinces.
- o Approximately 3.5 person months short-term TA--Byrnes to review overall training program, Nunn for training field and greenhouse research, and Nelson for the Barani education program.
- o Approximately 2 months for an A&E consultant and contractor for the training and media production facilities (construction began in August 1988 to be completed in February 1990).

- o Ten (10) computers have been installed in the NARC Training Institute, but it appears that little other training equipment has been purchased for the NARC Training Institute or provincial training facilities. Plans exist for procuring equipment for the NARC Training Institute when the new facilities are completed.

Additional staff for the NARC Training Institute has not been provided. The additional cost of operations and maintenance of the new training facilities, due for completion in February 1990, needs to be incorporated in the budget.

(2) Outputs/Accomplishments To Date

This section summarizes accomplishments to date, as compared to outputs (subsection a(3) above) and activities (subsection a(4)):

(a) Personnel Needs Assessment

Data has been collected from 254 organizational units in the agricultural research network and has been put onto a computer. A short-term expatriate consultant is planned to help analyze the data. An in-country computer consultant has been employed to help with the data input and assist in its analysis.

(b) Training Plan

Work on the training plan is dependent on the personnel needs assessment being completed; therefore, little has been done to date. There is some information related to training needs in the NARC Master Plan. University of Agriculture Faisalabad has prepared a "Foreign Training Requirements" analysis describing their overseas training needs for the next five years.

(c) Training Trainers

Little has been done to date to determine the training needs of various persons involved in training. It appears that the prospective trainers in the provincial agricultural research institutes have not been identified. Work is currently under way to contract with an American university to do a needs assessment and develop a training program for NARC and provincial trainers. Work is also under way toward appointing provincial training coordinators. No long-term degree candidates for trainers have been identified. Overseas study tours in the training field have not been taken; however, a request for one such tour is currently pending. The traveling seminar to Thailand has not taken place.

(d) Expansion of In-Country Training Facilities

Construction is under way to expand the NARC Training Institute (and Multi-Media Production Center) and associated facilities. This construction is to be completed by February 1990. As the building moves towards completion the equipment is to be procured.

(e) In-Country Training Courses

According to the PARC briefing document, 70 in-country training courses have been conducted for a total of 2,119 participants, almost 4 times the 500 individuals expected to be trained in-country in research management and administration and related topics.

With regard to the four types of professional development training programs to be developed:

- o There have been at least 13 farming systems research courses offered. Some are traveling seminars offered multiple times in the provinces.
- o To date no sabbatical exchanges appear to have taken place in-country or with outside institutions. However, heavy use is made of conference travel.
- o Because of the multiple interpretations of the term "management," it is difficult to be precise as to how many courses have been offered on the subject of research management. There appear to have been no courses in institutional management practices/procedures (i.e., financial or personnel management, etc.). There has been a proposal for developing a series of management modules, of which three areas have been identified and agreed upon (organization of experiments, planning, and monitoring/evaluation).
- o There have been many "traveling seminars," most of them conducted by NARC, PARC and provincial institutions without assistance from MART. This approach has been accepted by the research establishment.

(3) Constraints to Implementation

(a) Personnel Needs Assessment

Work on this survey has been going on since early 1988 and the first analysis of data is ready for processing. The main problem appears to have been that the

survey design got completely out of hand when the training advisor tried to gather massive amounts of data to answer every question anyone ever wanted to know. This approach resulted in serious delays and may have reduced the quality of the data in some cases. A simple "start up" survey done quickly could have been much more appropriate with the intention of adding to it in the future.

(b) Training Plans

The stated reason for doing no work on this activity has been that it must wait until the personnel needs assessment is completed. It appears that another reason was that the training adviser and others were not sure how such plans could be done and used. The idea of a "national training plan" appears too ambitious and could lead to problems similar to those encountered in the personnel needs assessment.

(c) Training of Trainers

Delay in this activity is very serious and has prevented the research network from moving forward on the all-important in-service training program. The reasons for this delay are unclear. Part of the problem appears to be a lack of understanding or appreciation of training as a professional process and the types of expertise needed in critical training management/coordination and teaching positions. The provincial training institutes mentioned in the PP/PC-1 are actually extension training centers and have nothing to do with the research establishment, nor are they qualified to provide training for research personnel.

It appears that little progress has been made in appointing training officers in the provincial research institutes. NWFP Agricultural University has a new position of director of continuing education, but the post is still vacant. UAF has a director of short courses, but his professional training qualifications are unknown. Sind Agricultural University at Tandojam also has a continuing education unit. There appears to be no individual in the Pakistan agricultural research network with professional training and experience in the training/continuing education field.

(d) In-Country Training Courses

While there has been an impressive number of in-country training courses, many of them with an excellent rating, there appears to have been almost none focusing on training of trainers and institutional management fields. The main reason appears to be a lack of understanding of these two "process disciplines" on the part of key groups involved in the

MART Project. Few professionally trained and experienced individuals in the continuing education and management disciplines have been involved. The overwhelming majority of consulting personnel, overseas training and equipment purchased has focused on strengthening the technical disciplines. Much of the management activity has actually focused on research planning and implementation, not on management of institutions or organizational development/change issues.

c. Recommendations

(1) Suggested Modifications--Current Phase of the MART Project

(a) Frank Byrnes Consultancy Report

The evaluation team carefully went through Dr. Byrnes' September 1988 report and for the most part agree with its recommendations. It is strongly recommended that the committee appointed to review the report be activated. The review should be done by mid-March 1989, with policy issues being considered at that time.

The remaining part of this section of the report will not repeat the points raised in the Byrnes report, but will highlight some of the most important points he raised, and provide information in the few cases where the evaluation team differs with his recommendations.

(b) Personnel Needs Assessment

With help of an expatriate consultant and local computer consultant, existing data should be analyzed and a draft report prepared as soon as possible.

- o First priority should be given to preparing institutional profiles, including information on the 254 institutional units from which data was collected. The types of information to include in the profiles is found in the training advisor's terminal report.
- o Data analysis should be tried in the 31 areas suggested by the training advisor. During this process other analyses will become obvious.
- o The institutional profiles and other analyses should be reviewed by a panel of federal and provincial users of the information, and decisions should be made as to which data are needed by whom. Useful data should be transferred to a dBASE III+ program as the basis for a long-term data base.

- o A decision is necessary as to how to maintain the data base in the future.

(c) Personnel Record Data Base

The PARC Personnel Department has begun developing a computerized personnel record data base. During the remainder of the MART Project, assistance should be given to develop for PARC/MART and some provincial institutions a model personnel data base, including normal personnel information and a record of pre-service and in-service training, and special subjects in which individuals are knowledgeable. A computerized system should be developed for eventual use by all agricultural research network institutions and shared with PARC. PARC could then become a clearing house to identify personnel with special skills, and to meet other personnel demands of the research network.

Included in this exercise should be the preparation of job descriptions, involving all levels of personnel and their supervisors, and linked to the institutional master planning process.

(d) Other Data Bases

PARC, NARC and other institutions in the Pakistan research network are rapidly becoming computerized. There is a critical need to ensure that compatible programs are being used so that research information can be shared by all parties in the network. At the current time, for example, NWFP Agricultural University and NARC libraries are establishing a bibliographic data base using the Imagic program, whereas the UAF Library, the largest agricultural library in Pakistan, is using dBASE III+.

Other areas such as financial recordkeeping, word processing programs, and desktop publishing programs, should also be reviewed, with all institutions taking part in the decision making.

(e) Training Plan

With respect to the training plan, the evaluation team differs somewhat from the recommendations made by the training advisor and Dr. Byrnes. The team recommends that guidelines for plan preparation eventually be developed for each type of institution--PARC/NARC, research institutes, educational institutions, field stations/farms, communication units, etc.-- and be linked to overall institutional strategic planning programs. A systematic training needs assessment can then be carried out for each institution and a training plan developed covering overseas and in-country degree programs and in-service/ refresher training.

PARC should serve as the facilitator and clearing house for these institutional needs assessments/training plans and could eventually help institutions in the entire network prepare similar plans. PARC should be able to draw selected information on personnel and training priorities from the aggregate of these plans. There are some excellent, and simple, training plans in the form of management matrices done in other Asian countries by the UNDP Asia and Pacific Programme for Development Training and Communication Planning (UNDP/DTCP).

It is recommended that priority be given to formulating a NARC training plan building upon their master plan and a UAF plan building upon their overseas training plan. The data system for training should be compatible with personnel-related data.

It is recommended that a consultant be used intermittently to help develop a methodology for institutional training plans. This same consultant should also help plan the establishment of training units within the major research institutes, and establish closer linkages with continuing education/short course programs at the universities.

(f) In-Country In-Service/Refresher Training

While there has been much activity in this area, little has been done to develop a viable in-service training program and support system. This should involve the following:

- o In-service training needs for researchers, technical support personnel, administrative support personnel, and managers/administrators are great. It is impossible for the agricultural research network to conduct all in-service training in-house, especially for the support and management fields. There appear to be many training institutions in Pakistan that could be used in this regard, and a survey should be conducted to identify them.
- o The role of PARC in facilitating, funding, coordinating, and monitoring in-service training needs to be defined. It is recommended that PARC provide HRD leadership for the research network by taking up with a broad range of issues related to manpower planning, recruiting procedures, constraints to work performance, career development, etc.
- o There is also an urgent need to define the role of the NARC Training Institute. The Byrnes report contains a series of recommendations on this subject. The

evaluation team also feels that priority should be given to (a) NARC staff development; (b) national training in subject areas where NARC has unique capabilities; and (c) training of provincial trainers.

- o There are plans to contract with an American university to organize in-country training for trainers and training coordinators. Every effort should be made to involve Pakistani trainers in this program, including NARC trainers (if that is to be one of their future responsibilities). It is extremely important that participants in this in-country exercise be carefully selected. At the current time, it appears that insufficient effort has been given to appointing training coordinators, identifying trainers at the research institutes, and involving continuing education/short course coordinators at the universities.

The terms of reference and instructions to the provincial secretaries of agriculture indicate that participants will be the training coordinators at the research institutes, whom the Secretaries have been asked to designate. At the major research institutes these should be full-time positions and the individuals should be given rank and authority to manage an effective in-service training program.

The Secretaries should also be asked to designate training coordinators/liason persons at the universities. These should probably be university directors of continuing education (at NWFP Agriculture University), the head of short courses (at UAF) or a comparable position. University training coordinators could become important links in the in-service training program for the research network, and therefore should be included in the training of trainers program sponsored by MART.

The "sandwich" training approach proposed by Dr. Byrnes is definitely the most effective for this subject. Even though the proposed six-week sessions are probably too long for the participants, the outside training consultants could profitably spend their extra time working with in-country training collaborators. A key objective should be to build up training of trainers capabilities in NARC or some other institution, or both.

(g) Overseas Training for Training Personnel

It is recommended that immediate attention be given to identify three individuals for Ph.D. training in Adult/Continuing Education (Byrnes recommended only one) with a special focus on human resources development (HRD) and training management--for the HRD coordinator/director for

PARC and key training positions in the system. It is also suggested that five individuals be selected as soon as possible for M.Sc. training in adult/continuing education with heavy emphasis on training planning and management, teaching methods, and evaluation. These individuals could become master trainers and provincial training coordinators.

It is also recommended that three trainers (from the NARC Training Institute, university continuing education units, research stations) for each of the next three years be sent abroad for a four-to-six week training of trainers short course. Excellent short courses are being offered by UNDP/DTCP Manila (through UNDP/Islamabad), University of Illinois INTERPAKS, and USDA OICD. These institutions also have experienced professionals that might be used in-country.

(h) Technical Assistance

The evaluation team completely agrees with Dr. Byrnes' recommendation of utilizing recurring TDYs to develop training plans, establish a personnel data base, strengthen the in-service training system and define the role of PARC/NARC in the HRD/training field. As twinning arrangements emerge (suggested below) individuals from partner institutions should be used for technical assistance and the institutions used for overseas training of Pakistani officials.

(i) Teaming Arrangements Needed

To introduce management and training processes into the research network, "teaming arrangements" with consultants and/or in-country training organizations can be developed. Using this approach, specific reviews--of personnel policies, financial management, management information/monitoring systems--can be carried out, as well as in-country management training courses. Examples could be to team an American experient station or department head with a management specialist (from business/public/educational administration disciplines) for a course on research institute management. Another example is to combine the National Institute of Public Administration or Lahore University of Management Science with UAF or the NARC Training Institute to conduct a management training course.

Other innovative mechanisms need to be explored for the in-country in-service training program, such as secondment programs between the federal and provincial programs, and sabbatical leave programs for people from within Pakistan and outside.

(j) Strengthening the PIU

The Project Implementation Unit serves as the interface between PARC, the donors and the various implementing agencies involved in external assistance to the Pakistan agricultural research network. Therefore, the evaluation team feels that some attention should be given to in-service and other training for members of this important unit. The PIU should be given assistance in developing a computerized monitoring and reporting system for donor-funded projects, compatible with any other management information systems developed for PARC and other research institutions.

As part of this effort it is suggested that the PARC chairman, PIU personnel, and the USAID MART project officer visit the National Agricultural Research Project in Egypt, which has established an excellent project monitoring and reporting system. It is also recommended that information on project management be requested from the East-West Center, the Resource Systems Institute, in Honolulu. The center has done a considerable amount of work in project cycles and management. A member of the PIU staff might be sent for an M.B.A. with special emphasis on project management, with the intent of eventual assignment to the PARC monitoring and evaluation unit.

(k) Organizational Development (OD)

The reason for including this item in the training section is because training is often the mechanism to trigger and sustain OD programs. One of the biggest challenges in the MART Project is to help change the structure, policies and basic procedures of the system. Pakistani institutions are not unique to resisting change. There has emerged a field focusing on stimulating internally the change process--normally referred to as organizational development or "OD." It is recommended that an OD professional, with Pakistan experience, be brought in intermittently to work with the PARC chairman and Winrock COP to introduce processes resulting in organizational development and change.

There are many examples in the Pakistan context of success and innovation, including the work of AED with the Pakistan Audit Department (PAD). These examples can become case studies, and special review seminars can be conducted to see what might be learned from their experience. In case of the PAD program, it might be useful for AED to organize a briefing for USAID, donor agency project personnel, and some GOP officials.

(2) Longer-Term Issues to Address--Beyond the Next Two Years

(a) Leadership Needed in Human Resources Development (HRD)

Training usually offers only a partial solution to improving work performance. PARC needs to establish a senior-level HRD coordinator/director, focusing on policy and procedures related to manpower planning, recruiting, pre- and in-service training programs, incentives, career development, etc. This individual should be professionally trained in continuing education/HRD. PARC's role in the HRD and training fields also needs examination.

A focus on HRD issues should lead to a logical sequence of activities concerning institutional role reviews, master plans, training plans, and other HRD issues. The end result should be the development of institutional goals related to work performance, training programs, and other factors affecting researchers, technical and administrative support personnel, and managers/administrators.

(b) Raising the Quality of In-Country Agriculture Education/Training

There is a good indication that the quality of agricultural degree programs, especially at the Ph.D. level, is deteriorating. There is pressure on individuals to get Ph.D.s and on research organizations to hire them because of financial incentives and prestige, regardless of the quality of the education or qualifications of the graduate. While universities are not directly linked to PARC and the research network, this situation is of major concern over the long term. Upgrading the quality of higher education is not the responsibility of the MART Project. Therefore it is recommended that at higher levels of government the following be explored:

- o Adopting education-research responsibility for PARC, which is used by other national agricultural research organizations, including more involvement of researchers in conducting research so they are aware of the demands put upon their graduates. The TIPAN approach and others should be studied by the provinces to see how education-research linkages could be made more effective.
- o Establishing accreditation programs, standard examinations for graduates, and ranking of programs by national or international standards organizations

- o Establishing twinning/collaborative relationships between Pakistan university departments and U.S. counterparts, linked to short-term visiting programs, overseas study tours, in-country training activities, joint research, sabbatical leaves, exchange of library and other materials, and post-doctoral visiting scholar programs. PARC should provide leadership in promoting these twinning arrangements and experimenting with a variety of arrangements.

There are many disciplines where Pakistani university personnel must have intellectual collaborators outside the country and at the same time their American colleagues need access to the tropical conditions that exist in Pakistan. These arrangements should be beneficial over the long term.

In 1981 a study was jointly sponsored by the University Grants Commission and PARC on Agricultural Education in Pakistan. The recommendations related to higher education, which appear on page 6 of the report, should be brought to the attention of senior government officials once again for implementation.

(c) Pre-Service Orientation Training Program

Much debate has gone on about establishing an "academy" to conduct a 9-12 month course for graduates before they enter the civil service agricultural research cadre. There appears to be a fairly wide consensus that there is a need for some type of pre-service orientation. The debate now appears to focus on (a) the duration and (b) who should do it. The evaluation team agrees with Dr. Byrnes' comment that the "academy or no academy debate" is a waste of time. Some mechanism should be established to systematically:

- o Assess the orientation training needs of fresh graduates.
- o Prepare a curriculum (or multiple curricula for different groups).
- o Explore alternative institutional mechanisms for conducting training.
- o Determine the PARC role in this program.

It is important that the "root problem" be addressed, which is the low quality and non-relevance of university agricultural education with respect to research. In this case there are examples where universities have placed their students with NARC for thesis research with excellent results.

Another orientation program is for officials moving to new positions--from researcher to research team leader, to middle-level management positions, or to senior-level policy management positions. In each of these cases, the nature of the program should be determined by a needs assessment process.

(d) Cost of Training

Transportation, tuition, books, and per diem are only part of the cost for degree and non-degree training. A major cost is the lost time of the participant to the institution while training is going on. Traditional training is one of the most costly and time-consuming ways to communicate technical information. There are alternatives to "classroom" training that can be much more cost effective, including information dissemination, self-study programs, on-the-job training, etc.

(e) Implementing these Recommendations

The evaluation team noted the importance of implementing consultant reports. It is therefore recommended that a task force be established to review the Frank Byrnes report and this section of the evaluation report to identify priority issues needing policy decisions, review recommendations to see if they are feasible, and ensure that the proper people are consulted in their implementation.

The membership of the task force on strengthening training infrastructure should include the PARC director of training, the NARC Training Institute principal, the UAF short course director, the NWFP Agricultural University director of continuing education, the SAU head of continuing education, provincial training coordinators (if any have been named), the USAID MART program officer, and the AED/Winrock DSTP agricultural training coordinator. This task force should be established as soon as possible and be given three months to present a suggested action plan.

3-B. MART Participant Training

This section has been separated from the regular training component of MART because it supports all project components.

a. Descriptive Summary

(1) Purpose

To identify, process, place, monitor and assist in re-entry of Pakistani participants for overseas degree and non-degree training.

(2) Component Outputs

Two outputs related to the participant training component are:

- o 246 individuals trained overseas in degree and non-degree programs and 500 individuals trained in-country in research management and administration and related topics. Note that this is inconsistent with other targets included in the PP.PC-1.
- o Establishment of uniform guidelines for overseas participant training program for degree and non-degree participants including (1) participant selection, (2) pre-departure preparation, (3) placement, and (4) academic supervision.

(3) Component Activities

The project was to undertake the following activities:

- o Select, place, backstop, and assist in re-entry of participant sent overseas for degree and non-degree training.
- o Develop guidelines for the selection, pre-departure preparation, and supervision of overseas degree and non-degree training programs.
- o Develop a pre-departure English and academic preparation program.

(4) Project Inputs

The inputs for this project activity include:

- o Funds for participant training costs.
- o Assistance from MART/Winrock training advisor for development of guidelines.
- o Contract to prepare a participant manual.
- o AED services for processing and placing of participants through the USAID Development Support Training Project.

b. Performance To Date

While there have been some difficulties in this program, the delivery of participants has been excellent. It has

been a massive task which was complicated because of the many organizations involved leading to some 27 steps for processing, as well as the normal difficulties of identifying and processing participants. During the past six months some of the earlier difficulties were worked out. With recent arrival of the AED/Winrock agricultural training coordinator, even more progress should be made.

(1) Project Inputs Provided

The inputs specified above have been provided in a timely manner.

(2) Outputs/Accomplishments

This section summarizes the accomplishments to date as compared to the outputs (subsection a (3) above) and activities (subsection a (4)):

(a) Overseas Participant Training

According to the PARC briefing document for the Evaluation Team, out of the 92 total long-term degree positions currently allocated, 61 are studying abroad and 20 are being processed by USAID/AED for a total of 81. The remainder are in process of nomination. Of the 164 total short-term training positions currently allocated, 140 have gone abroad with 24 yet to be programmed.

(b) Pre-Departure Guidelines

A number of guidelines and manuals have been prepared by the PARC Training Directorate for the World Bank ARP-1 and MART projects. The MART Project also contracted Beth Greenwood to prepare the "Pre-Academic Orientation Handbook" which is a thorough document for participants going to American universities.

(3) Constraints to Implementation

One of the greatest difficulties has been getting participants through the TOEFL language test. This limits the flexibility required to systematically determine priority subject areas and institutions needing strengthening in the selection process. There have also been delays because of the large number of organizations involved and number of steps (at least 27) required to identify, test, approve, and place a participant for an overseas degree or non-degree program.

c. Recommendations

(1) Suggested Modifications--Current Phase of the MART Project

(a) Review and Refine Procedures for Participant Training

The arrival of the new AED/Winrock agricultural training coordinator for the USAID Development Support Training Project (DSTP) is an opportune time to conduct a thorough review of the procedures being used to select, process, monitor, and re-entry activities for the participant training program. This should include defining, or redefining, the roles of the various GOP- and donor-associated agencies involved in this program. The people who should be most directly involved in this review should include the PARC director of training, AED/Winrock agricultural training coordinator, USAID MART project officer, representative of USAID HRD, and others as needed. Their findings should be reviewed by PARC, USAID and other parties involved plus a panel of outside officials (from Pakistan and elsewhere). An action plan should be formulated and approved within six months from when the review is initiated.

(b) Re-Entry Program

One of the most important needs in the participant training program is to design and implement a re-entry program that includes (1) evaluating participants' overseas training; (2) job counseling; (3) updating personnel record data; (4) reviewing career prospects; and (5) beginning to develop an in-service training plan.

(c) Follow-Up Evaluation of Participant Program

There should be a follow-up--one to three years after participants return--survey of the placement of the returned participants, what they are doing as contrasted with their degrees (technical vs. administrative or support programs), and an assessment of the impact on the individual and institution of the participant training.

(d) Data Base for Participant Training Program

An important area needing attention in the PARC Training Directorate is expanding and maintaining the data bases on personnel (manpower) needs, overseas training, and in-country in-service training. The Training Directorate has excellent information on computer for the overseas participant

training program. This should be completed and possibly expanded. Selected information from the Personnel Needs Assessment survey should be transferred to dBASE III+, the program used by the Training Directorate and Personnel Department of PARC, so that it can be maintained by the Training Directorate. The data bases maintained by this directorate must be compatible and complementary to the personnel record data base being established by the PARC Personnel Department (and those established in the future by the provinces).

(e) Establishing Closer Communication with Participants

It is recommended that the PARC training director be provided the means for establishing direct communication with participants while they are abroad, in addition to official communications through the USAID/AED channels. It is also recommended that the training director visit some participants who are in the United States and talk with their advisors and department chairs. He should review the standards expected by the American universities so this can be better explained to GOP officials and participant candidates.

(f) Redefining the Short-Term Overseas Training

Following the first group sent for a combined management/technical training in the U.S., the program for the second group was refined. The main change was to provide an internship portion with an individual researcher in each field. The second group felt the training was much better. However, there is still a feeling among participants and other officials that this type of training may not be cost- or time-effective. There are several reasons given. Because of the diversity of backgrounds and levels of the participants, the management and technical training could not be targeted to specific needs of the participants. The management training course outline was found to concentrate on research design and implementation rather than institutional management issues (this probably was not bad, but using the term "management" is misleading). The participants make very little reference to the management component of this short-term training program, which indicates that it may not have been very helpful.

Before more groups are sent for short-term training, this program needs a hard examination. It would appear that the management training component could better be done in Pakistan. The technical training needs to be more targeted. It is suggested that future training of this nature be linked to twinning arrangements with collaborating departments at American universities, rather than a scatter-gun approach with

participants visiting several institutions. A small group could be identified, the problem area to be addressed could be specified in advance, and sufficient time could be spent at the collaborating institution to focus on the problem with the intent that there be additional exchanges between the institutions in the future.

(2) Longer-Term Issues to Address--Beyond the Next Two Years

As the quality of in-country education and training improves, there should be a reduction in the amount of degree and non-degree training done overseas. The following could be some of the criteria for establishing future priorities for sending participants overseas:

(a) Degree Training

Priority should be given to (a) fields which are new or particularly weak in Pakistan; (b) developing master teachers at universities/training institutions; and (c) post doctoral/visiting scholars programs to twinning institutions.

(b) Non-Degree Training

While this type of overseas training should decrease, there will still be a need for some overseas non-degree training in special areas. Special priority should be given to (a) facilitating twinning arrangements; (b) visiting scholars with specific research or course development programs; (c) sabbatical research/teaching programs; and (d) small teams to study particular programs and develop action plans for Pakistan.

The decision-making process for the selection of institutions, subjects, and participants needs to be better defined and based upon a systematic human resources development plan.

4. Arid Zone Research Institute (AZRI) Quetta

a. Project Summary

(1) Purpose

Improvement of the capacity at the Arid Zone Research Institute (AZRI) to plan and carry out effective research on agricultural problems applicable to the arid and high altitude areas of Baluchistan and similar areas of Pakistan.

(2) Outputs

The AZRI component will produce the following outputs:

- o A 10-year long-range plan developed for station and on-farm trials.
- o About 25 research and extension personnel at AZRI and from Baluchistan province trained in the U.S., at ICARDA, and in third countries in research methods and operations.
- o At least 12 major field surveys and field research programs designed and implemented by AZRI staff in collaboration with provincial agricultural research and extension personnel.

(3) Activities

Specific activities to be undertaken include:

- o Adaptation trials of imported and local varieties of cereal grains, legumes, forage and pasture grasses;
- o Demonstration and verification studies on farmer fields of technologies that have proven superior on research station; and
- o Special studies on such topics as range and livestock management, mixed farming, animal nutrition and livestock marketing.

ICARDA will furnish four long-term agricultural scientists, one long-term extension specialist, and short-term specialists to assist AZRI conduct a program of field research to improve crop and animal production in Baluchistan and other dry areas of Baluchistan.

- o The germ plasm evaluation specialist (48 months) will be responsible for the evaluation, over a range of environments, of germ plasm of cereals, food legumes, forage and pasture species of the performance of the germ plasm.
- o The range management/livestock scientist (48 months) will design and test a viable, integrated range/forage/grazing management system; test crops suitable for grazing, fodder and hay and straw production; conduct surveys on causes of livestock mortality and morbidity; and of feeding supplements.

- o The extension specialist (30 months) will ensure the work of this permanent expatriate staff will be supplemented by 30 person months of short-term consultant for integration of extension services into the farming system research approach being developed at AZRI.
- o The soil water nutrient agronomist (48 months) will focus on soil, water, drainage, and cultivation issues.
- o The FSR specialist (agricultural economist) will focus on farming systems and on-farm research.

Special emphasis will be placed on rangeland and livestock research due to the importance of livestock in the agricultural systems of Baluchistan. Research designs will emphasize crop/livestock interactions, but will include:

- o Evaluation of cereal grain, food legumes, forage and pasture germ plasm;
- o Trials of selected annual and perennial legumes and grasses;
- o Study of sown fodder crops with and without irrigation;
- o Demonstration of superior crop production technologies;
- o Testing of improved technologies in farmers' fields.

The most important output of the arid zone research component will be strengthened capacity at AZRI to plan and carry out agricultural research in the dry areas of Pakistan. Formal, non-formal, and on-the-job training is, therefore, of critical importance to the success of this component's activities. The project will provide fellowships for U.S. graduate degree training in range management, animal husbandry, agricultural economics, agronomy, plant breeding, crop protection, soil science, and extension. To the extent possible, preference will be given to Baluchis for these fellowships. In some cases, higher degree students, particularly those studying for Ph.D. degrees, will undertake their thesis research in Baluchistan. Upon completion of their degree training, all participants will be required to serve at AZRI for a specified period of time.

Each year, ICARDA conducts six-month practical, field-oriented courses for junior scientists and senior technicians. These courses are in agronomy and breeding of cereals, food legumes, and forage and pasture crops. Project funds will be made available to enable AZRI scientist and research assistants to attend these courses. In subjects where ICARDA does not conduct a six-month course, the project will sponsor visits by AZRI staff

to work with ICARDA scientist in relevant disciplines such as soil science, animal husbandry, economics, and crop rotations. For planning purposes, 64-person-months of short-term training has been programmed.

All surveys and field research activities will be carried out by teams composed of AZRI and ARI scientist, provincial extension personnel, faculty from agricultural universities in Pakistan, and long- and short-term ICARDA specialist. The participation of Pakistani agricultural personnel in these activities will provide valuable on-the-job training.

ICARDA personnel will also organize workshops in Pakistan on key subjects relevant to the AZRI research program. These courses will be attended by Pakistani research, university, and extension personnel.

b. Performance

The AZR component of the MART project is about on schedule for meeting its activities for the contract period. It has published 26 research reports and papers exceeding the PP/PC-1 requirements for surveys and field research programs. One of these papers will be presented at the International Grassland Congress to be held in Nice, France in October 1989. Another will be presented at the Symposium on the Agrometeorology of Rainfed Barley-Based Farming Systems in Tunis in March 1989. One will be submitted for publication in the Pakistan Journal of Agricultural Research.

Nevertheless, this program is just getting under way. Improved research expertise is evident in performance but it is also evident that the institution will need guidance and assistance past the completion date of the ICARDA contract. Financial support for operations and technical assistance will be required for some period past the MART PACD, probably a minimum of four years.

The current programs are at about the level to be expected for the amount of time that the expatriate team of advisors has been on site. By the PACD, much research should be entering the next stage for development of more advanced systems for production of crops and livestock. Discontinuing or interrupting the assistance of expatriate advisors will very likely retard the movement toward more advanced stages of investigation, leaving research accomplishments at their present levels. The AZRI staff are competent, interested people but largely inexperienced. They rely on the experience and leadership of the expatriate advisors, without which it is unlikely much headway will be made into the more involved and difficult studies ahead.

AZRI performance is limited by the availability of qualified staff. However, no staff should be added unless they are clearly needed for priority activities and can be adequately supported by the limited budget. Staff scientists are burdened with many jobs that could be handled by trained technicians. Routine field and laboratory work should not be among their duties.

The two most important areas of study, i.e., those offering the greatest possibility of significant accomplishment, are range and water harvesting. Both areas offer specific research possibilities for investigation and these should be in areas most likely to:

- o Be responsive to farmer needs;
- o Be acceptable to farmers;
- o Be economical to adopt;
- o Improve production of crops and/or livestock.

(1) Strategic Plan

A 10-year long-range plan has been prepared and submitted: A Strategic Plan for the PARC Arid Zone Research Institute, 1990-2000. A second paper (Development Plan for the Arid Zone Institute, 2nd Draft, January 1989) overlaps with the first. Both documents will be considered as one in this discussion.

Essentially, the only priorities established in the plan are by disciplines. Range/livestock improvement has justifiably been rated the highest priority. However, a large number of types of studies are listed without any apparent order of preference.

Attaining the manpower requirements projected into 1993 in the development plan is highly unlikely either on the basis of likely budgets or qualified scientists. Research studies and the personnel required to staff them should be prioritized within the constraints of realistic budget projections and staff limitations.

One recommendation of the plan, the transfer of the national coordinated programs on sheep and wool to Quetta has been accepted by PARC. This transfer is logical and should strengthen the AZRI livestock program.

The request to transfer the sub-stations at Umerkot and Bahawalpur to provincial control also is desirable because it is unproductive to maintain research units that do not have sufficient operating funds. The four scientists at these two locations could be better utilized elsewhere. The transfer of these stations will narrow AZRI's geographic scope and thus reduce its image as a national institute. However, these units are unproductive and detract from AZRI's accomplishments.

The proposal to change the name to National Agricultural Research Center-Arid Zone is unwise. AZRI has some international name recognition. As its research results become more plentiful, the designation of AZRI will be even more recognizable. Information on dryland agriculture is becoming more important throughout the world, and AZRI's recognition as a source for this information is important.

(2) Training

Training of scientific personnel has been limited by the brevity of the call-forward notification for participants, and by the inability of potential trainees to meet the requirements of TOEFL at the onset of the training program. Despite these problems, there are presently four scientists in training at U.S. universities, two of whom have been approved for training this year, and four others who have been nominated for training starting in late 1989 and 1990. The English language laboratory established at AZRI has been instrumental in upgrading the level of competence in both spoken and written English.

(3) Research

Research presently being conducted by AZRI personnel is of a preliminary nature but basic to understanding the environmental/plant relationships on which future work must be based. The research activities at AZRI in many cases seem to be based on quantity rather than quality. That is, too many trials involving too many variables are conducted at too many sites for effective management by a small staff of limited experience. A simpler format for work plans should be adopted.

(a) The Germ Plasm Group

The germ plasm group is conducting variety trials at several locations on bread wheat, durum wheat, barley lentils, chickpeas, and Vicia spp. Varietal selection of all crops is for cold tolerance, and on wheat varieties for resistance to yellow rust. In the trial at Mian Gundi, one half of each plot is cut in mid-November to evaluate early forage production and cold tolerance.

(b) Economics/FSR and Extension

Farmer-managed trials involving wheat variety and phosphate fertilizer were conducted with 20 farmers in Kovak Valley in 1987. This was a joint endeavour of the extension and agronomy sections. The collaboration is to be extended to farmer-managed trials with barley varieties and seed treatment. There is little documented evidence of extension

activities other than these farmer-managed trials. The ICARDA extension specialist has contact with provincial extension personnel and farmers in the regions of AZRI's Range/Livestock Research Centers. However, activities expected from this position will be limited until research reaches the stage where technologies can be demonstrated and extended. The extension specialist's duties as stated in the project paper include an FSR function. The ICARDA organization of the AZRI expatriate staff places the FSR component with economics. Except for these farmer-managed trials there is little evidence that AZRI is developing an FSR component.

The Economics/FSR section has conducted seven surveys to identify constraints to production. These surveys have supplied a data base on livestock and crop farming systems of upland Baluchistan. Other work includes estimates of returns to research.

The comprehensive collection of climatic data of the region is very good and should be used in planning many types of experiments, particularly in agronomy and range plantings.

(c) The Range/Livestock Section

The major strength of the total program at AZRI at present is the range/livestock section. However, one weakness of the program is that the greatest progress in range forage production and animal nutrition is based solely on fourwing saltbush. The introduction of new range grasses and shrubs this year may result in adapted species that perform well.

Forage establishment trials with fourwing Saltbush (Atriplex canescens) have been very successful as have feeding trials with this shrub. It appears to be performing well at the Tomagh Range/Livestock Research Center where native forage is principally grasses, and at Zarchi Range Livestock Research Center where rainfall is lower and the native vegetation is principally shrubs. Weeping lovegrass (Eragrostic curvula) is the most promising of the grasses in trials at Tomagh. Although, the stand obtained in 1987 is only about 30 percent, it suggests possible revegetation in this area with favorable rainfall. Trials using fourwing saltbush for overwintering yearlings and flushing ewes indicate that this forage can be an important addition to animal nutrition for this region.

The range program has progressed to the point that it is time to make best-guess judgments and move into studies evaluating methods of establishing fourwing saltbush on larger areas where grazing intensity and standability of the forage can be evaluated. Some questions that will need to be answered are:

- o How long does it take to become established?
- o What is the best method of planting on large areas?
- o How will it stand under normal grazing practices?
- o What is the cost-benefit ratio of establishing fourwing saltbush?

These should be controlled studies to evaluate the effect of grazing intensity.

Feed and nutrition trials, vaccination for prevalent diseases, and treatment for internal and external parasites are programs showing favorable results. Internal parasites have been found to be a serious problem in some areas of Baluchistan. In the Kovak Valley, all 900 sheep examined were infested with internal parasites.

The enclosure at Zarchi does not show any regeneration and very little regrowth after two years. The value of these enclosures should be evaluated as should the costs of collecting native plants for the herbarium.

(d) The Agronomy Section

The major weakness is the agronomy section. This section has spread out to cover all of the likely areas of research outlined in the PP/PC-1. The field experiments need close inspection and evaluation to determine their relative pertinence to immediate needs.

The agronomy section is conducting wheat and barley variety trials, fertilizer trials, and intercropping studies of Vicia villosa with barley. Fertilizer and autumn vs. spring planting are variables in the barley seed rate test and fertilizer and innoculum are included in the test with Vicia villosa. Soil water monitoring, alleviation of soil compaction and water harvesting studies are also functions of this group.

One of the problems is the amorphous structure of the division, so that particular specialities have no identity, i.e., everyone is an agronomist. This section should be split into agronomy (crop production, crop ecology, crop physiology, and possibly germ plasm evaluation) and soil science (soil fertility, soil management (physics), and soil conservation).

Under such an organization the agronomy section would evaluate:

- o Crop and forage varieties;
- o Crop and forage germ plasm evaluation;
- o Possible crop physiology problem that may arise; and
- o Crop diseases.

The soil section would study:

- o Soil-water-plant relationships;
- o Tillage-cropping systems;
- o Water use efficiency of various crops;
- o Water harvesting;
- o Soil fertility-soil test correlations; and
- o Soil conservation.

In the proposed organization of the crops and soil sections, the study areas should be prioritized and scientists should be trained for specialization in a particular area. Some studies, such as soil-water-plant relationships and water-use efficiency, would be evaluated concurrently within the other studies.

The agronomy program needs considerable overhauling. Most of this study effort should be refocused on water harvesting, which offers the most promise for stabilizing crop production and is the logical direction for crop management to proceed in many areas. It is practiced in a crude form at present but many innovations are necessary to make it an efficient system for crop production. Outside consultants with design and construction experience are needed before work in this area is expanded. The suggested treatments for the catchment areas in "A Strategic Plan for the Arid Zone Research Institute" do not appear to be logical. All proposed treatments assume that all of the rainfall should run off of the catchment area; but this may well be unrealistic considering the ponding characteristics of the soils.

Two people have been proposed for training in agronomy (water harvesting). In the western U.S. this subject would translate into soil management. We do not know of any program specifically aimed at water harvesting and care must be taken to select the location and curriculum for these participants.

The soils of Baluchistan are in the worst possible physical condition for dryland crop production. These structureless soils crust and puddle readily. Tillage, cropping sequence, and planting methods need to be studied diligently to find systems to alleviate this condition. The tillage trial compares only deep moldboard tillage with the farmers' tillage. Two years of data has not shown any difference economically between the two methods. There is a need to evaluate tillage methods but more implements and methods are needed in the evaluation.

The research program of AZRI has progressed to the point where AZRI scientists are performing research, but their involvement in designing and initiating research is unknown. MART has undoubtedly contributed to the research effort at the institute since little information or data was generated prior to the MART project. AZRI is at present generating appropriate

technologies but these will not be ready to transfer to the Provincial Extension Directorate within the next two years. AZRI will not be a fully-functional, well-organized, or well-managed institution staffed with competent professionals at the end of the ICARDA contract period. In the long term the sustainability of the AZRI program will depend on the GOP's ability to finance it. At present, further technical assistance is also required.

5. Wheat and Maize Coordinated Programs

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 includes 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 NCP generates cooperation of federal and provincial research organizations in achieving the common goal of agricultural development through complementary efforts.

Wheat and maize crops helped establish the special features of NCRPs while material and advice received from CIMMYT has received special attention in this exercise. The CIMMYT has been working with Pakistani scientists for the introduction and improvement of these crops since the 1960s by providing new germ plasm and helping in evolution, testing, and introduction of new varieties. The present component of MART is an adjunct to the program already in hand.

The wheat program has resulted in the introduction and adoption of high-yielding varieties responsive to the application of fertilizer. As a result, the production of wheat in the country rose from about 4 million metric tons in 1967 to about 14 million metric tons in 1987. The yields of this crop, however, have been static for the last few years, even at the research centers, and something had to be done for further build-up of the germ plasm to overcome this constraint. Moreover, even the present yield potential is not being realized in the farmers' fields in general.

Maize presents a similar situation. The yield was quite static and previous efforts were to be supplemented by further input to research and development.

a. Project Summary

(1) Objectives

As indicated above, there is a yield gap between the production obtained by research stations and progressive farmers and average farm yields of the country. Constraints in bridging this gap have to be identified and removed. Also, it was considered necessary to intensify breeding for disease resistance and to institutionalize the capacity of Pakistani scientists in this work. It was with this background that this component was added to the MART project with the objectives of: evolution of higher yielding varieties; conducting agro-ecological analysis for identifying different wheat and maize zones; generating optimum production techniques appropriate to each situation; and developing farming system research to remove constraints to adopting these techniques.

(2) Activities and Expected Outputs

- o Continuation of efforts to produce high-yielding varieties.
- o Agro-ecological analysis that would permit the identification of wheat and maize zones in Pakistan.
- o On-farm research that would permit the identification, testing and revision of production techniques appropriate to Pakistani conditions.
- o Extension of new technologies, so as to maximize the chance of their being adopted by farmers.

These activities were to be carried out under two sub-components.

(a) Germ Plasm Development and Evaluation

Pakistani and CIMMYT scientists were to continue to introduce and evaluate genetic material under the national and international germ plasm exchange and testing program with a view to rapidly developing varieties with disease resistance.

(b) Outreach/On-farm Research

CIMMYT scientists were to assist Pakistani scientists to develop a 10-year plan for wheat and maize research, focusing on the complementarities of FSR and the traditional approach to agricultural research. As a first step, CIMMYT and Pakistani scientist were to prepare an agro-ecological

analysis of wheat and maize from data assembled by the crop breeders on varietal needs and disease incidence, dividing zones into sub-zones based on cropping patterns, soil type, rainfall, and farm management practices. This will be used to identify research priorities to plan maize and wheat production programs.

CIMMYT and Pakistani scientists, working with provincial extension personnel, would plan and carry out a program of demonstrations and on-farm trials to test the feasibility of developed technologies.

- o Diagnostic surveys were to be conducted in the sub-zones to identify researchable ideas.
- o Teams of biological and social scientists would work with farmers in these sub-zones to identify the most critical constraints to increasing farm production.
- o Factors responsible for differences in production and productivity would be indentified and modifications required for widespread adoption of improved technologies by the farmers would be incorporated in recommendations.

(3) Inputs

The following inputs were designed for the project regarding the WMCP component. MART was to fund a host-country contract with CIMMYT to:

- o Fully finance the services of three additional CIMMYT scientists: a wheat agronomist and a maize agronomist, each for three years, and an on-farm research specialist (extension agronomist) for four years. Wheat and maize agronomists were to assist their Pakistani counterparts to:
 - develop 10-year plans for germ plasm evaluation and genetic development;
 - design and implement research activities;
 - develop an agro-ecological analysis to sub-zone level for wheat/maize production and maximization;
 - design and implement production research and out-reach packages to be tested in similar zones/sub-zones; and
 - organize seminars in support of above objectives.

The extension agronomist was to:

- assist Pakistani research, extension, and university staff to develop and carry out on-farm adaptive research;
 - assist in developing farming system research methods for wheat and maize;
 - develop and present to the extension agents short training courses on agronomic extension techniques.
- o A CIMMYT regional South Asia agricultural economist posted at Islamabad was to spend about half time working in Pakistan to assist PARC to develop an improved capacity for social sciences research.
 - o Finance eight person-months of short-term CIMMYT experts as required.
 - o Provide 216 person-months of scholarships for M.Sc. and Ph.D. degrees.
 - o Arrange for three- to six-month study for 10 to 15 scientists at CIMMYT.
 - o Provide vehicles for the long-term technicians and combines, seeders, equipment, and commodities to support the WMCPS.

b. Performance: Inputs and Outputs

One wheat and one maize agronomist, one full-time economist and one part-time agricultural economist were provided. The two agronomists terminated in 1987, having completed three years of the project. The full-time agricultural economist began in 1985 and was succeeded in late 1987 by the current economist. The part-time economist terminated in June 1987, after three years. By the end of 1987, Pakistani scientists assumed responsibility for the management, conduct, and evaluation of wheat and maize programs and are now handling the work with occasional short-term bilateral expatriate assistance.

The remaining full-time CIMMYT staff member is the agricultural economist, who provides assistance and guidance to the social sciences division of PARC, particularly for the Agricultural Economics Research Units (AERUs) established in the provinces under a World Bank project. His assignment has been extended to 1990. He is involved mainly in applied economic analysis of research issues at the farm level, built mainly around the wheat and maize crops. As already indicated, he also advises the economists placed in various institutes.

Recent publications include "Monitoring Rice Varieties Grown in the Rice Zone of the Punjab," "Weed Management Strategies for Wheat in the Irrigated Punjab," "Monitoring Wheat Varietal Diffusion in the Irrigated Punjab," "Analysis of Barani Farming Systems of Northern Punjab," and "Rice Varietal Adoption in the Rice Zone in the Punjab under PARC/CIMMYT Collaborative Program."

Foreign training facilities provided under this MART component were two in maize, 10 in wheat, and 10 in economic fields. There were 17 in-country courses in addition to on-the-job training by CIMMYT scientists. Twelve visits to CIMMYT were arranged and a new system of visiting scientists is under consideration. Thirty vehicles have been provided from MART funds and micro-computers have been introduced.

c. Activities

(1) Buildup of Germ Plasm

Regarding the buildup of the germ plasm and the evolution of new varieties, CIMMYT contribution in the coordinated programs has been commendable, starting with Mexi Pak 65, Blue Silver, and other varieties. The Mexican wheats have been responsible for numerous varieties for various zones in Pakistan. Pak-81, the most adapted variety to date, was selected from Veery line; Tandojam-83 and FD-85 are to replace Blue Silver in Sind and Punjab. Pirsabak 85 (another selection from Veery S) is recommended in NWFP, and so on. Recently, seed of backcrosses of Yecora variety were received from CIMMYT to incorporate leaf-rust resistance. Yecora background and good lines selected from it may prove to be better than Pak-81. Apart from CIMMYT material, 60 to 70 ICARDA nurseries were received in 1984-85 and 1985-86, and two sets of the nurseries were received from Oregon.

Continuation of the process described above is necessary because the yield potential of the breeding material has been almost static for the last few years. For further improvement it will be necessary to incorporate flexibility in sowing dates, resistance to leaf and stripe rusts, loose smut, and karnal bunt, drought tolerance, and soil salinity. According to a report of PARC, "most of the high-yielding varieties released over the last 25 years have succumbed to new races of leaf-rust within three to four years after widespread commercial production." This can cause average yield reduction of 10 to 40 percent if not controlled. New diseases like powdery mildew have also to be managed.

Varietal diversification with new and improved genetic bases appears to be necessary and there should be continuous efforts to

avert pitfalls caused by disease. Diversity of germ plasm is essential at this stage. New genotypes should be imported from all over the world and incorporated in the present genetic system. Some local varieties will also have to be assessed for incorporation of characteristics like drought resistance. While long duration varieties may suit barani areas for early planting, short duration varieties would be desirable in most of the cropping patterns in irrigated areas. Heat tolerance is also desired to withstand the frequent hot spells at the time of maturity.

Similar attempts have been made for build-up of maize germ plasm as well. Efforts to breed high-yielding varieties and hybrids were initiated in 1955 but had little effect on raising the country's average yield. Introduction of some synthetic and composite varieties in the late 1960s and early 1970s had a broader effect because the seed could be reproduced by the farmers. Breeding material and varieties were imported from various sources, especially the United States and CIMMYT. While wheat varieties introduced from CIMMYT had a marked effect on yield improvement in Pakistan, they could not catch on in the field directly. In NWFP, a major reason appears to be the lack of an effective commercial seed industry for maize. However, useful work has been done at Yousafwala and Pirsabak Research Institutes and good hybrids/varieties have been developed. Some efforts in this direction have also been made by private industry (Rafhan Products). These efforts must continue. Cropping patterns are changing and early maturing short duration hybrids/varieties have to be evolved for fitting into cotton-maize or wheat-maize rotations.

The objective of varietal improvement implies a continuous process of never-ending research. Enough capability exists now in PARC and provincial institutes for this research without expatriate help. The CIMMYT economist at Islamabad and other sources will still cooperate in bringing germ plasm as required.

(2) Outreach/On-farm Research

The remaining objectives laid out under the MART project in the WMCP component have yet to be completed. There is still an alarming gap between the present yield potential observed at research stations and progressive farms and the average farm yields of the country. While the new varieties and hybrids are giving a yield of about 3-4 T/ha in wheat and about 4-5 T/ha in maize at experimental stations and at progressive farms, the country's average yields have stagnated at a level of 1.7 to 1.8 T/ha and 1.2 T/ha in the two crops, respectively. The MART program planned to make efforts to resolve this problem by undertaking on-farm research to generate production technologies under different situations and to develop

methodology for their large-scale adoption. To repeat, this program consisted of agro-ecological analysis to identify wheat and maize zones, generate techniques for optimum production appropriate to each situation, and develop farming systems research to remove constraints to the adoption of these techniques to optimize crop production.

Due most likely to the shortened tours of CIMMYT agronomists, a full agro-ecological analysis was not completed. The effort required to define wheat and maize zones according to climate, soil, availability of water and farming systems, and to work out appropriate production technology for optimum production in each environment is enormous. Only sporadic efforts have focused on this aspect in the past. A few diagnostic surveys were conducted under this project in rain-fed areas, rice-wheat-zones and maize-wheat tracts in NWFP. Low fertilizer input was a common factor responsible for low yields. Zero-tillage for wheat in rice-wheat rotation needs further probe with respect to its implications for the spread of stem-borers. Sixty-five percent of fields in rice-wheat are still planted with the old Yecora variety which is no longer recommended due to its susceptibility to rust. Varieties to be planted in this area and agronomic practices may have to be revised due to introduction of early "basmati" PK-385 and the consequent earlier planting of wheat. In NWFP, rust-susceptible varieties are still being planted over a wide scale and so on. These efforts have been rather inadequate to enable the PARCs to give zone-specific recommendations for increasing wheat production.

d. Recommendations

It is recommended that the following part of the WMCP component of MART project be followed up in the next two years of the project and that arrangements be made for its continuation. Achievement of the objectives will involve sustained efforts for a longer period.

- o Diagnostic surveys should be undertaken in different agro-ecological zones and sub-zones to be delimited for wheat and maize on the basis of climate, soil, water resources, cropping patterns, incidence of diseases, etc., to obtain basic data regarding constraints to increase in yield. These surveys should be designed by the CIMMYT economist and executed by the AERUS in each province.
- o On-farm research should be conducted in each zone or sub-zone to work out the optimum production technology for each environment and demonstrated on bigger blocks in the farmers fields to test the feasibility of application of this technology at the farmer level.

- o Project areas or villages should be selected for testing and demonstrating the feasibility of application of recommended technology at village or union council level. The constraints encountered in achieving the objectives will be marked and help will be sought from other input/service departments wherever necessary.
- o Ways and means to remove constraints will be identified so that farmers may adopt the recommended practices on a large scale to reduce the difference between the production and the productivity of their farms.
- o Based on the above studies and experience, plans for effective country-wide follow-up of the program may be prepared by PARC as required.

The CIMMYT economist should plan the diagnostic surveys with and arrange to conduct them through AERUs of each province. He will help the PARC in organizing all the above program. He will help PARC in organizing and following up all the above programs to achieve the objectives. This will be in collaboration with AERUs, agronomists, crop specialists of the Institutes and Adaptive Research Cells of the provinces. One PARC specialist will work as his counterpart at the headquarters. Extension wings of the provincial departments will be co-opted at planning and operational stages.

B. Extent to Which Project Purpose is Likely to be Achieved by PACD

1. Project Status

As indicated in the USAID PROMIS report for September 30, 1988, and as confirmed by the individual component assessments, the project is close to schedule. Inputs have been delivered on time, and have managed to produce programmed outputs. Some new elements added by MART, e.g., FSR and communications, are not yet institutionalized, so their impact is not yet evident, nor can the anticipated outputs be achieved as programmed. Some delays have occurred in in-country training, particularly training-of-trainers and management-focused short courses. The procurement and commissioning of laboratory equipment has caused some concern. The time required for review and decision on study recommendations was underestimated, and this situation was aggravated by the delayed start-up of the Winrock contract. Otherwise, project implementation appears to be well managed, on track, and relatively free of problems.

The project provides necessary and desired support to a national agricultural research system whose products are sorely needed to attain production targets. It is very unlikely,

however, that satisfactory progress will be recorded in all 12 measures of end-of-project status by the current PACD, even with the additional time and resources currently being considered, reflecting both an overly optimistic time frame and unrealistic expectations.

MART assistance is a necessary but insufficient response to problems confronting the system. Differences in technical knowledge and instrumentation among the institutions that form the system may be relieved by providing training and equipment. However, limited technical assistance cannot adequately deal with entrenched management systems in such an enormous and dispersed system, nor with major differences in financial and managerial capacity among its units, nor can it ensure coordination among independent institutions.

Although there is better cohesion within the Pakistan agricultural research system now than at the start of the project, this cohesiveness is constantly threatened by tendencies toward provincial independence. Donor support may remain a significant factor in the institutionalization of this still somewhat fragile system.

2. Strengthened Capacity to Address the Problems of Research Management

a. Problems of Research Management Described

The research management problems addressed in the MART project design were identified specifically (PP, p.2) in a comprehensive 1983 evaluation of the ongoing Agricultural Research Project:

- o a diffusion of research organizations whose activities are often compartmentalized and duplicative;
- o uneven distribution of resources throughout the agricultural research network;
- o research activities that are frequently carried out without adequate concern for priorities, planning or proper methodology;
- o less than rational allocation of and inadequate accounting for research resources;
- o 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;

- o lack of facilities and appropriate technology for the packaging and transfer of research-generated information;
- o shortages of adequately trained personnel in key management and scientific research categories; and
- o major gaps in selected commodity and disciplinary research programs.

b. Findings

Despite systemic management problems, individual research institutions have made significant contributions to Pakistani agriculture in the form of improved varieties and better crop management. Relieving management constraints is intended to make research more effective by better allocation of resources to high-priority programs and improvement of linkages within the system and to end users.

A major constraint to this end is the provinces' independent responsibility for the agricultural sector, which limits PARC's direct authority. It is a system of alliances, much like the federal research system in the United States, and obeys similar constitutional conditions. Many of the management problems cited above reflect this provincial independence. Their resolution, which will reflect system maturity, can be achieved only through a collaborative mode carried out over a much longer period than that of the MART project.

The principal method being used to enhance collaboration is the system of coordinated research programs. These programs provide a forum for discussing research needs and priorities, allocating responsibilities, eliminating undesirable duplication, and distributing resources accordingly. Program resources, taken from the PARC budget, are used to complement the salaries, facilities and other resources provided by collaborating institutions. Some 30 program areas for possible collaboration have been suggested, but significant attention has been directed only to the most important of these. Coordinated research projects command only a fraction of total research resources in Pakistan; much of the remainder continues to be subject to the kinds of problems identified above.

Support services provided by PARC/NARC to the provinces also contribute to cohesion and efficiency. The central laboratories, the library, the Laboratory Equipment Repair and Maintenance Unit, and the processing of fellowships and procurement are examples.

A third collaborative method involves the process of setting long-range priorities, as in the preparation of NARC's 10-year research plan. This still incomplete effort, which involved the attention of 200 scientists, has already stimulated similar efforts in Punjab and Baluchistan. The NARC plan should be reviewed, revised rapidly if necessary, and approved so that it can be used as a formal guide to resource allocation.

PARC also has a leadership role to play in management systems, just as in technical excellence. PARC has displayed its leadership by promoting staff based on performance rather than seniority. Computerizing the accounting system and activating the management information system may also become models worthy of emulation. We also encourage PARC to take some specific management actions to clarify responsibilities, grant operational authority, and relieve the ambiguity that stultifies action. Publication and dissemination of standard operating procedures and specific job descriptions are examples.

We are concerned that MART has had less direct effect on improving management than we might have expected. Several management interventions programmed in MART were not undertaken because there appeared to be little chance of a constructive outcome. These have gradually been replaced by a series of consultations and studies that have provided useful insights but little in the way of concrete results. The primary reason lies in the deliberate pace of decision-making which must be preceded by careful study to assure compatibility of the recommendations with Pakistani conditions. Such care may indeed be warranted, but the trade-off between additional certainty and the effort needed to achieve it also requires management attention.

Specific examples are the York report on national coordinated research programs, and the Khattak management review of NARC. Both of these studies are outstanding contributions, and implementation of most of their recommendations would resolve ambiguities in the management of their respective areas. Both of these studies have been favorably reviewed in PARC debates and PARC working groups, and a full-time director general was recently appointed to NARC, a key recommendation. We have learned informally that decisions were taken on their recommendations in a recent meeting of the Council. Such decisions require full implementation and follow up.

Other MART contributions to management have been oriented primarily to support, e.g., communications and computerization, or technical issues, e.g., management of experiments. Short-course training, both domestic and international, has emphasized technical matters, rather than management principles. There is much that can be done to develop management capacity in PARC, NARC and other organizations through in-country short courses in

personnel management (supervision, evaluation, development); planning, implementation, and monitoring; and, at more senior levels, management of organizations and managing the process of organizational development and change.

c. Conclusions

Two interrelated conclusions may be drawn from the above: (1) the rigidities in public sector management are more intractable than anticipated, and do not respond readily to traditional interventions of the type programmed into MART; and (2) otherwise competent and responsible senior managers are unwilling to risk their careers by taking management decisions outside their traditional technical program areas. Defining the conditions that lead to these constraints is beyond the capacity of this team. However, failure to define and ameliorate such conditions is a major reason for very slow progress in improving management. We suspect, but do not know, that system rigidities are based on administrative need (e.g., to avoid a political spoils system), but have degenerated into obstructive behavior. We suspect, but cannot generalize, that many individuals will not act without specific delegation of authority, which may not be common in this environment.

The comprehensive expectations of the MART project are flawed by the nature, magnitude, and timing of resources relative to the nature of the problems and the size of the system. Nevertheless, the flexibility and good will with which the project has been managed have corrected some of these problems.

d. Recommendations

Over the long run, correction of the rigidities in public sector management is essential to effective and efficient government. Such an undertaking is beyond the scope and capability of MART. PARC has been given a substantial degree of autonomy, but has been slow to break away from traditional mechanisms. Neither the federal financial authorities nor PARC's administrative staff have been prepared to depart from tedious procedures that repeatedly check financial flows and delay executive action.

For the progress of Pakistan's agricultural prosperity, the provincial research institutes need the delegation of administrative authority, so that, in spite of discouragingly slow progress, donors will continue to press for genuine autonomy for the research organizations they are assisting.

We recommend that in the meantime PARC should use MART resources to get on with the essential steps that lie within its authority and will enable it to provide a model for emulation. Specifically:

- o Complete the review of the NARC long-range research plan so that it can be used formally as an approved guide to resource allocation.
- o Review, decide and implement the recommendations of the Khattak and York reports (in process).
- o Publish and distribute PARC/PAD as soon as inconsistencies can be removed. This provides a needed foundation for a more detailed administrative manual.
- o Establish a comprehensive, integrated program of project planning, monitoring and evaluation as covenanted in the Project Agreement. The Ulbricht consultations provide sound guidance in this regard.
- o Institutionalize job descriptions for all professional staff, prepared and negotiated at all supervisory levels.
- o Initiate a comprehensive training program for all supervisory levels in supervision and personnel management techniques, program planning, budgeting and monitoring, and principles of organizational development and change. This basic training is essential to build the confidence, responsibility and authority of the management cadre.
- o Undertake a careful investigation of the management systems of the public sector to determine the areas of flexibility within that system and use this to inform all levels of management of the range and limits of their authorities.

e. Lessons Learned

The management problems identified in earlier evaluations are much more deeply rooted and intractable than suspected. They do not respond (or respond very slowly) to traditional interventions. Interventions must be selected with care on the basis of well-informed judgments about constraints and their relative importance and the probable impact of the intervention. The intervention must be scaled to achieve feasible results within a realistic time frame. Flexibility in implementation is essential to respond to unforeseen conditions.

C. Critical Policy and Institutional Changes

1. Success in Meeting CPs and Covenants

a. Findings

The Project Agreement (ProAg) includes only two Conditions Precedent to Disbursement (CPs). The first, an requiring a legal opinion and a specimen of the signature of an authorized GOP agent, was met handily. The second, requiring the designation of a PARC project manager and provincial project representatives, required a time extension, but was met by November 27, 1985.

The GOP agreed, through several covenants included in the ProAg, to take certain action with regard to personnel appointments, analytic studies, and follow-up. The status of each of these is as follows:

- o Establish a comprehensive evaluation program. There is no evidence that such a system is established and in use. However, an FAO consultant visited Pakistan in 1986 and 1987, introducing basic concepts and recommending a structure for an office of monitoring and evaluation. Dr. Ulbricht also helped prepare the terms of reference for a management review of NARC, and edited the report of the review team. These reports deserve careful study and early implementation.
- o Fill the post of NARC director general. The post was filled fairly early in the course of the project, but the initial appointee was dropped for cause. Since then, the post has been filled on an interim basis by a series of PARC members as an additional responsibility. The former member (crop sciences) was recently appointed as NARC director general, and another scientist was named to replace him on PARC.
- o Fill the vacancies at AZRI. It is extremely difficult to retain transferred staff at AZRI due to severe problems of location and social rejection, which make it very difficult for families. Economic rewards induce staff to transfer, but not to remain.
- o Establish permanent posts at suitable grade structure for production studio staff. Several positions were established and recruitment is under way despite some problems with grade structure. Remaining positions will not be established until space becomes available, upon completion of the AVCTI building.

- o Provide qualified counterparts for all U.S. consultants. This appears to be routine practice.
- o Provide post-training employment for participants. Arranged so far in all cases. However, provisions for their re-entry should be strengthened. One method proposed is to have degree candidates perform their thesis research in country. We applaud this initiative, which should help the re-entry process while adding to relevant research output.
- o Prepare a report analyzing problems created by present funding mechanisms and propose alternative financial procedures for their remedy. This has not been done.
- o Prepare a report establishing a two-year plan for increasing private sector participation in setting the research agenda and in research. The required study was undertaken. The study showed that there was little sign of private sector research but only selection and field testing of a pragmatic nature over a disparate range which per se would not reinforce public sector research. The effort to incorporate agribusiness firms at this stage is probably counterproductive. However, PARC recently established an agribusiness advisory committee with private sector participation to foster further ties.

b. Conclusions

Response to some of the covenants (1 and 7 above) has been incomplete. USAID follow-up has been perfunctory. It appears to us that PARC has tried to respond to those covenants to which it was predisposed and for which the specific response was clear. The imposed studies do not appear to be a useful management tool. Such studies may lead to facile but unimplementable recommendations which nevertheless require further effort to refute. USAID appears to share some of these concerns; their efforts have been concentrated on supporting studies and other efforts that appear to be genuinely wanted and needed. The result has been a good deal of effort directed at the problems identified, many of which, like the AZRI vacancies, remain without practical resolution.

c. Recommendations

Covenants appear to be a very poor way to deal with the issues of a collaborative effort. The detailed content of a program should be established by discussion and negotiation during implementation when the root causes of problems can be identified and appropriate interventions designed. If an action is absolutely critical, compliance can be made a condition

precedent to selected disbursements, rather than treated as a covenant whose disregard can be penalized only by terminating the program. Having agreed formally to these covenants, it behooves the parties to alter them formally to reflect current understanding of the nature of the problems and their resolution.

d. Lessons Learned

Unenforceable covenants as a means of forcing program action should be avoided. Program actions preferably should be fully understood and agreed to as essential and built into the program document to be managed with reasonable flexibility in implementation. If disagreement persists, and the donor continues to believe that a particular action is critically needed, the donor may insist on that action as a condition precedent to specific disbursements.

2. Adequacy and Timeliness of Funding and Government Support for Operating Costs

a. Findings

Adequacy of funding for agricultural research as well as its seasonal allocation and objective distribution are interrelated financial constraints with different impacts. Adequacy of funding determines how much research can be undertaken. Timeliness, which means variable allocation consistent with the seasonally determined agricultural calendar, assures that research can continue in line with biological and climatic conditions. Objective distribution, which seeks an appropriate distribution between personnel costs and operating costs, is a major determinant of the efficiency of the research process. All three financial constraints continue to limit the effectiveness of agricultural research in Pakistan at all levels.

Tight GOP funding led to a 5 percent cut in PARC's 1988-89 recurrent budget and an 18 percent reduction in its investment budget. We do not have reliable information on provincial research budgets, but believe that they have been similarly constrained. PARC's investment budget is heavily dependent on donor funding. The conclusion of the World Bank Agricultural Research Project many months before a possible successor appears, and the exhaustion of FERRO funding (USDA-owned PL-480-generated Rupees), will halve PARC's investment budget, from Rs. 357 million in 1987/88 to Rs. 195 million in 1988/89. This situation may not be as bleak as it appears. Bank funds were directed primarily at infrastructure. Personnel funded by ARP-1 were built into the current budget and will continue. The Ministry of Agriculture has authorized the transfer of Rs. 10 million to the

Federal Fund for Agricultural Research. This fund will be a partial response to the loss of FERRO funding. Funding for coordinated agricultural research programs at all involved institutions is included in PARC's recurrent budget, and is not yet dependent on donor funds.

Provincial funding for agricultural research, except in the Punjab, is traditionally limited. The glue that helps hold together the provinces in a national agricultural research system against strong centrifugal forces is PARC's capacity to marshal and redistribute supplementary resources to the provincial institutions. Donor use of PARC as a channel for training and equipment to the provinces strengthens this loose alliance.

Agricultural research, like agriculture itself, is dependent on crop characteristics, including seasonality. Failure to receive funds on time in adequate amounts can and does ruin experiments. The need for agricultural research funds is determined by a seasonal rhythm ordained by nature and is imperiled by adherence to the monthly or quarterly allotments common to public sector finance. The problem is aggravated by the uneven inflow of GOP revenue receipts which constrains the ability of the finance office to respond to peak needs of a seasonal agricultural research program and still maintain the continuous flow required by the rest of government. These problems are aggravated by the current low receipts.

The ratio of staff costs to operating costs has been worsening steadily over the last few years, from a recommended 60:40 ratio to 70:30 and worse. In NARC, funds in the current budget for direct operating costs per scientist have dropped steadily from Rs. 69,000 in 1985-86 to Rs. 26,000 in 1988-89. The development budget is unable to pick up the slack; it has declined from Rs. 186 million to Rs. 97 million in the same period.

The reduced availability of operating costs is impelled by the reinforcing tendencies of personnel costs to expand more rapidly and at the expense of operating costs. In the absence of a hiring freeze, management obeys Parkinson's Law, tending to seek additional staff rather than reallocate existing staff, both for new programs and for the ever growing work load. More insidiously, costs for existing staff rise vegetatively with normal and special salary increments, rewards for higher degrees, promotion, and the like. When the total budget is constrained, the initial impact is absorbed by operating costs. Personnel are more difficult to reduce, and staff reductions entail additional expenses.

no more than 70:30, and establishing effective program monitoring and financial controls. These efforts should apply to all elements of the system.

There are no easy solutions to the problems of adequacy and timeliness of funding in a period of austerity. The silver lining is that the general awareness of limited resources enables (and indeed requires) triage among programs, eliminating those that are of lower priority, and redistributing the savings among the most important. This redistribution must be accompanied by a cost-reduction effort in the remaining programs aimed at making them as cost effective as possible. The resulting "leaner and meaner" program carries with it an added benefit: Once the process is well under way, savings accumulate faster than anticipated, providing some cushion against seasonal peak expenditures.

- o Although the current period of austerity generates the urgency for extraordinary immediate emphasis, the nature of the problem is long run and the response must be permanent and continuous. Improvement in the techniques of resource allocation, program design and monitoring, and financial control provide the management accomplishments that make arguments for additional resources credible. Incremental success in each of these management areas leads to further improvement.

D. Integration of Agricultural Research Supported by the Project with other Research Activities, e.g., Irrigation, Policy, Forestry, etc.

1. Findings

The PP/PC-1 makes no specific provisions for this activity, other than general support for PARC, which provides small-scale, incidental support for these activities.

An Australian project, organized through PARC, with a team arriving next month, will develop tree plantations of salt-tolerant species that will lower water tables in low lying areas of Sind. When the technology has been demonstrated, plantation on a large scale should follow.

PARC has provided support to a small-scale initiative by a fledgling international center, the International Institute for Management of Irrigation (IIMI), which is headquartered in Sri Lanka, to establish a group in Pakistan. While it may become very important in the long run, current scale is below the minimum needed.

There is growing contact between the Economic Analysis Network, which is primarily engaged in food policy analysis, and PARC/NARC, whose efforts are focused on farm management economics. Since many PARC/NARC agricultural economists are members of the Network, many have benefited from short courses and publications; some data are being shared. These relationships should be fostered but not forced, allowing collegial professionalism, rather than formal agreement, to expand collaboration.

2. Conclusions

Integration of PARC research efforts with those of other groups has been encouraged by PARC, but this integration probably is not at a stage where formal alliances can be established. This is not only unfortunate for research, but may be leading to serious national problems, particularly in the field of irrigation.

For at least twenty years, attempts have been made to apply modern methods of irrigation management to Pakistan's ancient and incomplete system of canals and drains. These initiatives remain fragmented and divided by professional and administrative separation of engineering and agricultural agencies. Combined teams of agriculturists and engineers have worked in canal command areas for many years but have lacked research support in soil physics and plant physiology to define watering regimes that would avoid waterlogging and minimize salinity.

3. Recommendations

Given the seriousness of the continued loss of large acreages of arable land to waterlogging and salinity, we believe that cabinet-level attention should be directed at this problem with a view to assuring coordinated attention, whether in research, construction, or system management.

SECTION III

INSTITUTIONAL ASSESSMENT: NATURE AND EFFECTIVENESS OF INSTITUTIONAL RELATIONSHIPS

The fundamental distinction to be made in an examination of institutional relationships is that between donors and the national institutions that participate in the national agricultural research system. Donors provide inputs and advice--they are support to a national system--but they are not the system. The decisions that determine the effectiveness of inputs and advice are made by participants in the Pakistan agricultural research system in light of Pakistan's financial capabilities and cultural and political institutions.

A. Findings

1. External Agents (USAID, World Bank, Other Donors, TA)

The World Bank ARP I and the USAID MART are the dominant donor support for the Pakistan agricultural research system. Their combined resources far exceed funds provided by all other donors. These two programs independently conform to the procedures of their respective donor organizations. However, they are philosophically attuned and mutually supportive. Both donors spend considerable effort trying to identify program constraints and allocate their resources to overcome them. They also try to understand the constraints to achieving the objectives of their program support, and to condition their aid to overcome those constraints.

Donors that provide more limited support (Canada, Italy, Switzerland, UN/FAO) are more apt to restrict their efforts to discrete research efforts within the system, usually along commodity lines, rather than providing support to the system.

The MART project design as presented in the PP/PC-1 is flawed by expectations that are quite unrealistic in light of the size and nature of the problems faced. Although the design appears superficially logical it reflects conventional wisdom rather than a perceptive appreciation of the nature of the Pakistan research system. Many of the proposed interventions (specifically the systems analyses and many of the covenanted studies) were quite inappropriate for attacking the problems. The indicators of EOP status were presented without baseline or targets. The level of effort allotted to management and administration was infinitely small in relation to the size and extent of the system, yet this level was further reduced and carried over into the technical assistance contract with no limitation in the scope of work.

The sequencing, as well as the total time allowed for other project inputs to affect EOP status, is incongruous. Most degree candidates will not have returned to the project long enough for the impact of their training to be felt. Equipment provided in 1988 will have little immediate impact on science. Finally, we cite the unrealistic expectation that 100 media packages could be developed concurrently with building a center, acquiring equipment for that center, and hiring and training staff for the center upon its completion.

USAID, PARC, and the contractors have nevertheless managed with flexibility to achieve significant progress towards the ends of the project. The fact that MART will not reach full EOP status by PACD is a design problem, rather than an implementation concern.

The technical assistance teams and individual consultants have generally been well-qualified for their assignments, and have made significant contributions to the program, generally maintaining cordial working relations with their counterparts. The major deficiencies (in only one or two cases) have been overzealous pursuit of accomplishments without assuring full understanding and agreement by those counterparts.

2. System Participants (PARC/NARC, Provincial ARIs, Agricultural Universities)

PARC was created to provide a leadership role in the development of the research system, but with circumscribed authority over the system. It has direct budgetary control over NARC and other federal institutes, but it must earn its leadership role among provincial organizations by scientific excellence and a capacity to provide support services and raise resources for the system.

PARC stakes its intellectual leadership on the competence of its members, on the development of NARC as the national center of excellence in research, and on the national coordinated research programs, most of which are led by NARC scientists. These efforts are on their way to success. NARC staff and facilities have been developed in less than 15 years into a significant scientific force. Only the 800+ scientists of the Punjab AARI can rival NARC in critical mass and historical accomplishment. Implementation of the NARC review team's management recommendations will give NARC the independence from PARC needed to move to a new stage of development. PARC's nurturing role has been essential in the development phase, but greater autonomy and responsibility should encourage the innovative risk-taking by both scientists and management that, beyond technical superiority, is the hallmark of excellence.

PARC's capacity to raise resources for the system is demonstrated primarily by donors who recognize the necessity of a coordinated national system of research, and are willing to finance the institutionalization of such a system. These donor resources have had the dual effect of meeting some of the material needs of most institutions in the system, thus providing a material reason for collaboration.

One of PARC's major roles is to promote the cause of a science-based agriculture among the government and people of Pakistan. In the long run, this capacity to influence national agricultural priorities to include significant financing for research--and to use it wisely--is a major determinant of PARC's success. The other major indicator is the excellence of its staff and its capacity to perform.

Between 1983/84 and 1987/88, PARC's non-development budget rose from Rs. 45 million to Rs. 110 million, before declining slightly to Rs. 107 million in 1988/89. This growth is not adjusted for inflation, which makes it less impressive. Moreover, expenditures for salaries and benefits increased even faster, so the increase went to fund staff cost, and operational funds per scientist dropped sharply. This simple analysis hints at both the success of PARC's efforts and the difficulty of its problem. The build-up of excellence increases costs faster than the recognition of excellence is converted to increased funding. This is not a simple area, however, and warrants considerably more study such as that being provided by the Evanson studies.

Provincial research programs, staff, facilities and finances are too variable for easy generalization. Some are quite well developed; others are much less so. Most have at least some staff and facilities that are of better quality than one finds in most countries at Pakistan's stage of development. Nearly all suffer from inadequate operating funds and a high proportion of personnel costs in their total budget. These provincial research organizations are partners in a national system, but still not fully convinced of the need for a "general partner" for the enterprise. Achieving and institutionalizing a truly collaborative research organization that serves national and provincial needs--the objective of PARC/NARC and its major donors--will be a long-term process.

The provincial agricultural universities have their own autonomy within the provincial sphere, placing them in an even more independent position. Although they sponsor some research, their primary role is to prepare agricultural professionals at the B.Sc. and M.Sc. levels. A major problem of the agricultural universities is that, as their student bodies have expanded, the standards of preparatory education have declined. The universities have not reacted effectively to correct this problem, so

that the quality of their output has also declined. Weak preparation of beginning scientists is the most severe limitation on the quality and effectiveness of science in the Pakistan agricultural research system.

B. Conclusions

The shared perception of major donor institutions and PARC/NARC of the need for an integrated national system is one of the most positive auguries for the continuation of that system. The collaborative mode is gradually having its impact on other institutional relationships within the system. However, this process of integration will continue to be very slow until the provinces and the nation accept the vital role of science in agricultural development, and the importance of the collaborative approach.

The major institutional constraint on the progress of agricultural research in Pakistan is the low educational standard of agricultural graduates. As revealed by screening tests for candidates for overseas training, the level of science and mathematics, as well as the level of English, is seriously below international standards.

In 1981, as a result of a presidential directive, the University Grants Commission and the Pakistan Agricultural Research Council jointly appointed a study group to raise the status of agricultural education. The study group held several meetings and visited all the relevant institutions. Their report was debated by PARC and by the agricultural universities; it was published in 1983.

The report recommended that PARC Ordinance XXXVIII be amended to include agricultural education. It was recommended that the council, in consultation with the University Grants Commission's Committee of Vice Chancellors of Agricultural Universities, establish minimum standards for courses of study for graduate and post-graduate qualifications in agriculture and allied subjects.

Minimum standards for admission, teaching staff, examinations and practical training were also recommended. PARC, in consultation with the vice chancellors, should coordinate, promote and fund the development of research programs.

Action is needed to implement this report, since agricultural education has not yet reached the standards essential to the progress of the nation's major industry.

Our review of the research management component shows clearly that a nationally coordinated effort to raise standards in agricultural education must be a major part of further attempts to improve performance in agricultural research.

C. Recommendations

- o PARC should further intensify its efforts to orient the GOP and provincial governments to the importance of their support for agricultural science--and to reflect this orientation in important increased financial support.
- o Donors should temper both expectations and support to levels that will permit them to continue support as long as necessary to achieve desired results.
- o The recommendations of the "Report on Agricultural Education in Pakistan" (1983) should be implemented with urgency and with financial support from the federal government.

SECTION IV

CROSS-CUTTING EVALUATION QUESTIONS

A. Sustainability

Sustaining the benefits of the MART program involves several distinct issues. These might be categorized as direct benefits from MART outputs (training, equipment, studies), management improvements, which are the principal purpose or end result of MART, and the national agricultural research system itself.

1. MART Outputs

a. Training

Sustaining knowledge depends on the type of training given and opportunities to use the knowledge gained. Much of MART short-term management training was of limited duration, intensity and content. Participants were oriented to benefit more from the management of experiments than from broader management principles. Most will have a greater opportunity to use and develop technical management skills under existing conditions than other management capabilities.

Overseas degree training, particularly to the Ph.D. level, confers considerable technical knowledge, modern research methods, and enhanced English language capability. The benefits of this education to the research system depend very much on the reintegration and support of the returning scientists, including assistance in adapting their knowledge to Pakistani conditions, and its extension to other scientists. We are concerned that reintegration of returning trainees be designed to assure immediate assignment. The proposal to have degree candidates do thesis research in Pakistan would help in this process. Without such programming, both individual and system-wide benefits are fewer and slower. Degree training does raise staff costs, placing an additional strain on the staff:operations ratio. If operating costs are not raised commensurately, the efficiency of specialized staff may be less than expected. This, of course, will be offset by the higher quality of performance accorded by the training.

b. Equipment

Equipment, whether vehicles, field equipment, computers or laboratory equipment, requires proper care and maintenance. The facilities for installation and storage, particularly for sensitive computers and laboratory equipment, were of variable quality, and generally less suitable than desirable. We were pleased with NARC's LEMRU (Laboratory

Equipment Maintenance and Repair Unit) and with the desire of provincial institutes and universities to establish similar cells. Even so, we believe the life of the equipment will be below average. Sustainability under such conditions may require replacement on shortened amortization schedules.

c. Construction

Construction is not a one-time cost, but requires maintenance and operating costs, neither of which are normally foreseen in the recurrent budget. A rule of thumb is that annual building maintenance alone requires one percent of the gross cost of the construction. This would require an additional \$20,000 per year for maintenance of MART construction. The current maintenance budget at NARC is less than half the amount required, and building maintenance reflects the deficiency.

d. Technical Assistance

MART technical assistance, both long- and short-term, has conferred benefits on those with whom there has been contact. There has been an effort to publish consultants' reports, and they seem to be rather widely known and available. The sustainability of this advice, however, depends upon its institutionalization in the form of executive decision, implementing regulations, and standard operating practices. As stated, this process has been exceptionally slow because of the care required to assure that recommendations are compatible with Pakistan's laws and regulations and are within PARC's authority. Procedures should be established to obtain a rapid preliminary review of each study and consultant report to assure that recommendations retain their currency.

2. Management Improvements

Significant improvements over recent years are primarily in the management of technical research. The computerization of accounting and a related management information system are not fully installed, so issues of sustainability could not be investigated. Improvement in resource allocation, in program planning, budgeting and monitoring, in the management of organizational systems, or in the management of organizational development and change is better in systems directly under PARC control than in provincial research organizations, but it is still slow. Improvements in these areas are evidently very difficult to come by in the regulatory and cultural environment of Pakistani public service. Improvements are apt to be very fragile and personalized until they are widely and deeply institutionalized.

3. National Agricultural Research System

The Pakistan National Agricultural Research System is a loose alliance of specialized national institutes and provincial research institutes under the leadership of the Pakistan Agricultural Research Council. PARC has authority over the national institutes, but has only a helpful coordinating role with respect to independent provincial institutes. The latter report directly to provincial secretariats of agriculture, from which they receive their budgets and marching orders.

Pakistan's constitution grants provinces considerable independence, including specific responsibility for the agricultural sector. PARC must continue to rely on scientific excellence for intellectual leadership and its capacity to generate resources, including scientific services for the system for more material bonding. The insistence of major donors (World Bank and the United States through USAID and FERRO) that their resources be channeled to the provinces through PARC is major evidence of this material role. The provinces would prefer direct assistance, relieving them of any responsibility for a national system. They grudgingly perceive PARC's superiority at international fund-raising, while they pursue these and other sources for direct assistance.

Clearly, this is still an uncertain alliance, made more so by the variations in research capacity among the provinces. PARC's scientific superiority over Sind, Baluchistan and NWFP is clear, at least in part because they are unable to support a comprehensive program. However, because of their limited attainment, these provinces may be less appreciative of the utility of scientific excellence. The Punjab, on the other hand, has a very effective and well-supported provincial research institute, as well as the best agricultural university in Pakistan. This province may not have such an urgent need for PARC, but it can appreciate its importance.

The tensions within the system are not necessarily bad. Similar tensions have existed since independence in the United States and Australia and have contributed to scientific growth. They may also be exaggerated relative to cohesive tendencies that are less noticeable. NARC, for example, has developed into a model institution in little more than a decade. Its Research Master Plan has stimulated emulation even before it was finalized. The more mature national coordinated programs demonstrate the benefits of a collaborative approach. PARC's supporting services, e.g., training, library, and international linkages, will be expanded with the new information transfer capability and training facilities. The longer these joint programs, services and relationships continue, the better they should become, and the more comfortable the system's institutions will be with each other.

In the short run, donor support makes a major contribution to maintaining the national system. Intellectual leadership, no matter how important, is a precarious foundation for permanence. Preservation of the system requires that PARC develop the capacity to intercede effectively for larger and more timely allotments of national funding. PARC's growing capacity for such intercession is demonstrated by: 1) its secular budget expansion; 2) its absorption of the World Bank ARP-I; and 3) the Rs.10 million replenishable fund. This will assure continued support for the national coordinated research programs, which are PARC's most visible (and provincially acceptable) manifestations of its utility.

B. Lessons Applicable to Redesign

1. The management problems MART addresses are rooted in conditions (provincial independence within a federal system, and inflexible government-wide controls) that will change only by consensus within a loose alliance of federated institutions. Such consensus will occur only over a long period; donor assistance can encourage but not force this process. Redesign should recognize the nature of the problem and set EOP status indicators accordingly.

2. Proper sequencing of inputs and expected outputs requires attention to the time lags in each. For example, degree training requires up to a year to select and process a candidate and three years for a Ph.D. No impact can reasonably be expected from training until some time after an individual returns. The impact of information transfer must await the construction of a building before equipment can be provided and a staff to occupy and use it can be recruited and trained.

3. Procurement of scientific instruments and equipment is a delicate task requiring both careful resource allocation and the informed consent of the scientist who will use it. Great care is required to adjust traditional procurement procedures and criteria to the scientific end use of the instruments. Buying in smaller lots is one way to permit this adaptation.

4. Covenants are an unsuitable way to deal with conditions that should be incorporated in design and implementation. If a condition is so critical to success that a particular enforcement mechanism is required, a condition precedent to some disbursement category provides such a mechanism, short of terminating the project. Any such mechanism must be carefully scrutinized for feasibility of compliance.

5. Flexibility in implementation is essential for managing large complex projects; a project paper should recognize this overtly. Variation from the prescribed design, as mutually

agreed, should be recorded in a project log for the benefit of subsequent project officers and evaluation teams.

C. Project Effect on Women

Women in Pakistani society generally have few outlets beyond the home. This is reflected in a very low literacy rate (below 25 percent in rural areas), a university enrollment of less than 10 percent of students, and lack of exposure to extension services. Within this system, a woman has become prime minister--the first in an Islamic nation. A few women scientists hold responsible positions in NARC, AZRI and other research institutes.

On a broader level, farm women fulfill a significant role in agricultural production, besides their functions in caring for house and family. Women provide much of the harvesting labor, both on the family farm and as contracted labor, e.g., cotton picking. They are responsible for feeding, watering, and otherwise caring for the poultry and tethered household livestock (cows, buffalo, camels, donkeys) and for processing and selling their production. The traditional seclusion of women and their exclusion from commerce limits the direct assistance they can receive from extension agents, and requires that marketing be done through middlemen at the farmstead. Both of these processes restrict their ability to obtain economic advantages.

The MART FSR program is seeking remedies for this situation. Winrock International has contracted a competent and dedicated WID specialist who, besides organizing a women-in-development conference, provides advice in FSR pilot areas. Her role is to investigate women's roles, aspirations, and needs, and to select and train local promoters through which assistance and innovations may be channeled to rural women.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

A. Current Status of Project

The project provides necessary and desired support to a national agricultural research system whose products are sorely needed to attain production targets. The project is close to being on schedule. Inputs have been delivered on time, and managed to produce programmed outputs. Some delays have occurred in in-country training, which has focused more on technical matters than on management. The impact of new elements added by MART, e.g., FSR and communications, and that of international training, cannot be expected until fully integrated. Procurement and commissioning of laboratory equipment has led to some aggravation. The time required for review and decision on study recommendations was underestimated. Otherwise, project implementation appears to be well managed, on track, and relatively free from implementation problems.

Nevertheless, substantial progress will be less than hoped for, in the 12 measures of end-of-project status at the current (extended) PACD, even with the additional time and resources currently being considered. Most of the management problems identified stem from two sources beyond the effective influence of MART. First, the provinces' independent responsibility for agriculture constitutes a federal system of research, similar to that of the United States. It is an alliance rather than a controlled organization, so changes must be brought about by consensus, which takes considerable time and effort to develop. Second, inflexible public sector management systems are not readily modified, even by autonomy. Staff are unwilling to risk their careers by innovation in arcane areas. In this environment, MART is a necessary but insufficient response.

It should be noted that, despite these problems, agricultural research has been able to produce or adapt the technology needed to keep agriculture growing at 3.6 percent/year for 25 years. Improvements in management of the research system are intended to increase its efficiency and cost effectiveness to assure a continuation in growth.

The MART project design is seriously flawed by expectations that are quite unrealistic in light of the size and nature of the problems faced. Many of the proposed interventions (specifically the systems analyses and many of the covenanted studies) were inappropriate for the type of problems described above. The indicators of EOP status were presented without baseline or targets. The level of effort allotted for technical assistance

for management and administration was infinitely small in relation to the extent and dispersion of the system.

The sequencing, as well as the total time allowed for other project inputs to affect EOP status, are incongruous. Most degree candidates will not have returned to the project long enough for the impact of their training to be felt. Equipment provided in 1988 will have little immediate impact on science. Output of the information transfer component must await the building of a center, the purchase of equipment for that center, and the hiring and training of staff upon its completion.

USAID, PARC, and the contractors have nevertheless managed with flexibility to achieve significant progress towards the ends of the project. The fact that MART will not reach full EOP status by PACD is more of a design problem than an implementation concern.

At this point in time, the Pakistan national agricultural research system continues to be a loose alliance rather than an integrated national system. PARC strategy for strengthening the cohesiveness of the alliance has three elements: (1) scientific excellence in the performance of its controlled elements; (2) the provision of useful services to the system; and (3) the ability to acquire resources for and represent the system. They are doing a good job in all three areas, and donor assistance has provided material assistance and encouragement in all three.

NARC has become a center of excellence in little more than a decade. Its laboratories, library, and equipment repair units provide needed services to other parts of the system. A draft long-range research plan involved the entire scientific staff in its development, providing experience in setting goals, establishing priorities, and allocating resources. Other organizations are seeking to emulate this example. PARC's computerized accounting and management information systems, when operative, are expected to become other models. Its adoption of a system of promotion based on objective indicators of performance instead of seniority is an example we hope other organizations will adopt.

The national coordinated research programs, usually along commodity lines, bring together researchers with similar interests to exchange information, determine priorities, and allocate responsibilities and resources. The PARC budget provides support complementing the provincial institutes' manpower and facilities. Although these programs represent a small portion of the total resources, they are particularly useful in establishing cohesiveness.

PARC has been very successful in attracting the support of donors, who share its views about the need for an integrated

system. Although these donors have helped build up PARC and NARC, significant flows of resources have been channelled to the provinces, an indicator of PARC's responsibility for aiding the system as a whole.

PARC has been less successful in raising domestic resources. While agricultural research has obtained its share, and more, of the budget, Pakistan's low revenue growth constrains research budgets as well, at both national and provincial levels. This situation is not apt to improve significantly in the near term.

Although its recurrent budget has apparently grown at a compounded rate of 25 percent over the last 5 years, personnel costs with inflation have grown even faster, so that operating funds for research per scientist have actually declined by more than half. Clearly, excellence has its costs.

The disparity between financial trends and operating requirements makes the strengthening of management capabilities even more important if research is to be cost effective. Management must be strengthened in all components to meet the challenge of better science with continuing austerity. The components include: (1) careful allocation of resources to well-planned research programs directed at high priority problems, and elimination of repetitive studies of less importance; (2) tight management of research operations, enforced by good program monitoring and evaluation; (3) personnel management practices that reallocate and/or retrain scientists to meet program needs, and assure through job descriptions and supervision that they understand what is expected of them; (4) effective financial management so that resources flow to experiments when needed under effective controls; and (5) realignment of organizational structures for organizational development and change.

Short-term training and consultation activities in MART should be refocused to emphasize these management fields rather than technical subjects. PARC should strengthen the management of its own organizations along the same lines. Its leadership role in management is as important as its scientific excellence, since other organizations in the system need working models to emulate.

B. Recommendations

The following recommendations are summarized from information provided in the assessment of individual components and in other sections of the report. They are not prioritized, but are believed to be the most important feasible actions that can be taken in each area. Other recommendations and suggestions are included throughout the report.

1. Management

PARC has been given a substantial degree of autonomy, but has been slow to break away from the bureaucratic system. For the progress of Pakistan's agricultural prosperity, all research institutes need the delegation of administrative and financial authority. In spite of discouragingly slow progress, donors should continue to press for genuine autonomy for the research organizations they are assisting. We recommend that in the meantime PARC should get on with the essential steps that lie entirely within its authority. Specifically:

- o Review, decide and implement the recommendations of the Khattak and York reports.
- o Publish and distribute PARC/PAD after review to remove discrepancies.
- o Institutionalize job descriptions for all professional staff, prepared and negotiated at all supervisory levels.
- o Initiate a comprehensive training program for all supervisory levels in supervision and personnel management techniques, program planning, budgeting and monitoring, and principles of organizational development and change. This basic training is essential to build the confidence, responsibility and authority of the management cadre.
- o Undertake a very careful investigation of the management systems of the public sector to determine the areas of flexibility within that system and use it to inform all levels of management of the limits and range of their authorities.
- o Encourage other organizations to emulate the PARC/NARC example of promotion based on performance rather than seniority.
- o Strengthen the PARC Project Implementation Unit through advisory assistance to help develop a computerized monitoring and reporting system. A study tour to Egypt to observe the PIU established by the GOE Agricultural Research Center for the National Agricultural Research Program would be useful.

2. Information Transfer

a. Status

This component has probably been the most successful because the goals were clearly specified, the technical assistance was of high quality, and PARC was fully

committed to developing this program. The Multi-Media Production Center is under construction, the equipment is available or on order, a skeletal staff under a competent but inexperienced director is undertaking a practicum, information transfer training courses have been given to 250 individuals at national and provincial levels, and a Technical Transfer Coordination Committee is functioning. Considerable effort has been given to improving library information search capability, including bibliographic reference summaries.

b. Recommendations

- o Additional staff must be recruited as the Multi-Media Production Center nears completion.
- o The assignment of the information transfer advisor should be extended until at least June 1990, until the center is operational.
- o The incipient inventory of people, programs and resources available for work in information transfer at federal and provincial levels should be formalized.
- o Data base compatibility among library bibliographic programs should be assured, as well as in other areas where data bases and specialized computer programs are being developed.
- o Overseas degree training should be provided for five to nine participants from national and provincial levels in agricultural communications.
- o Over the long run, a balanced information focus is needed, with first priority given to serving scientists, but with attention also given to technical transfer to intermediate groups and to information for GOP decision-makers on the value of science to agriculture.

3. Training

a. Status

The participant training program is on track. Considerable documentation has been prepared to orient participants going to the United States for degree programs. The PARC Training Directorate has established a valuable computerized data base with information on participants overseas. Work is under way on constructing the addition to NARC Training Institute facilities. Seventy short courses have been conducted in-country under the MART project. This component has had difficulties related to unclear goals in the PP/PC-1, resignation of the long-

term advisor, and a general lack of understanding of the professional training/human resources development field.

b. Recommendations

- o The issues raised and recommendations made in Frank Byrnes' report should be digested and acted upon as soon as possible. PARC should provide leadership for agricultural research in the human resources development field. In doing so, it should make expanded use of innovative approaches, including recurrent TDYs, twinning arrangements with foreign institutions, and organizational development and change concepts.
- o High priority should be given to implementing a re-entry program for returning scholars and expanding the PARC Training Directorate data base.
- o A consultant should be brought in as soon as possible to help analyze the accumulated survey data, with priority given to developing institutional profiles. A national training plan should not be attempted at this time. Emphasis should be given to training plans for individual institutions, with priority given to NARC and The Agricultural University, Faisalabad.
- o PARC should establish a model computerized personnel data base that can be used by other research institutions and agricultural universities, providing a compatible system.
- o A systematic in-service training program is essential throughout the system. NARC's in-service capacity should be improved and used to assist provincial institutes and universities to organize and conduct this type of training.
- c International participant training needs include three Ph.D.s in continuing education-HRD management; five M.Sc.s in continuing education-teaching methods; and three trainers per year for short courses in training of trainers.

4. Arid Zone Research

a. Status

The objective of a fully functional, well-organized and well-managed Arid Zone Research Institute, staffed with competent professionals by the end of the contract, is not feasible by PACD. An estimated four to six years of additional technical and financial assistance will be required to achieve a stable, productive institute. Research has progressed as far as

can be expected in the current time frame of the project, given the staff constraints. Most research sections have been trying to conduct too many field trials, evaluating too many variables at too many locations for effective control. Work planning and reporting documents frequently do not provide a clear picture of the research being done or its expected impact. Current staff and advisers lack the competence to conduct reliable research in the important area of water harvesting. The staff structure proposed in the strategic plan is not related to prospective budgets, physical facilities or the availability of staff.

b. Recommendations

- o Prioritize research within subject matter areas, selecting for study only topics of significance that offer the promise of extendable results within a few years. Hire statistical consultants who can help design simple, effective field trials.
- o Bring new staff on board only to fill essential positions for priority research projects, as described in the professional job descriptions. Each proposed position must be scrutinized in light of anticipated budgets, urgent need, and the availability of highly qualified candidates.
- o Employ consultants with design and construction experience in water harvesting methods before expanding research in this subject. Soil problems affecting both water harvesting and crop production should be evaluated in conjunction with this research.
- o Review and revise the work planning and reporting forms to provide a clear, concise, and accurate presentation of essential material.

5. Coordinated Wheat and Maize Program

a. Status

Pakistani scientists are directly in charge of these programs, having demonstrated the capability for independent collection and maintenance of germ plasm, its manipulation to produce new varieties with desirable characteristics, and testing of their adaptability. There remains a serious gap between the yields obtained on station and by better farmers and national average productivity. The economics of production constraints and proposed solutions remain weaker points of this program. More precise definition of agroecological zones used in wheat and maize production was an intended, but incomplete output of this component.

b. Recommendations

- o Conduct a careful study of the yield gap to identify factors that may be responsible, and undertake specific interventions to overcome the problem. Some possible constraints are continued use of seed of traditional, non-resistant varieties (possibly reflecting the weakness of the seed industry); lack of access to other inputs (possibly reflecting lack of credit and/or delivery systems); and misuse of available water.
- o Continue the services of the agricultural economics advisor to work with AERUs to survey and analyze these problems until NARC's social science capability has been reinforced.

C. Larger Issues

During the course of this evaluation the team has become aware of several issues beyond the scope of PARC, which nevertheless affect its performance. We present them here in the hope this discussion will reinforce PARC's efforts to correct them.

1. Education Standards

The major institutional constraint on the progress of agricultural research in Pakistan is the low educational level of agricultural graduates. Our review of the research management component shows clearly that the nationally coordinated raising of standards in agricultural education must be a major target of further attempts to improve performance in agricultural research. The effort to raise the standards of agricultural education warrants the concentrated attention not only of educators and end users of graduates, but of national and provincial governments and of the donor community.

The recommendations of the "Report on Education in Pakistan" (1983) should be implemented with urgency and with financial support from the federal government.

2. Financing Agricultural Research

The financing of agricultural research is a matter of utmost importance. Donors recognize this far better than most national planners, and have been and may continue to be generous. This support cannot be allowed to obscure the value of research to the nation--a value that should be recognized in national budget allocations. Such recognition will have a salutary effect on donor funding.

- o PARC--as a council and its individual members--should focus and intensify efforts to orient the GOP and the provincial governments to the importance of their support for agricultural science--as reflected in important increases in financial support.
- o Donors should continue their support as long as necessary to achieve the sought-for result of a strong, cost-effective research system.
- o The argument for expanded, better allocated, more timely funding must be reinforced by strong efforts to achieve cost effectiveness by controlling program proliferation, limiting staff to a consistent staff:operations ratio of no more than 70:30, and establishing effective program monitoring and financial controls. These efforts should apply to all elements of the system.

3. Deterioration of Irrigated Land

For at least twenty years, attempts have been made to apply modern methods of irrigation management to Pakistan's ancient and incomplete system of canals and drains. These initiatives remain fragmented and divided by professional and administrative separation of engineering and agricultural agencies. Combined teams of agriculturists and engineers have worked in canal common areas for many years but have lacked research support in soil physics and plant physiology to define watering regimes that would avoid waterlogging and minimize salinity.

Given the seriousness of the continued loss of large acreages of arable land to waterlogging and salinity, we believe that cabinet-level attention should be directed at this problem with a view to assuring coordinated attention, whether in research, construction, or system management.

ANNEX A
STATEMENT OF WORK

This initial project evaluation focuses primarily on management and implementation issues. Key areas include a review of project management (including TA performance), an assessment of project progress to date, and recommendations regarding future directions and concerns.

The evaluation shall include but not necessarily be limited to the following areas:

1. Assess extent to which the project purpose is likely to be achieved by the PACE. Are project objectives being met as a measure against the project inputs and outputs described in the project paper and the GOP project document, the PC-1? What concrete evidence is there that the capacity of the national agricultural research system is being strengthened to effectively address the problems of management of research as described in the Project Paper?
2. Assess the extent to which policy and institutional changes, described as critical to the project, have been effected (including government support for agricultural research operating costs, success in meeting CP's and adequacy and timeliness of funding, etc.)
3. Assess progress to date at AZRI in designing and implementing meaningful research on problems of agricultural production of arid and high altitude areas of Baluchistan and other similar areas of Pakistan.
4. Assess the integration of agricultural research as supported by the the project with other research activities in irrigation, policy, forestry, etc. How can the institutional coordination be improved?
5. To what extent have on-farm/on-station research and outreach of the National Coordinated Wheat and Maize

Programs been improved to sustain and further build upon the past gains achieved in production of these commodities?

6. Assess the nature and effectiveness of the institutional relationships among major entities involved (USAID, GOP, Provincial Agricultural Research Institutes, Agricultural Universities, TA Teams, and other donors, etc.) in meeting the project purposes and outputs. Special attention is to be given to coordination with IBRD funded Agricultural Research Project-II (ARP-II).
7. Assess the extent to which the goals of the TA team of CIMMYT and ICARDA have been met, when measured against their terms of reference as described in their contract and indicated in their detailed plans of work (for the arid zone research and the wheat and maize coordinated programs).
8. Assess the effectiveness of long and short-term TA under the Winrock contract in establishing relationships with GOP counterparts and assisting in implementation of specific project activities (for the research management and administration, information transfer, and training for the agricultural research network components).
9. Briefly address the following "cross-cutting" evaluation issues general to all A.I.D. mid-term and final evaluations: (1) which benefits are likely to be sustainable after A.I.D. funding ends?; (2) what specific "Lessons Learned" can be applied to redesign or a similar project elsewhere?; and (3) how has the project had an effect on women?
10. Based on the findings presented above, assess the current status of the project and recommend possible modifications to improve overall project effectiveness.

A. Methods and Procedures - Detailed background information and data on planned and accomplished activities will be provided to the evaluation team by resource persons at USAID and PARC. A team planning meeting will be held on arrival in the mission. Team members will be required to work a six day work week for five weeks and present a draft report four days before the end of their assignment. The team leader will be required to stay in-country for up to one additional week to finalize and present the final report. Logistic support in Pakistan will be provided by USAID's Office of Agriculture and Rural Development and PARC. Work in Pakistan will be initiated by meeting with USAID staff to review and finalize the scope of work schedule and plan of operation.

ANNEX B

INDIVIDUALS INTERVIEWED

At Chemonics/Washington

Dr. Richard Harwood, Winrock International Project Officer
Mr. Allan Hankins, former USAID/Pakistan ADO, ret.
Mr. Dean Alter, Project Technical Support Officer, ANE
Mr. Chris Hermann, AID/ANE Evaluation Specialist

PARC

Dr. Amir Muhammed, Chairman, PARC
Mr. Sahbzada Muhammad Ayaz, Member (Finance)
Dr. Abdus Salam Akhtar, Member (Animal Sciences)
Dr. M. Hanif Qazi, Member (Crops Sciences)
Dr. G. R. Sandhu, Member (Natural Resources)
Dr. Agha Sajjad Haider, Member (Social Sciences)
Mr. Manzur Ahmed, Consultant Coordinator
Mr. Abdul Hafeez, Director (Training)
Mr. Idrees Anyum, Director (Civil Works)
Mr. Aslam Kiani, Deputy Secretary, ARD
Mr. Liaqat Hussain, Senior Procurement Officer
Mr. Muhammad Shafi, Director (Finance)
Dr. Muhammad Iqbal, Director (Planning)
Ms. Shahida Jamil, Deputy Chief (Planning)
Dr. Abdul Sattar Alvi, Project Secretary (MART)
Mr. Sheikh M. Kamal, Scientific Officer, MART Project
Dr. Jabbar, Program Officer, PIU
Mr. G. N. Shahid, Director of Personnel
Dr. Malik Mushtaq Ahmed, Director, Publications Division

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ANNEX C

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