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No. 3

BANGLADESH

THE EVOLUTION AND SIGNIFICANCE OF ON-FARM AND FARMING SYSTEMS RESEARCH IN THE BANGLADESH AGRICULTURAL RESEARCH INSTITUTE

by

M.A. Jabbar

and

Md. Zainul Abedin

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International Service for National Agricultural Research

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Special Series on the Organization and Management of
On-Farm Client-Oriented Research (OFCOR)

OFCOR — Case Study No. 3

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April 1989

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INTRODUCTION TO THE ISNAR STUDY ON ORGANIZATION AND MANAGEMENT OF ON-FARM CLIENT-ORIENTED RESEARCH

Deborah Merrill-Sands
Study Leader

Introduction

In 1986, ISNAR initiated a major study on the organization and management of on-farm, client-oriented research (OFCOR) in national agricultural research systems. The study was developed in response to requests from leaders of national research systems for advice in this area and was carried out with the support of the Government of Italy and the Rockefeller Foundation. The objective is to analyze the critical research policy, organizational and managerial factors which affect national agricultural research institutes' capacities to integrate and sustain on-farm, client-oriented, research as a stable and productive component of the research process.

What is on-farm, client-oriented, research?

On-farm, client-oriented, research (OFCOR)[1] is designed to help research systems meet the needs of specific clients, most commonly resource-poor farmers. It complements -- and is dependent upon -- experiment station research. It involves a farmer-oriented philosophy, a specific research approach and methods, and a series of operational activities carried out at the farm level. These activities range from diagnosis and ranking of problems through the design, development, adaptation, and evaluation of appropriate technological solutions. Farmers are directly involved at various stages in the process.

In this study, on-farm, client-oriented, research programs are analyzed in terms of the functions this type of research can perform within the larger research and extension process. We have identified the following seven potential functions as a framework for analyzing the organization and management of a range of on-farm research programs in nine national agricultural research systems. The functions are:

1) to support within research a problem-solving approach, which is fundamentally oriented toward farmers as the primary clients of research;

2) to contribute to the application of an interdisciplinary systems perspective within research;

3) to characterize major farming systems and client groups, using agroecological and socioeconomic criteria, in order to diagnose priority production problems as well as identify key

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1/ We have used the generic term "on-farm, client-oriented, research" (OFCOR) as distinct from "farming systems research" (FSR) because the latter has come to have too many different and confusing meanings.

opportunities for research with the objective of improving the productivity and/or stability of those systems;

4) to adapt existing technologies and/or contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems by conducting experiments under farmers' conditions;

5) to promote farmer participation in research as collaborators, experimenters, testers, and evaluators of alternative technologies;

6) to provide feedback to the research priority-setting, planning and programming process so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs;

7) to promote collaboration with extension and development agencies in order to improve efficiency of the technology generation and diffusion processes.

Why is organization and management of on-farm, client-oriented, research important?

Over the last 15 years, many national agricultural research systems have set up on-farm research programs of varying scope and intensity to strengthen the link between research and farmers -- particularly resource-poor farmers. While significant attention has been given to developing on-farm research methods, provisions for fully integrating this approach within the research process have been inadequate and the institutional challenge often underestimated. With the accumulation of experience, it is clear that national research systems have confronted significant problems in implementing and effectively integrating on-farm, client-oriented, research into their organizations. In many cases, these programs have become marginalized and have not had the intended impact on the research process.

Improved organization and management are crucial to overcoming these problems. Effectively integrating on-farm research programs with a strong client orientation within a research system implies forging a new research approach which complements and builds on existing research efforts. This is no small task. It involves establishing new communication links between researchers of diverse disciplines, extension agents, and farmers. It requires hiring people with the right skills or systematically training existing staff. It requires changes in planning, programming, review, and supervisory procedures. It creates increased demands for operational funds and logistical support for researchers working away from headquarters. And, it often involves working with one or more donor agencies. All of these make the management of OFCOR more demanding than that of traditional experiment station research.

This study focuses directly on these issues of implementation and institutionalization. We have analyzed and synthesized the experiences of diverse national research systems in which on-farm, client-oriented, research programs have been established for at least five years. The intention is to provide a body of practical

experience upon which research managers can draw as they strive to strengthen on-farm research as an integral part of their research systems.

Operational strategy and products of the study

Our approach has been to learn from the experiences of research managers in national agricultural research systems. We have built the analysis around case studies of nine countries whose national research systems have had sufficient time to experiment with and develop diverse organizational arrangements and management systems for implementing on-farm, client oriented, research. By region, the countries are as follows:

Latin America: Ecuador, Guatemala, Panama.

Africa: Senegal, Zambia, Zimbabwe.

Asia: Bangladesh, Indonesia, Nepal.

The case studies are stand-alone products. Each is a comprehensive analysis developed by a team of national researchers with personal experience in the individual on-farm research programs. The cases provide important insights and lessons on the general issues, as well as specific guidance for research policy and the organization and management of on-farm research in their countries. The cases will be published in 1988 and 1989. A list of the reports follows.

Comparative study papers providing a systematic analysis across the case studies are a second product of the study. Synthesizing the experience of case study research institutions, these papers provide practical advice to research managers on organizational and managerial issues central to integrating on-farm research focused on resource-poor farmers within their research systems. The themes developed are:

* Alternative arrangements for organizing on-farm, client-oriented research: comparative strengths and weaknesses
* Integrating on-farm and experiment station research: organizational and managerial considerations
* Organization and management of resource-poor farmer collaboration in research
* Organization and management of linkages between on-farm research and extension
* Organization and management of field activities
* Development and management of human resources for on-farm, client-oriented, research
* Financial resource use and management in on-farm research
* Management of relations with donors and external sources of knowledge
* Issues in the institutional development of on-farm, client-oriented, research in national agricultural research systems.

We expect these papers to be published during 1988 and 1989. They are working papers presenting results of the analysis of the nine concrete case study situations. At this stage, they are intended to stimulate discussion and debate; they are not presented as "state-of-the-art" pieces on these topics.

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OVERVIEW OF THE NINE CASE STUDIES

Deborah Merrill-Sands
Study Leader

The on-farm, client-oriented, research efforts reviewed in the cases vary in scope, the emphasis assigned to different objectives and functions, and the specific methodologies employed. They all conform, however, to the general definition of on-farm, client-oriented, research developed for this study. The cases reflect a variety of institutional settings and strategies for introducing and developing on-farm research. They also reflect the broad range of models used in the organization and management of on-farm research. The profiles below highlight the salient features of each case and Table I provides some key descriptive indicators for comparison across cases.

Latin America

Ecuador:

On-farm, client-oriented, research is conducted by the Production Research Program (PIP, Programa de Investigación en Producción), an autonomous program within the Instituto Nacional de Investigaciones Agropecuarias (INIAP). It has two national coordinators responsible for the highland and coastal macro-regions and 10 regional field teams assigned to different provinces under the administrative auspices of regional experiment stations. Five teams are associated with integrated rural development programs.

Initiated in 1977 with support from CIMMYT, the case allows us to trace the evolution of the organization and management of an on-farm research program from its origins as a pilot project through to its institutionalization as a full-fledged national program.

Guatemala:

A client-oriented research philosophy pervades Guatemala's 16-year-old agricultural research institute, the Instituto de Ciencias y Technología Agrícolas (ICTA). Two units, however, are specifically charged with carrying out the functions of on-farm, client-oriented, research: the Technology Testing Department and the Socioeconomics Department. The first is responsible for testing in on-farm trials all technology developed by the commodity programs. The second conducts diagnosis, on-farm monitoring, and special studies.

The 14 Technology Testing Teams are made up of scientists and technicians whose research is coordinated from regional stations, but who live and work in designated research areas. The Socioeconomics Department is organized at the national level with

representatives in some of the regions. Almost all scientists in the department are agronomists with training in social science methods. Coordination between the two departments is limited.

ICTA's experiences with on-farm research have had a major informative influence on other countries. What makes the Guatemala case especially is that on-farm, client-oriented, research was not appended onto an existing system. Rather, ICTA was set up from the beginning to incorporate such an approach. Moreover, the ICTA case also allows us to examine the organization and management of on-farm research within a regionally organized research system. This is important because a regionalized research system has generally been regarded as the institutional setting most compatible with the organizational requirements of on-farm, client-oriented, research.

Panama:

In the late 1970s, the Instituto de Investigación Agropecuaria de Panamá (IDIAP) developed a "national plan" through which priority areas for on-farm research were selected. On-farm research is implemented in some of these areas as part of the regular research programs of scientists who also work on-station. In other areas, it is implemented through projects with full-time staff, developed in collaboration with international agricultural research centers. The projects are variable in organization and operations, and there is no mechanism at the national level for coordinating the diverse on-farm research efforts. What is particularly interesting about Panama's experience is the institutionalization of on-farm, client-oriented, research as a research strategy, rather than as a formal program with a discrete on-farm research unit or units.

Africa

Senegal:

The Department of Rural Sociology of the Institut Sénégalais de Recherches Agricoles (ISRA) initiated an on-farm, client-oriented, research program in 1978. It is now part of the Department of Production Systems and Technology Transfer (DRSP, Département des Recherches sur les Systèmes de Production et le Transfert de Technologies en Milieu Rural), one of the four main research departments established in 1982 after a major reorganization of ISRA under the auspices of a World Bank project. The DRSP consists of a Central Systems Analysis Group (GCAS, Groupe Central d'Analyse Systèmes), three multidisciplinary research teams located at regional stations, a Bureau of Macro-economic Analysis (BAME, Bureau d'Analyses Macro-Economiques), and a division of thematic research. The case focuses on the on-farm, client-oriented, research part of the DRSP, namely the GCAS and the three regional teams.

Senegal is an interesting case because the classic regional team model for implementing on-farm, client-oriented, research was modified to include a core multidisciplinary group of scientists, the GCAS, which supports the work of the teams. Also of interest is Senegal's experience blending francophone and anglophone approaches to on-farm research.

Zambia:

The Adaptive Research Planning Team (ARPT) conducts on-farm, client-oriented, research in Zambia. The ARPT, initiated in 1980, is a national research program under the Research Branch of the Ministry of Agriculture. It is of equal status to and complements the national commodity programs. The ARPT comprises a national coordinator, based at the central research station, and seven teams of scientists and field technicians at provincial experiment stations. Each team is funded by a different donor.

ARPT includes two important innovations: the formal integration of sociologists and the inclusion of research-extension liaison officers in the teams.

Zimbabwe:

Zimbabwe's Department of Research and Special Services (DR & SS) adopted on-farm, client-oriented, research in 1980 as a strategy for reorienting research to meet the needs of small farmers in the communal areas. This was in response to the post-independence national policy to emphasize agricultural development for this sector.

There is no integrated on-farm research program. Several research institutes and stations and a specialized Farming Systems Research Unit (FSRU) have developed independent initiatives. The case study examines on-farm, client-oriented, research in the Farming Systems Research Unit and four institutes -- the Cotton Research Institute, the Agronomy Institute, the Crop Breeding Institute, and a regional research station. This provides us with an unusual opportunity to analyze the implementation and integration of on-farm research under several distinct models for organizing research, but all within a single institution.

In the institutes, individual scientists carry out both on-farm and station-based research, while scientists in the FSRU specialize in on-farm research. The FSRU consists of a core multidisciplinary team based at the central station and two regional teams staffed by technicians. Their research has had a strong systems perspective emphasizing crop-livestock interactions.

Asia

Bangladesh:

The Bangladesh case study concentrates on the on-farm research activities of the Bangladesh Agricultural Research Institute (BARI), the largest unit of the NARS. The On-Farm Research Division (OFRD), created in 1985, has the exclusive mandate for on-farm research in BARI. On-farm research teams are located at 23 stations and substations, from which they direct technicians in 11 farming system research sites and 83 multi-locational testing sites.

The OFRD subsumed four distinct older programs: multi-locational testing of the Soil Fertility and Soil Testing Institute (later

renamed the On-Farm Trials Division); cropping system research on the IRRI model; varietal testing and verification of the wheat program; and the adaptive research of the T & V Extension Research Program. An important aspect of the Bangladesh case study is its analysis of the consolidation of these different approaches to OFCOR under common management.

Indonesia:

On-farm, client-oriented, research is implemented in Indonesia's Agency for Agricultural Research and Development (AARD) in sub-programs of the commodity institutes, and also in multi-institute projects organized at the AARD level. The case study focuses on two examples of each major type.

The multi-institute projects are an interesting institutional innovation. These projects are staffed by senior scientists seconded from the participating institutes. They maintain contact with their home institutes and return to them at the end of the project. We wanted to examine this arrangement because of its potential for building strong links between on-farm research and station-based specialist scientists, as well as for the long-term integration of the on-farm, client-oriented, research philosophy and methodology within the national research system.

The gradual evolution of on-farm, client-oriented, research in the national research system is another important aspect of the Indonesian experience. Starting as an informal program of one institute in the early 1970s, on-farm and systems research methods were slowly integrated into other commodity institutes. Specialized teams have only been developed since the early 1980s. On-farm, client-oriented, research in Indonesia has been a national initiative which has drawn on a number of approaches, particularly that of the Asian Cropping Systems Network developed in association with International Rice Research Institute.

Nepal:

On-farm research programs of different types have existed in a variety of institutions in Nepal since the early 1970s. Out of the diverse settings of on-farm research in Nepal, we chose five subcase studies which illustrate the major models of organizing on-farm client-oriented, research:

-- OFCOR implemented through a commodity program -- the National Rice Improvement Program;
-- OFCOR implemented through a cropping systems program;
-- OFCOR implemented through a specialized unit -- the Farming Systems Research and Development Division (FSR & DD), supported by a separate socioeconomics division;
-- OFCOR implemented as a generalized strategy in two small, externally funded, regional research institutes -- Lumle Agricultural Research Centre and Pakhribas Agricultural Centre.

The contrast between the on-farm, client-oriented, research programs of the national research system and those of the externally funded institutes make Nepal an especially interesting case.

Descriptive indicators of the nine OFCOR studies

Case Studies	National Agricultural Research System		Organization of OFCOR	Years in Operation [3]	Scale of OFCOR: (Scientist Years)	
	Institutional Type	Organization of Research Program			OFCOR as % of NARS Human Resources	Size of OFCOR effort
Ecuador	Semiautonomous institute (INIAP)	Regional research stations/commodity programs	Production Research Program (PIP)[b]: National program with two coordinators and 10 teams based at regional research stations.	9	6	14
Guatemala	Semiautonomous institute (ICTA)	Regional research programs/commodity programs	Technology Testing Department with 14 field teams in 6 regions and national socioeconomics department with limited regional representation.[c]	14	34	65
Panama	Semiautonomous institute (IDIAP)	Commodity programs/ regional offices	National OFCOR plan identified target regions where OFCOR is implemented through special FSR projects or part-time on-farm research.	7	16	24
Senegal	Semiautonomous institute (ISRA)	Multi-commodity departments/ regional stations	OFCOR, located within Department of Production Systems Research and Technology Transfer (DRSP)[d], consists of 3 regional teams and a Central Systems Analysis Group.	4	13	22
Zambia	Ministry (MAWD)	Commodity and factor programs	OFCOR program with national coordinator and 7 provincial teams at regional stations.	6	20	38[h]
Zimbabwe	Ministry (MLARR)	Commodity and disciplinary based institutes and stations	OFCOR implemented by: - 8 research institutes/stations with combined on-station/on-farm research programs; - Farming Systems Research Unit (FSRU) based at central station with two regional teams.	6	18	26
Bangladesh[1]	BARI, semiautonomous institute of larger NARS with council	Disciplinary departments/ commodity programs	On-Farm Research Division (OFRD), with Central Management Unit at headquarters and 24 teams deployed through BARI's network of regional stations, has official mandate for on-farm research . Consolidation of previous OFCOR efforts.	9[e]	12	104
Indonesia[2]	Ministry, Dept. of Research (AARD) with multiple institutes and coordinating bodies	Commodity-based regional institutes	Two principal modes of implementation: - Research institutes conduct OFCOR as part of regular programs; - OFCOR projects organized at AARD level with staff seconded from multiple institutes.	11[f]	n/a	57[i]
Nepal[2]	I . NARS: ministry II. LAC and PAC:[a] externally funded autonomous institutes	I. Commodity programs / disciplinary departments II. LAC: Multi-disciplinary research thrusts PAC: Disciplinary departments	I. - Farming Systems Research and Development Division (FSR&DD) with 6 FSR sites, supported by Socio- Economics Research and Extension Division (SERED); - Commodity programs with multi-locational testing and outreach programs. II. LAC and PAC, regional institutes with OFCOR as a generalized research strategy.	14[g]	n/a	35[i]

NOTES FOR TABLE I

1. The case study is limited to the Bangladesh Agricultural Research Institute (BARI), the largest of the 5 institutes coordinated by the Bangladesh Agricultural Research Council (BARC).

2. Data refers only to the sub-case studies unless otherwise indicated; NARS-wide data not available.

3. Base year for all statistical data is 1986.

a. Lumle Agricultural Center and Pakhribas Agricultural Center.

b. Programa de Investigación en Producción.

c. The Spanish names for these departments are Prueba de Technología and Socioeconomía.

d. Département de Recherche de Systèmes de Production et Transfert de Technologies en Milieu Rural.

e. Refers to NARS. Several OFR programs with complex histories operate within BARI. The oldest, the On-Farm Fertilizer Program dates back to 1957. This program was reorganized in the late 1970's, about the same time Cropping Systems Research was established in BARI. The OFRD was not formally consolidated until 1984.

f. Refers to NARS. In 1973, multiple cropping research in the Central Research Institute for Food Crops took on a systems orientation and was renamed cropping systems research (CSR). CSR moved onto farmers' fields in 1975.

g. Refers to NARS. Cropping/farming systems research was initiated 9 years ago. On-farm rice research is 14 years old.

h. Includes 6 Research-Extension Liaison Officers seconded from extension.

i. Represents totals for sub-case studies only. Not directly comparable to other NARS-wide data.

LIST OF CASE STUDY REPORTS

-- Zambia: Organization and Management of the Adaptive Research Planning Team (ARPT), Research Branch, Ministry of Agriculture and Water Development. (S.A. Kean and L.P. Singogo) OFCOR Case Study No. 1. Now available.

-- Zimbabwe: A Case Study of the Organization and Management of Five On-Farm Research Programs in the Department of Research and Special Services, Ministry of Agriculture. (M. Avila, E.E. Whingwiri, and B.C. Mombeshora)

-- Sénégal: Organization et Gestion de la Recherche sur les Systèmes de Production, Institut Sénégalais de Recherches Agricules (ISRA). (J. Faye and J. Bingen)

-- Ecuador: Un Estudio de Caso de la Organización y el Manejo del Programa de Investigación en Finca de Productores en el Instituto National de Investigaciónes Agropecuarias (INIAP). (R. Soliz, P. Espinosa, and V.H. Cardoso)

-- Guatemala: Organización y Manejo de la Investigación en Finca en el Instituto de Ciencia y Technología Agrícolas (ICTA). (S. Ruano and A. Fumagalli) OFCOR Case Study No. 2. Now available.

-- Panamá: Un Estudio de Caso de la Organización y el Manejo del Programa de Investigación en Finca de Productores en el Instituto de Investigación Agropecuaria de Panamá (IDIAP). (M. Cuellar)

-- Bangladesh: A Case Study of the Evolution and Significance of On-Farm and Farming Systems Research in the Bangladesh Agricultural Research Institute (BARI). (M.A. Jabbar and Md. Zainul Abedin) OFCOR Case Study No. 3. Now available.

-- Indonesia: A Case Study of the Organization and Management of On-Farm Research in the Agency for Agricultural Research and Development, Ministry of Agriculture. (J. Budianto, I.G. Ismail, Siridodo, P. Sitorus, D.D. Tarigans, A. Mulyadi, Suprat)

-- Nepal: A Case Study of the Organization and Management of On-Farm Research in Nepal. (B.N. Kayastha, S.B. Mathema, and P. Rood).

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

TABLES

FIGURES

PREFACE

This study was conducted under a collaborative agreement between ISNAR and the Bangladesh Agricultural Research Council with funds provided by ISNAR. The objectives of the study were:

1. to describe and understand the development of farming systems research principles, procedures, methods, and organizational structures in the Bangladesh Agricultural Research Institute through an analysis of:

    a) the historical development of on-farm and farming systems research in BARI;

    b) the way in which organizational structures and management methods have changed, including the reasons for, and problems encountered in, these changes and the implication of this development;

2. to synthesize the organizational and management lessons to be learned from the BARI experience.

The report is in five chapters, following guidelines provided by ISNAR. We are extremely grateful to ISNAR and the Bangladesh Agricultural Research Council for sponsoring this study and for inviting us to conduct it. We are grateful to Dr. Deborah Merrill-Sands, ISNAR OFCOR Project Coordinator, for her guidance, assistance and suggestions throughout the period of this study including comments on an earlier draft. Dr. M. M. Rahman, Executive Vice-Chairman, Bangladesh Agricultural Research Council, has coordinated and supervised the work and he also provided valuable suggestions and criticisms on an earlier draft. Dr S. D. Biggs, University of East Anglia, UK, and Professor Anil Kumar Gupta, Indian Institute of Management, Ahmedabad, were designated advisors for this study. We are grateful to both of them for providing valuable advice at various stages of the study and also for critical comments on earlier drafts. Dr Bruce Currey, Program Leader, Human Resource Development Program, Winrock International, Bangladesh, also provided valuable comments on an earlier draft. We also benefited from comments from the workshop participants. We are grateful to the staff of the On-Farm Research Division, and senior scientists in the Bangladesh Agricultural Research Institute, the Bangladesh Agricultural Research Council, and other organizations for giving us data, interviews, and other assistance. However, we alone are responsible for the views expressed and the remaining errors and deficiencies.

The revised version of this study was prepared while the first author was enjoying a Hallsworth Research Fellowship in the Department of Agricultural Economics at the University of Manchester. He is grateful to the Trustees of the Fellowship for allowing him to spend considerable time away from the original workplan.

Special thanks are due to Mr. Abdul Matin at the Bangladesh Agricultural University for typing the drafts and to Jennifer Vaughan and Judy Darnton at the University of Manchester for typing the final version.

M.A. Jabbar
Md. Zainul Abedin

Dr. M.A. Jabbar is currently an Associate Professor in the Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh. He joined the department as a Teaching Fellow in 1969 while doing a Masters degree in the same department. He obtained a PhD in Agricultural Economics from the University of Wales in 1976.

He has published extensively on a variety of subjects including land tenure and productivity, mechanization, employment, crop-livestock interaction, and agricultural policy. One of his current area of interest is the assessment of the process of generation and diffusion of agricultural technology. He has done short-term consultancies for the Bangladesh Government, the United Nations Development Program, the International Labour Office, Winrock International, Deutsche Gesellschaft für Technische Zusammenarbeit, and the Intermediate Technology Development Group. He was a Nuffield Fellow at the University of Manchester in 1987/88.

Dr. Md. Zainul Abedin graduated from Bangladesh Agricultural University, Mymensingh in 1968 and he obtained a Masters degree in Agronomy from the same University in 1969. He obtained a PhD in Crop Production from Agricultural University, Prague in 1976.

Before joining the agronomy division of the Bangladesh Agricultural Research Institute in 1977, he worked in the Department of Agricultural Extension, Bangladesh Agricultural Development Corporation and a Non-Government Rural Development organization in various capacities. Since 1979, he has been involved in on-farm and farming systems research and is currently the Chief Scientific Officer and Head of the On-Farm Research Division in BARI.

LIST OF ACRONYMS

BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARD	Bangladesh Academy for Rural Development
BARI	Bangladesh Agricultural Research Institute
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRRI	Bangladesh Rice Research Institute
CIMMYT	International Maize and Wheat Improvement Center
CSR	Cropping Systems Research
FAO	Food and Agriculture Organization
FRI	Fisheries Research Institute
FSR	Farming Systems Research
GOB	Government of Bangladesh
IADS	International Agricultural Development Service
IDA	International Development Agency
IDRC	International Development Research Center
IRDP	Integrated Rural Development Program
IRRI	International Rice Research Institute
NORAD	Norwegian Ministry of Development Cooperation
OFCOR	On-farm Client Oriented Research
OFR	On-Farm Research
OFRD	On-farm Research Division
OFTD	On-farm Trials Division
UNDP	United Nations Development Programme
USAID	United States Agency for International Development

Currency Equivalents

The following are average annual exchange rates for selected years.

	US Dollar	Taka
1979	$ 1.00	Tk 15.643
1980	$ 1.00	Tk 16.250
1981	$ 1.00	Tk 18.085
1982	$ 1.00	Tk 22.119
1983	$ 1.00	Tk 24.901
1984	$ 1.00	Tk 30.625

CHAPTER ONE

NATIONAL CONTEXT FOR AGRICULTURAL RESEARCH

BRIEF OVERVIEW OF BANGLADESH AND ITS ECONOMY

Bangladesh is one of the world's most densely populated and impoverished countries. An estimated 101.7 million people live in an area of 143,998 sq km, an average density of about 700 persons per sq km (data for 1985/86) (Table 1). Eighty percent of the population resides in rural areas and is reasonably well distributed geographically except in the Chittagong Hill Tracts, which are sparsely populated by ethnic minorities. Bengali is the mother tongue, currently the official language and the medium of instruction in the country. English is the second most important language and until recently was the official language. Arabic is taught as a religious language.

Table 1: Basic Demographic Statistics

Population (1985/86)	101.7 million
Population density	706 per km^2 (including rivers) 756 per km^2 (excluding rivers)
Population growth (1961-1974)	2.6%
(1974-1984)	2.3%
Crude birth rate (per thousand)	33
Crude death rate (per thousand)	12
Average life expectancy	54.0
Religion	
Muslims	86.6%
Hindus	12.1%
Buddhists	0.6%
Christians	0.3%
Ethnic minorities	0.4%
Literacy rate (5 years and over)	23%
Urban population as percent of total	18%[1]

Note: 1) World Bank, 1988.
Source: GOB, 1985a and 1986c.

Level of Socio-Economic Development

Bangladesh is classified as a low-income economy by The World Bank (World Bank, 1988). During 1985/86, the total GDP at current prices was 405.5 billion taka or US$15 billion and the per capita GDP was US$143 (GOB, 1986c). At constant 1972/73 prices, GDP grew at the rate of 6.1% during the First Five-Year Plan period (1973-78), 3.5% during 1978-80, and 3.8% during the Second Plan period (1980-85) (GOB, 1985). The average annual growth rate of per capita GDP, however, was only 0.4% between 1965 and 1986 (World Bank, 1988).

Although total food production has failed to keep pace with population growth since separation from Pakistan, there is wide evidence of inadequate nutrition, and disease arising from malnutrition is rife. According to the 1981/82 household expenditure survey, the average daily intake of calories was about 87% of adult requirements. A 1975/76 nutrition survey revealed that the average calorie intake for children up to 15 years of age did not meet minimum requirements and that among children up to five years of age, 16% suffered from acute and chronic malnutrition. This situation has deteriorated further in recent years.

Agriculture is the largest sector of the economy, contributing 48% to GDP in current prices (Table 2), and accounting for approximately 80% of exports. The sectoral share of agriculture showed a

Table 2: Percentage Sectoral Shares of GDP, in Current Prices for Selected Years

Sector	1972/73	1976/77	1981/82	1984/85
Agriculture	57.9	50.9	48.8	48.4
Crops	43.8	38.1	36.6	36.5
Forestry	2.8	2.0	2.9	3.7
Livestock	4.9	4.3	6.0	4.8
Fisheries	6.4	6.5	3.3	3.4
Industry	10.1	13.9	15.5	14.5
Mining and manufacturing	6.4	8.2	9.7	8.6
Construction	3.4	5.5	5.5	5.3
Electricity and gas	0.3	0.2	0.3	0.6
Services	32.0	35.2	35.7	37.1
Transport and communication	7.5	7.0	10.1	6.8
Trade	8.5	9.9	9.8	8.8
Banking and insurance	1.2	1.0	1.1	1.5
Housing	5.4	7.6	6.4	6.9
Others	9.4	9.7	8.3	13.1
Total	100.0	100.0	100.0	100.0

Source: Wennergren et al., 1984.

significant decline during the last decade in spite of a rise in agricultural output. The reduction was due to greater relative increases in output by the other sectors, primarily services.

Bangladesh faces a difficult situation with foreign trade and balance of payments: foodgrains, industrial raw materials, and numerous items important for human welfare are imported. But with jute and jute goods, manpower, tea, and hides and skins the major exports, the country lacks an extensive export base. Since 1973, the balance of payments on current account has been negative each year: the deficit increased from US$361 million to US$1.5 billion in 1986 (GOB, 1986b).

Administration

Bangladesh is divided into four administrative divisions, 64 districts, 495 upazilas, 4,472 unions, and 85,650 villages. Civil, police, and judicial departments, and nearly all development and supply agencies, have networks up to the upazila level. Few government departments, e.g., agricultural extension, public health, and land revenue, have networks as far as union level. At district and upazila levels, the heads of most departments enjoy similar pay and status but the Chief of Civil Administration has been given the power to coordinate and supervise the work of other departments and agencies. This has been a source of conflict between civil and professionally oriented departments and has been hindering development works to some extent.

AGRICULTURE AND DEVELOPMENT

Overview of Agricultural Sector

Agriculture is the largest sector, both in terms of its share in GDP and in employment. The 1983/84 labor force survey showed that 58.7% of the national and 66.7% of the rural employed population, age 15 years and above, were engaged in agriculture. The crop sector alone accounted for 36.5% of GDP and 70% of rural employment. Unemployment, measured in terms of person-days of work offered but not used, was estimated to be 39% of the agricultural labor force and 31% of the total labor force for 1976 (Clay & Khan, 1977). Other micro estimates show still higher unemployment rates, which are not unrealistic because about 50% of rural households are now landless and most adults migrate seasonally to urban or other areas for work.

Government Agricultural Policy

Since Bangladesh's First Five-Year Plan (1973-78), the main objectives of government agricultural policy have been to achieve self-sufficiency in foodgrains as quickly as possible, and to create employment opportunities in order to provide adequate income and basic necessities to the masses. To achieve these objectives, expansion of the use of high-yielding varieties (HYV) of seed, along with fertilizer and irrigation, has been the strategy. This technology was expected to improve the efficiency of to both land and labor use. However, neither objective has been achieved. Over

the years, Bangladesh has acquired a chronic food deficit, increasingly relying on foodgrain imports to sustain its rapidly growing population at minimum caloric levels. Foodgrain imports averaged 9% of domestic production during the 1960s, 15% during the 1970s, and about 18% during the first half of the 1980s. On the other hand, dietary levels have worsened. Nutrition surveys have shown that between 1962/64 and 1975/76, daily per capita consumption of cereals, animal products, and vegetables decreased by 2.5%, 23.3%, and 2.5%, respectively (Dhaka University, 1977). The decline for the poorest section of the population is likely to be even higher. Thus, inadequate consumption of basic foods is a more serious dietary problem than simply the underconsumption of nutrients (proteins and vitamins, etc.).

Public Investment in Agriculture

The government's policy objectives for agriculture have not been matched by its investment in this sector. For example, during the Second Five-Year Plan (1980-85), 34.6% of total public-sector expenditure was allocated for agriculture, irrigation, and rural development, but actual expenditure was 29.8%. For the Third Five-Year Plan (1985-90), only 28.2% of public-sector expenditure has been allocated for agriculture, water resources, and rural development. Total planned expenditure is 70.6 billion taka (US$2.5 billion) or US$277 per ha over the Plan period (GOB, 1985b). Expenditure on rural development is for creating institutions, structures, and services, so it may not directly contribute to agricultural production. Actual productive expenditure per hectare will therefore be much lower than $277.

The pattern of public-sector expenditures as shown in Table 3 gives some indication of government activities in crop production, livestock, fisheries, and forestry. The major shift in agricultural policy in recent years has been to reduce subsidies on inputs, to privatize the ownership and distribution of agricultural equipment and inputs, and to increase expenditures on general rural development activities such as creating local government institutions. Expenditure son research and education have been substantially increased.

Agricultural Land

Land is the scarcest resource in Bangladesh; 63% of the total land is arable and per capita arable land in 1985/86 was only 0.09 ha. Harvested or gross cropped area is 1.53 times the cultivation, giving an average intensity of cultivation of 153%. At present, about 14% of gross cropped area or 22% of cultivated area is irrigated. There is no land classified as pasture but 5.6% of the total land is classified as cultivable waste and fallow where animals (cattle, buffalo, goats) scavenge.

Land is fairly homogeneous in the sense that except for some small hills and high land in the northeastern and southeastern parts of the country, the country consists of plains. But there are enormous regional variations in elevation, fertility, and soil composition which have implications for farming activities and productivity. Farming in the flood-prone areas is very risky. The climate is warm and humid. Maximum temperatures range between the low 40s in summer

Table 3: Public-Sector Expenditure in Agriculture during the Second and Third Five-Year Plans

Sector and Program	1980/85 (actual) Million taka	%	1985/90 (planned) Million taka	%
Crop Sector				
Fertilizer subsidy and distribution	4,743.4	31.97	1,500.0	10.64
Seed subsidy and distribution	1,363.3	9.19	1,765.9	12.52
Plant protection	74.9	0.50	200.0	1.42
Fertilizer warehouse construction	1,784.4	12.03	311.0	2.21
Food warehouse construction	2,805.3	18.91	1,478.3	10.48
Extension services	1,613.4	10.88	2,053.3	14.56
Research	1,236.2	8.33	2,094.4	14.86
Education and training	388.7	2.57	1,225.5	8.69
Marketing, information, census	85.2	0.57	85.0	0.67
Others	748.8	5.05	876.6	6.22
Upazila/area development	-	-	2,500.0	17.73
Total	14,835.6	100.00	14,100.0	100.00
Irrigation and Flood Control				
Large projects	-	-	19,400.0	61.3
Small-scale projects	-	-	11,130.0	35.2
Survey, investigations, etc.	-	-	1,100.0	3.5
Total	19,110.0	100.00	31,630.0	100.0
Livestock				
Research and training	-	-	327.0	13.3
Other	-	-	2,123.0	86.7
Total	579.7	100.00	2,450.0	100.0
Fishery				
Research, education, training	-	-	570.0	16.3
Extension	-	-	420.0	12.0
Other	-	-	2,510.0	71.7
Total	1,583.0	100.00	3,500.0	100.0

Source: GOB, 1985b.

to the high 20s (centigrade) in winter when minimum temperatures reach near 0°. Geographical differences are not great but higher temperatures tend to occur in the west and north. Average annual rainfall varying from 140 to 366 cm is a highly critical risk factor in crop production. The level of rainfall tends to decrease from east to west. The heaviest rains occur during the monsoon months from late May to early October. December to March are the driest months. These variations in rainfall also have a major influence on seasonal cropping patterns.

Agricultural Production

Crop-livestock mixed farming predominates in Bangladesh. Rice, the major crop, is grown in three principal seasons -- Aus, Aman, and Boro[1]. Jute, wheat, sugarcane, potato, tobacco, tea, oilseeds, pulses and vegetables are also important (Table 4). During 1967-82, crop production increased by only 1.2% annually, 49% of which came from increased productivity, 34% from increased area or changes in cropping pattern, and 17% from area-productivity interaction. Only rice, wheat, potato and tobacco have registered positive growth rates. Production of all other crops has declined either because of decreased area or because of decreased yield rate or both (Murshed et al., 1984).

Table 4: Area, Production, Yield Rate, and Gross Marketable Surpluses of Major Crops, 1984/85

Crop	Area '000 ha	Production '000 tons	Yield kg/ha	Gross Marketable Surplus %
Rice	10,223	14,391	1,430	38.7
Aus	2,928	2,739	947	-
Aman	5,710	7,805	1,389	-
Boro	1,575	3,847	2,482	-
Wheat	676	1,441	2,166	62.9
Sugarcane	163	6,769	42,193	94.8
Potatoes	111	1,141	10,444	38.5
Pulses	272	195	729	54.1
Oil Seeds	294	266	920	72.5
Tobacco	52	49	957	-
Jute	601	817	1,381	93.7

Source: GOB, 1986b.

It is estimated that there are 21.5 million cattle, 0.6 million buffalo, 10.6 million goats and sheep, and 79.4 million domestic fowl in the country. Nearly all of these are maintained by small farms on crop by-products and residues for which humans have little

1 Aus: summer or dry season
Aman: wet or rainy season
Boro: winter season

use. Apart from providing nearly 98% of draft power for crop production and a substantial amount of the power for transportation of goods, these animals and birds annually produce about 6,014,000 tons of milk, 80,000 tons of milk products, 275,000 tons of beef, 47,000 tons of mutton and 58,000 tons of poultry meat (GOB, 1985).

Table 4 shows gross marketable surpluses for the principal commodities. The commercialization of food crops remains quite low. For many marginal and small farmers, the marketable surplus of food crops is in fact negative, but they sell part of their produce to meet essential family expenses.

Structure of the Agricultural Sector

Land tenure. According to the 1983/84 agricultural census, out of 13,817,646 rural holdings, 22% had no land or only a homestead, 40% had a homestead plus cultivable land up to 0.4 ha, and 38% had over 0.4 ha of cultivable land. Approximately three-quarters of the farm holdings were less than 3 ha in size (Table 5). Owner, owner-cum-tenant, and tenant farms accounted for 62.6%, 1.4%, and 36% of the total farms, respectively. Nearly all cultivable land is privately owned, except for some low-lying communal areas where cattle are seasonally grazed (GOB, 1986c).

Table 5: Distribution of Farm Holdings by Size, 1983/84

Farm Size	% Land Owned
Small Farms (< 1 ha)	29%
Medium Farms (1-3 ha)	45%
Large Farms (> 3 ha)	26%

Source: Bangladesh Agricultural Census, 1983/84.

Division of labor. The influence of purdah and the restricted mobility of Bengali Muslim women are the basis for a clear division of labor in rural households. Men generally engage in production and marketing activities while women perform post-harvest processing of field crops, care for crops and vegetables grown in homestead areas, care for poultry and goats, and sometimes feed large animals at home. The situation started changing recently; women of landless and poor families, because of subsistence pressures, now engage in different activities outside the home, and there is evidence that they are now doing work such as rice transplanting and weeding.

Rural organization. There are two types of formal organization which rural people may join:

1. Cooperatives and farmer groups. These are organized variously by the government cooperative department, banks, rural development agencies, and local and foreign nongovernmental organizations.

Their functions are to provide credit and other inputs or services for certain activities ranging from purchase of fertilizer and irrigation equipment by farmers to petty trade by the landless. Many studies and reports have shown that this type of organization is dominated by medium and large farmers unless it has been specifically set up for the poor and landless.

2. Political organizations. These are organized by various political parties. In general, most rich farmers try to remain attached to the party in power. Many rich farmers also have connections with one of the traditional political parties but unite on issues of economic interest and to bargain with the government. Only the more radical political parties have grassroots level farmers' and landless organizations which try to address long-term issues of social change and short-term issues such as fair prices for products and inputs, subsidy, employment opportunity and wages, khas (government-owned) land distribution, and corruption of local or national politicians. A small proportion of the population are now involved in these radical organizations, but evidence suggests that the government is taking steps to combat their increasing influence.

Large farmers have succeeded in deriving considerable gains from the government. Up to 1982, the wholesale distribution of fertilizers and pesticides was in government hands. Irrigation tube-wells and pumps were also under government ownership but were rented to cooperatives and groups of farmers. All these have gradually been given to private traders and farmers. Thus, large farmers, who for many years were involved in nonagricultural and agricultural commodity trade rather than becoming capitalist/commercial farmers using improved technology, are now gaining control of agricultural inputs and technology. Whether this change from 'landlords' to 'land-cum-water lords-cum-businessmen' will ultimately lead to the development of capitalist farming is yet to be seen. Some evidence suggests that the change has accelerated the process of exploitation and dispossession (Mandal, 1985).

Training institutions. The Bangladesh Agricultural University and its two affiliated colleges together produce about 500 graduates annually in crop science, animal science, fisheries, agricultural economics, and agricultural engineering. Several technical institutes award a few hundred agricultural diplomas (two years of training after 10 years of schooling). Virtually all of these graduates and diploma-holders take up jobs in agricultural extension, research, credit, marketing, and development organizations in several ministries and departments. In spite of a recent reorganization of the Directorate of Extension which amalgamated a number of separate agencies, too many institutions still appear to be involved in each activity. Rather than creating a competitive environment, there is duplication and evasion of work and thus a waste of scarce resources.

TECHNOLOGICAL CONSTRAINTS TO AGRICULTURAL DEVELOPMENT

Development is a human action aimed at changing the human condition and the environment. Politicians, government functionaries, farmers, and laborers all have specific roles in this process but the most fundamentally important decisions are invariably made by

political bodies and are not governed exclusively by economic considerations. In a top-down development process, economic action is related to political thinking. Interpretation of constraints and strengths, reality and pragmatic decision-making, may differ depending on the viewpoint held. For example, land tenure may or may not be considered a constraint for agricultural development depending on who analyzes the issue. Hand tube-wells, shallow tube-wells, or deep tube-wells have all been considered as appropriate irrigation technology for Bangladesh depending on who did the analysis, for what purpose, and for whom (Jabbar, 1977; Jabbar, 1985). That is why the study of operative economic, social, and technical aspects of a society include an examination of the political relationships involved in decision-making (Bognar, 1969).

It is beyond the scope of this paper to make a detailed analysis of the political characteristics of the present government and to speculate about political changes. However, there are technological and sociopolitical constraints to agricultural development in Bangladesh. Wennergren et al. (1984) have provided a donor perspective and consider the following as major constraints:

Inadequate research base. Inadequate government allocation to research; heavy emphasis on crop genetic research and less emphasis on soil fertility, water response, cultural practices; too much emphasis on rice and less on other crops; general neglect of livestock, fisheries; proliferation of individual programs and duplication of efforts and problem of coordination; weak extension-research linkage.

Ineffective outreach-extension support base. Inadequate and ill-trained agents; low operating budget; proliferation of extension functions among several agencies, creating problems for coordination.

Inadequate investment in human capital. Low rate of investment in education and high rate of illiteracy have created difficult problems for expanding science-based agriculture; trained scientists, technicians, extension workers are inadequate.

Limited agricultural diversification. Rice dominates the crop sector, wheat and potatoes marginally increased, jute significantly decreased, others are minor crops; livestock-crop interaction is breaking down but specialized alternatives are not being developed; irrigation used mainly for rice and may become a costly investment if enterprises are not sufficiently diversified.

Excessive government intervention in market. Subsidies on inputs, support prices for output, rationing, credit quota, and export regulations distort relative price relationships; investment and resources misallocated.

Limited market services and standards. Inadequate transport and communication network; inadequate storage and processing facilities; electrical network inadequate.

Unchecked population growth. High agricultural growth rate required to sustain present level of living, not to mention improvement in living conditions; consequently high investment required; implications for size of farm holdings and fragmentation, adoption of technology.

Limited mobilization of domestic resources. Too much dependence on aid; low domestic saving and investment.

Deficient export base. Serious trade imbalance; decline of jute as principal earner; poor industrial base to expand exports.

Inadequate farm power. Human and animal power main sources; shortage of draft power in critical periods.

Inadequate public services. Bureaucracy, red tape, corruption.

Limited data base and policy analysis.

Restricted status of women.

Land tenure. Unequal land ownership, too many landless people without adequate work, too many small farms which are efficient but lack investment resources and few large farms which do not invest in agricultural transformation.

There may not be any disagreement about the list of constraints but opinions may differ about the implications of some of them and their suggested solutions. For example, it has been suggested that interest rates on savings and agricultural credit should be increased to the level of interest rates in the informal credit market as a means of mobilizing domestic savings. Akash (1985) has shown the poor logic of the argument. Too much government intervention has been considered a constraint. In reality most government intervention occurs because of intervention of donor agencies through aid programs. During recent years, 75 to 85% of the country's annual development budget comes from aid (Table 6). However, if donors made a clearer distinction between assistance and intervention, many problems and distortions would not be created, and further intervention would be unnecessary.

Table 6: Foreign Aid Received by the Government during 1980/81-1984/85

Item	Amount by year (million US$) 1980/81	1981/82	1982/83	1983/84	1984/85
Food aid	195	231	255	276	245
Grants	163	231	221	263	242
Loans	32	-	34	13	3
Non-Project aid	393	421	452	439	432
Grants	183	214	244	245	244
Loans	210	207	208	194	188
Project aid	560	584	638	552	591
Grants	257	205	244	226	215
Loans	303	379	394	326	376
Total	1,148	1,236	1,345	1,267	1,268

Source: GOB, 1986b.

CHAPTER TWO

AGRICULTURAL RESEARCH AT THE NATIONAL LEVEL

BRIEF HISTORICAL OVERVIEW

Formal agricultural research in the area now called Bangladesh began in 1880. On the recommendation of the Famine Commission, a Department of Agriculture was established under the Department of Land Records in Bengal. Systematic research on jute was started by the provincial government at the turn of the century. Tea research was started about the same time by planters, tea traders, and several government units. With the establishment of Bengal Veterinary College in Calcutta in 1893, veterinary education and research began in the province.

The Bengal Department of Agriculture was granted separate status after the Indian Department of Agriculture was established in 1905, and rice research was started two years later. An agricultural research laboratory was established at Tejgaon in 1908 to serve the provinces of Bengal and Assam. A chemist was employed to develop sugarcane and tobacco trials, and for experiments on manure. At about this time, a 403-acre experimental station, the Dhaka Farm, was set up to complement the laboratory. In 1925 there were 17 scientific staff in the laboratory and on the farm, and research focused on rice, jute, cotton, oilseeds, pulses, and sugarcane.

On the recommendation of the Royal Commission on Agriculture (1926-28), the Imperial Council of Agricultural Research was established in 1929 to coordinate research activities undertaken in various institutes and centers all over India.

The Bengal Agriculture Institute was established in Tejgaon, Dhaka, in 1938 to provide higher (graduate level) education in agriculture. It had close links with the Dhaka Farm. From the mid 1930s to the end of the Second World War, the funds available for agricultural research severely declined. The partition of India in 1947 resulted in the loss of the jute, tea, and sugarcane research centers and the veterinary education and research center to India. Many Hindu scientists also left the country. After the creation of East Pakistan, a series of reorganizations were carried out and new establishments were set up. These are summarized in Table 7.

Table 7: Agricultural Institutions, 1947-1970

Year	Event
1947	Veterinary college established in Comilla. It was moved to Dhaka in 1950 and to Mymensingh in 1958.
1948	Veterinary Department and Livestock Production Unit of the Department of Agriculture merged to form Directorate of Animal Husbandry with functions to control livestock diseases and promote animal and poultry production.
1951	Department of Agriculture with responsibility for crops divided into (i) Directorate of Agriculture (Extension) with responsibility to disseminate knowledge on improved agricultural technology, (ii) Directorate of Agriculture (Research and Education) comprising the Dhaka Farm and Agriculture Institute.
1952	Jute Research Institute and Sugarcane Research Station established in Dhaka and Ishurdi, respectively.
1955	Forest Research Institute established in Chittagong.
1958	Tea Research Station founded in Sylhet District.
1961-1962	Atomic Agricultural Research Centre established in Dhaka.
	Directorate of Animal Husbandry renamed Directorate of Livestock Services but the functions remained the same.
	Bangladesh Agricultural University established with the Faculties of Agriculture (Crop Science) and Veterinary Science. Four other faculties followed: Animal Husbandry in 1962, Agricultural Economics in 1963, Agricultural Engineering in 1964, and Fisheries in 1966.
	The Dhaka Farm taken over by the government for construction of Pakistan's second capital; thus, the principal research facility, including a rice germplasm collection of over 50 years, was lost.
1964	The Food and Agriculture Council of Pakistan formed to coordinate agricultural research but East Pakistan did not benefit much from it.
1966	International Rice Research Institute introduced its HYVs for testing through the Accelerated Rice Research Program administered by the Directorate of Agriculture (Extension). Improved sugarcane and tobacco varieties also introduced.
1970	East Pakistan Rice Research Institute established in Joydebpur as an autonomous organization with IRRI support. Later this became the Bangladesh Rice Research Institute.

Research activities were disrupted during the 1971 war of independence. Subsequently, the new government of Bangladesh undertook some reorganization with the view of strengthening research as outlined in Table 8.

Table 8: Strengthening of Agricultural Research, 1971-1984

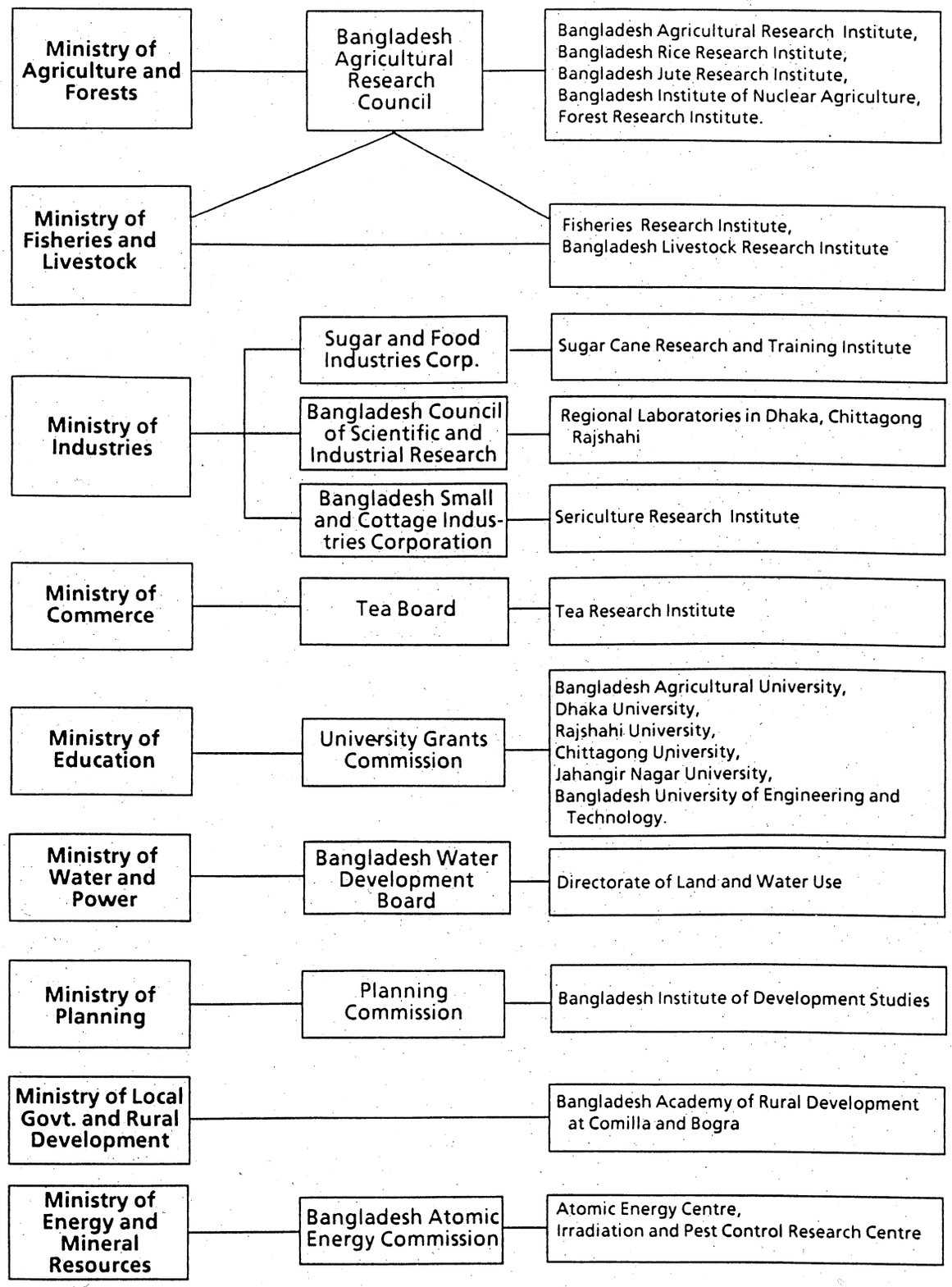
Year	Event
1972	Agricultural research at the Atomic Agricultural Research Centre reorganized under the Bangladesh Institute of Nuclear Agriculture, which moved to the Bangladesh Agricultural University Campus in 1974 with support from the Swedish International Development Agency.
1973	The Bangladesh Agricultural Research Council (BARC) established to coordinate and promote agricultural research.
	The testing program of HYVs and wheat expanded through the Directorate of Agriculture (Research and Education) with assistance of scientists of the International Maize and Wheat Improvement Center (CIMMYT).
	Sugarcane and Tea Research Stations became Research Institutes. They became autonomous in 1976.
1976	BARC given more authority to coordinate and provide leadership to the national agricultural research system.
	Following the dissolution of the Directorate of Agriculture (Research and Education), the Bangladesh Agricultural Research Institute (BARI) was made autonomous and moved to Joydebpur.
1984	The Fisheries Research Institute and Bangladesh Livestock Research Institute established by expanding the limited research facilities created under their respective directorates.

CURRENT ORGANIZATION OF RESEARCH

National Agricultural Research Institutes

The national agricultural research institutes and their controlling ministries as of 1986 are shown in Figure 1. The Universities and some institutes devote only part of their program to agricultural research. Because of the frequent reorganization of the ministries and changes in policies of successive governments, some research institutes have been under the control of various ministries at

Figure 1: Institutions Conducting Agricultural Research in Bangladesh, 1987.



different times. For example, the Bangladesh Jute Research Institute has fallen under the Ministries of Agriculture, Jute, Science and Technology, and Industries at different times.

The institutes vary considerably in size and each has a unique history and mandate. Table 9 shows the manpower and annual expenditure of the principal institutes directly involved in agricultural research. Some have regional stations and substations for location-specific research, which has facilitated the adoption and expansion of on-farm research. The Bangladesh Agricultural Research Institute (BARI), the focus of this study, is the largest research institute in the country.

The agricultural research system has grown rapidly since 1975. The physical and manpower development of most of these institutes has been made possible by support from donor agencies, prominent among them are the World Bank, USAID, the Ford Foundation, and the Australian, British, and Japanese governments. The sequence of events outlined in Tables 7 and 8 may be taken as a good indication of government and donor agencies' research priorities at different times.

Bangladesh Agricultural Research Council

The Bangladesh Agricultural Research Council (BARC), established in 1973, is functionally at the apex of the national agricultural research system and has the responsibility to plan and coordinate research at the national level. Since 1983 the council has had five affiliated research institutes under its control and direct guidance: Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Jute Research Institute, Bangladesh Institute of Nuclear Agriculture, and Fisheries Research Institute. It also has the responsibility to strengthen the national agricultural research capacity through planning and integration of the research resources of other institutes and organizations such as the universities. This involves cooperative activities with several ministries other than the Ministry of Agriculture. About 50 local scientists and a small number of expatriate scientists currently work at BARC.

BARC's policies are made by a governing council chaired by the Minister of Agriculture and Forests and comprised of senior officials of ministries and research institutes and outstanding scientists. The policies are then implemented by the Council's Executive Vice-Chairman and member-directors and directors of specific discipline areas: crops, soils, irrigation, livestock, forests, fisheries, agricultural economics and social sciences, appropriate technology, planning, training, and communication. In 1979, BARC prepared a National Research Plan to guide research according to priorities set out in the Five-Year Development Plan. The National Research Plan was revised in 1984 but was not accepted by the appropriate authorities. BARC is now engaged in preparing a strategic National Research Plan.

Over the years, BARC has expanded its role as coordinator of research across institutes to include greater control over the direction and content of research programs. For example, in 1979

Table 9: Manpower and Annual Expenditure of Selected Research Institutes

Institute	Regional/substations	Number of scientists 1987	Average annual expenditure (million taka)* 1976/80	1981/85
Bangladesh Agricultural Research Institute	22	886	68.11	85.40
Bangladesh Rice Research Institute	5	153	26.46	34.28
Bangladesh Jute Research Institute	4	192	8.12	10.58
Bangladesh Tea Research Institute	-	41	4.67	6.51
Sugarcane Research and Training Institute	-	58	6.76	10.81
Bangladesh Institute of Nuclear Agriculture	-	88	6.74	8.42
Fisheries Research Institute	5	62	10.41	13.53
Bangladesh Livestock Research Institute	3	112	NA	NA

Note: * Excluding short-term projects.
Source: Gill, 1981; Alauddin, 1981; Annual Reports of different Institutes.

BARI was designated as 'a constituent unit of BARC while operating under its own board for administration and management of affairs.' By 1982, the Ministry of Agriculture indicated that while the institutions which were constituent units of BARC were to work according to their respective constitutions, they were under the supervisory control of BARC. Although it is accepted that important steps had been taken for the development of agricultural research facilities in Bangladesh since 1979, it is also alleged that in consolidating the research system, BARC's own power and control has in fact been consolidated.

ON-FARM AND FARMING SYSTEMS RESEARCH AT THE NATIONAL LEVEL

On-farm research has a long history in Bangladesh. A proposal for conducting on-farm fertilizer trials was initiated by the Directorate of Agriculture (Research and Education) in the early 1950s. Trials were started in 1957 and institutionalized with the creation of the Soil Fertility and Soil Testing Institute in 1963. In the early 1970s, the Directorate of Agriculture (Research and Education) started on-farm wheat trials to select suitable varieties.

Early Cropping Systems Research Efforts

The Bangladesh Rice Research Institute (BRRI) began cropping systems research (CSR) in 1974 as a participant in the Asian Cropping Systems Research Network established by IRRI. The research, directed towards improving cropping systems in Bangladesh using improved and high-yielding rice varieties, began as an on-station program in the Agronomy Division with partial funding from the International Development Research Center (IDRC). The program subsequently gained separate status and was called the Multiple Cropping Programme or, sometimes, the Rice-Based Cropping Systems Programme.

Since the Bangladesh Rice Research Institute had very few research substations at that time, it launched its on-farm trials through the Extension Directorate. New substations were subsequently created to facilitate location-specific research, including cropping systems research. Farm surveys were also conducted to obtain an understanding of farmers' situations that would help design trial patterns. IRRI guidelines and CSR methodology were used partly because BRRI was a member of the IRRI network and partly because the cropping systems research leader, Dr. Zahidul Huq, was trained at IRRI.

Also in 1974, the Sugarcane Research and Training Institute independently started on-farm trials of sugarcane varieties developed on-station. In 1981, it began CSR activities including intercropping with sugarcane. This work was conducted by agronomists under the guidance of the director, and was not organized into a separate program or division or given a formal structure.

National Coordinated Cropping Systems Research Programme

After several other institutes started CSR activities, BARC, at the suggestion of Dr. V. R. Carangal, IRRI cropping systems research

scientist, initiated a National Coordinated Cropping Systems Research Programme to coordinate the diverse CSR activities across all institutes, to coordinate funding, and to promote a standard (but flexible) methodology. The idea of the National Coordinated Programme was strongly supported by Dr. Matlubur Rahman, then member-director (crops), who was already in control of the various CSR projects, both as coordinator of CSR projects and as the allocator of funds. He also had personal experience in on-farm and cropping systems research from his work in the Sugarcane Research and Training Institute during 1974-77.

Several institutes were involved in the National Coordinated Programme: the Bangladesh Rice Research Institute, Bangladesh Agricultural Research Institute, Sugarcane Research and Training Institute, Bangladesh Agricultural University, and Bangladesh Water Development Board. A few small CSR programs undertaken by Proshika, the Mennonite Central Committee, the Bangladesh Rural Advancement Committee, and the Danish International Development Agency, which did not have any formal command structure linked to ministerial decision making, remained outside the National Coordinated Programme.

BARC prepared a standard CSR methodology following IRRI CSR guidelines in 1981 (BARC, 1981). This guideline, to be followed by all institutions in the National Coordinated Cropping Systems Research Programme, considered CSR to consist of five steps:

1) site selection;
2) site description, including agro-economic and socio-economic data;
3) design and testing of improved cropping systems at the site, including cropping patterns, component technology, superimposed (farmer-managed) and researcher-managed trials;
4) preproduction evaluation, including multilocation testing and pilot production program;
5) production program.

Two major shortcomings of this guideline have been identified. First, it gives no attention to risks involved in farming. Any research to solve farmers' problems in Bangladesh should consider risks, particularly those due to national calamities, e.g., floods and droughts, and the ways in which farmers face them. Second, the diverse needs of different categories of farmers, particularly resource-poor farmers, were not given any particular attention. This is important because most farmers in Bangladesh are resource poor.

National Coordinated Farming Systems Research Programme

In 1980, a team from the International Agricultural Development Service, in its general review of the research system for the second phase of a big USAID agricultural research project, made two important recommendations with respect to CSR: 1) that it should be broadened to a farming systems research (FSR) approach, and 2) that apart from agro-ecological considerations, the needs of different categories of farmers should be addressed (Moseman et al., 1980).

Although these proposed changes did not come about until 1984, the term 'farming systems' began to be used before this even though it was sometimes used to describe only cropping systems. For example, in 1983 in a book published by BARC on the occasion of its tenth anniversary on research achievements in Bangladesh, the section written on achievements in farming systems (Abedin, 1983) only described cropping systems research and the extension-research linkage. On the same occasion, a national symposium was held and farming systems was one of the 13 topics discussed. The keynote paper described the philosophy of FSR and the need for FSR in Bangladesh. It also reported that BARI had already redirected its crop-oriented research to the FSR approach through its Extension and Research Project. However, the type of FSR activities undertaken was not specifically mentioned (Rahman, 1985). This paper also urged other institutes to adopt a system-oriented, rather than a crop-oriented, approach.

In another paper on "Crops Research in Bangladesh" (Ahmad, 1985), a small section was devoted to farming systems where it was said that "'farming systems' is sometimes called 'cropping systems' because the lion's share of the farmers' efforts are devoted to crop production. Livestock in most cases is limited to caring for draft animals, which are often kept for two or three purposes, first for milk, then for draft, and finally for meat." The section then briefly described the importance of CSR and left out the other aspects of farming, possibly because they were not considered important.

In the same seminar, a number of agricultural research leaders and policymakers highlighted the importance of on-farm and farming systems research:

> "All of our research in agriculture must start from the small farmer, his needs, resources and constraints -- socio-economic, financial and physical. Our scientists must emphasize all aspects of farming systems, not only crop and livestock systems" (Badruddoza, 1985).

> "We should work hand in hand to improve the lot of the small and marginal farmers. Scientists should get away from their research institutions and learn about the farmers' problems. Our research has to be farmer-oriented. I am happy to know that on-farm research is being emphasized" (Khan, 1985).

> "Far too many of our research scientists are research station oriented. They regard the farmer as illiterate, and therefore ignorant. Has BARC recognized this problem? If so, what has it done to correct it? What has it done to convince our scientists that they must respect the farmers as highly competent professionals? What has it done to encourage scientists to get into the farmers' fields to conduct farming systems research, and to take the farmers' needs, constraints and resources as the starting point of their research?" (Anisuzzaman, 1985)

These public statements by policymakers contributed considerably to bringing about the transformation from CSR to FSR and to strengthening the commitment to on-farm research in general.

In December 1984, BARC sponsored a national workshop on FSR in which local and expatriate scientists participated. The papers and proceedings are yet to be published. However, the workshop recommended that a nationally coordinated FSR program be set up. As a result, in 1985 the National Coordinated Cropping Systems Research Programme was redesigned and formally changed to the National Coordinated Farming Systems Research Programme (NCFSRP) to accommodate changes in the scope and methodology of on-farm research that had evolved since 1980.

The objectives of the National Coordinated Farming Systems Research Programme are:

* to provide the agricultural research institutions with information concerning the performance, in farmers' fields, of the technology generated in the experiment stations;

* to study the interactions among different components of a farm in a rural development program;

* to observe the application of an integrated and multidisciplinary research approach to provide ways to increase productivity on the farms;

* to develop or suggest solutions to the major problems and constraints faced by farmers in the proper operation of their farms.

Participating institutions could add more objectives to suit their institutional mandate (BARC, 1985a).

Two key issues were debated in the workshop:

1) whether or not FSR should be directed specifically to the problems of resource-poor farmer clients;

2) how to organize FSR in different research institutions and what the content should be.

With respect to the first issue, the FSR methodology adopted by the National Coordinated Farming Systems Research Programme endorsed the concept of the whole farm as a production unit and said that FSR ". . . will be in principle farmer-based, integrating farmers into the research and evaluation process; problem solving; comprehensive, considering the farming system in the context of all its environmental influences; interdisciplinary, with a team approach involving researchers and extension workers with different disciplinary backgrounds; socially responsible, keeping public interests -- both present and future -- in mind; complementary, providing feedback to disciplinary and commodity-based research; and dynamic" (BARC, 1985a). Thus it appears that FSR would be farmer-based but not necessarily oriented toward problems of poor farmers. The question of risk, another major deficiency of the CSR

approach, was also ignored in the FSR methodology. Furthermore, the question of linking research to achieve national objectives such as food self-sufficiency, employment generation and nutritional improvement remained vague.

In discussions during 1984 on the content and organization of research in the institutions participating in the National Coordinated Farming Systems Research Programme, the group from the International Agricultural Development Service based at BARC made a strong move to replicate in Bangladesh the centralized and controlled institutional approach that had been used for the development of cropping systems research in Bangladesh. BARC had already followed this approach in the CSR methodology issued in 1981. An alternative view expressed during the discussions was that each participating institution should be encouraged to develop its own capacities and approach to FSR which would be determined as much by the particular institutional conditions of the research group as by their specific objectives for FSR (Biggs, 1984).

BARC's administration favored a more centralized approach to FSR which was in line with its general approach to its mandate of coordinating and planning research at the national level. BARC's Coordination Unit for the National Coordinated Farming Systems Research Programme developed guidelines for research activities to be carried out by member institutions. Based on these guidelines, participating institutions have submitted projects to be scrutinized and approved by the appropriate authorities. Many suggested topics are yet to be included in the National Coordinated Programme.

Table 10 shows the approved budget and staff for the institutions participating in the National Coordinated Farming Systems Research Programme. The Programme is managed by an executive committee with the Minister of Agriculture as chairman, a national technical coordination committee with the Executive Vice-Chairman of BARC as chairman, and a coordination unit at BARC. The composition and function of these bodies are described in Appendixes A and B.

RESEARCH ACHIEVEMENTS AND WEAKNESSES

The research system in Bangladesh is still evolving. It has passed through difficult years of infrastructural development, manpower recruitment, and training. Funds, for both development and operation, have not always been adequate and regular. Yet the system has produced some good results. The rate of return to investment in research was calculated, under an alternative set of assumptions, to be 30-50% per year in the 1970s (Gill, 1983; Pray, 1979).[1]

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1 "These rates of return should be interpreted with caution. Apart from the problem of disentangling the contribution of research and other factors all the assumed and prevailing prices of inputs and outputs may not be realistic. The low level of investment in the early years may be another reason for high rates of return" (Gill, 1983; Pray 1979).

Table 10: Approved Budget and Staff of Institutions Participating in the National Coordinated Farming Systems Research Programme, 1985-1988

Institution	Total budget (million taka)	Number of sites[1]	Staff				
			Scientists		Scientific assistants	Office assistants	Budget per scientist[3] (million taka)
			Part-time	Full-time			
Bangladesh Agricultural Research Institute	14.96	11	20	30	2	34	0.43
Bangladesh Jute Research Institute	5.56	4	6	31	9	13	0.39
Bangladesh Agricultural University	4.23	2	20	8	6	6	0.35
Sugarcane Research and Training Institute	4.77	2	9	9	7	8	0.44
Fisheries Research Institute	3.32	1	-	8	3	5	0.42
Bangladesh Rice Research Institute	3.38	1	-	7	-	3	0.48
Bangladesh Livestock Research Institute	7.31	2	-	29[2]	4	9	0.25
Bangladesh Agricultural Research Council (Coordination Unit)	2.50	1	-	6	-	6	0.42
TOTAL	46.03	23	55	111	31	84	(0.38)[4]

Notes:
1) All institutions except the Bangladesh Agricultural University have kept a portion of the budget for headquarters.
2) 19 will be recruited for FSR sites of other institutions.
3) Calculated assuming 20% of part-time scientists available for FSR activities. This is standard.
4) Average budget per scientist.

During the period 1967/70 to 1979/82, crop output increased at the rate of 1.2% per annum. Rice, wheat, potato, and tobacco production increased at the rate of 1.3%, 22.3%, 1.9%, and 1.1% per annum, respectively while production of all other crops declined. Forty-nine percent of increased output came from increased productivity, 34% from increased area, and 17% from increased area and productivity. In the case of rice, wheat, potatoes and tobacco, both area and productivity have increased; in the case of jute and mustard, the area declined but productivity increased slightly (Murshed et al., 1984). Certainly, the research system has contributed significantly to this success. In the case of other crops, both area and productivity have declined.

Rice varieties developed and released by BRRI are increasingly replacing local varieties as well as some of the IRRI varieties released in the early years. The new varieties have characteristics which farmers prefer: disease resistance, often short growing periods, and suitability for growing in different seasons. The dramatic increase in wheat production between 1974/75 and 1981 resulted from concentrated wheat research. Apart from the screening of existing varieties for local suitability, efforts have been made to develop high-yielding, disease-resistant varieties specifically for Bangladesh.

At least two improved mustard varieties have been released by BARI. These are now quickly replacing local varieties. Adaptation of Dutch and Indian varieties of potatoes and their further development by BARI scientists have contributed to the rapid expansion of potato production. Research for increasing fertilizer efficiency has produced some important results.

The major inadequacies in the system are:

1) The various components of the system have not advanced uniformly in terms of time and relative importance. Livestock, fisheries, and forestry should have received much more attention than they did until recently. In the case of crops, the main focus of research was to develop technology to increase yield. Employment expansion and nutritional improvement are important objectives of national policy, but they did not receive explicit attention from agricultural researchers. The question of specific clients, e.g., large or small farmers, was not explicitly considered by the researchers, but eventually large farmers benefited more from research results because of their better resource base and access to improved technology and inputs.

2) Some disciplines have not received proper attention. For example, genetic research has rightly received high priority but efficiency in irrigation and water management, as well as socio-economic and other aspects of agronomic research, including soil fertility, have received much less attention than their potential contribution warranted.

3) Regional and substations have been created for good reasons but inadequate research and living facilities make them less useful than they might be.

4) As a result of the proliferation of monocrop-oriented research institutes, the creation of offices and laboratories has become rather costly. Research capacities have become thinly distributed and coordination of the overall system for both research administration and resource allocation has become difficult. In some institutes, many research activities tend to be of a routine nature and topics covered may have little relevance to the priorities for the nation. Research output is poor in quality and irregularly reported, so that the potential value is lost. There are about 30 research journals published by various institutes and societies but some of them are of poor quality and are published irregularly.

5) The CSR/FSR approach is being introduced within the prevailing monocrop-oriented institutes where research is organized along disciplinary lines. Consequently, progress with FSR has been rather slow, and tangible results are yet to be seen.

There are continuous efforts to improve the system under BARC's leadership. In recent years, contacts with international research centers have increased; more than 20 are providing assistance which supplements in-country resources and programs. Nowadays, both farmers and the government are increasingly demanding solutions to critical, specific production problems. This pressure and the corresponding support from the international research centers are expected to improve the structure and efficiency of the research system.

CHAPTER THREE

ORGANIZATION AND MANAGEMENT OF ON-FARM CLIENT-ORIENTED RESEARCH WITHIN THE BANGLADESH AGRICULTURAL RESEARCH INSTITUTE (BARI)

ORGANIZATION OF BARI

The Bangladesh Agricultural Research Institute (BARI), with headquarters in Joydebpur, was founded in 1976 and is the largest agricultural research institution in the country (Table 9). It has primary responsibility for research in oilseeds, pulses, wheat, tobacco, cotton, citrus, maize and other coarse grains, potatoes, and a wide range of vegetables and horticultural crops.

At present BARI has five multidisciplinary research projects/centers on specific commodities, 10 disciplinary research divisions, and a multidisciplinary On-Farm Research Division. It has a central research station, six regional stations, and 18 substations (Figures 2 and 3). Information presented in Table 11, showing the distribution of scientific staff among the principal organizational units, indicates that the system is quite centralized with only about 20% of the scientists assigned to regional and substations. Detailed data on the distribution of scientists and other staff among BARI units is provided in Annex Table 1.

Table 11: Distribution of Scientific Staff within BARI, 1987

Organizational Unit	Percent Scientists
Director General's Office	5
Disciplinary Research Divisions[1]	30
On-Farm Research Division	12
Projects/Centers	10
Regional Stations	13
Substations/Testing Stations	5
Special Crop Substations	3
Bangladesh Agricultural Institute	9
Patuakhali Krishi College	8
Institute of Postgraduate Studies in Agriculture	5
Total	100

Notes: 1) Includes the Farm Division (Central Station)
Source: Annex Table 1.

Figure 2: Organizational Structure of Bangladesh Agricultural Research Institute

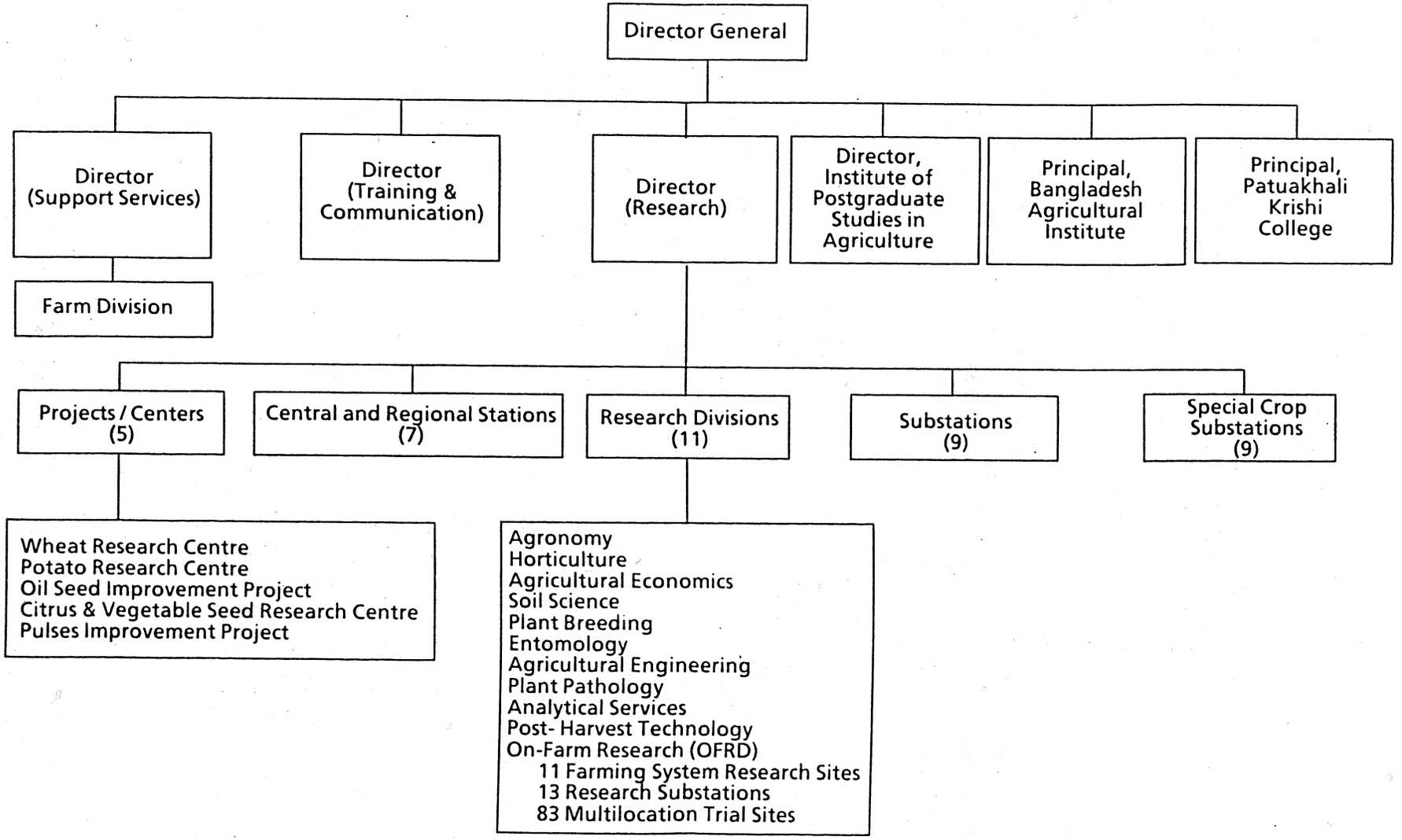
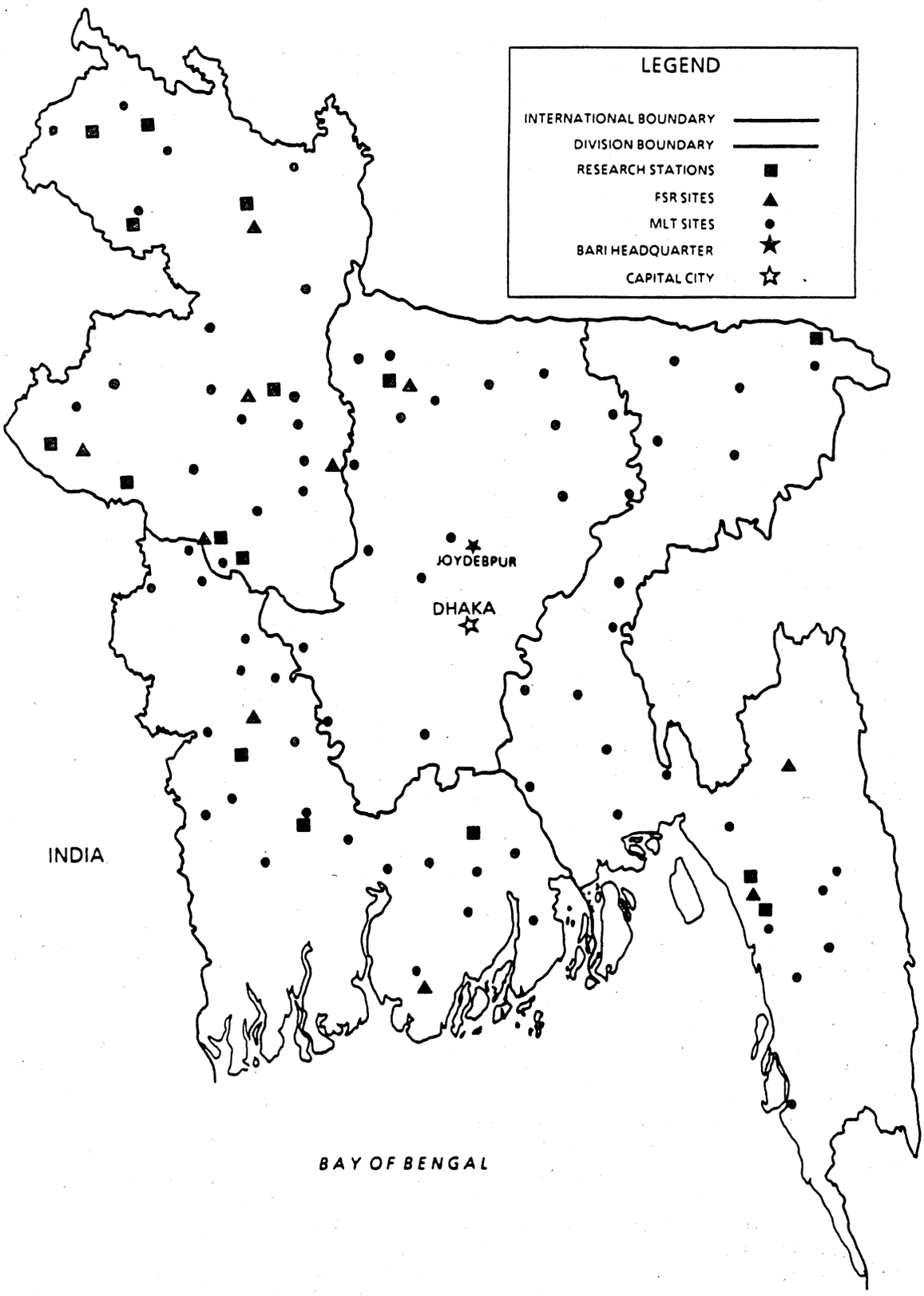


Figure 3. BARI Research Network, 1988



The On-Farm Research Division (OFRD), the largest research division in BARI, comprising 12% of the scientific staff (Table 11), has responsibility for OFCOR within BARI. Under OFRD are an additional 11 farming systems research sites, 13 substations, and 83 multilocation trial sites. Out of 11 FSR sites, six are attached to regional substations and their activities are supervised by the chiefs of those stations. The remaining sites are under the direct supervision of the OFRD chief.

EVOLUTION OF ON-FARM RESEARCH WITHIN BARI

The history of on-farm research within BARI is nearly as old as the institute itself, and the form and content of on-farm research has changed along with changes in the structure and organization of BARI.

OFRD, currently responsible for OFCOR in BARI, was created in 1984 in order to bring five different on-farm research programs or projects under one organizational unit:

1. On-Farm Fertilizer Trials
2. On-Farm Wheat Research
3. Cropping/Farming Systems Research
4. Extension and Research Project
5. Fertilizer Distribution and Demonstration Project

To understand the evolution of OFRD, its activities and organizational structure, the history of these programs and projects is reviewed below.

On-Farm Fertilizer Trials

In 1949, the Department of Agriculture initiated a scheme for conducting fertilizer trials on farmers' fields with the objective of disseminating knowledge about fertilizers through practical demonstrations in on-farm conditions, and encouraging farmers to use them. Until then, chemical fertilizer and organic manure trials were conducted on experiment stations. Chemical fertilizers were rarely used at that time except in the tea gardens and farmers and district-level agricultural officers were barely aware of the recommendations for their use. The scheme for conducting fertilizer trials was repeatedly turned down by the Food and Agriculture Council of Pakistan because scientists were not convinced that scientific experiments could be conducted in the farmers' fields. In 1953, it was revised to incorporate recommendations of the International Rice Commission on the use of fertilizer in rice. The scheme was finally approved and implemented in 1957 with support from the Food and Agriculture Organization of the United Nations.

The results of the field trials were used to complement experiment station results for preparing fertilizer recommendations for important crops. The program expanded rapidly (Table 12) and the use of fertilizers by farmers started rising steeply. By 1960, trials were being conducted in 50 upazilas (then called thana) which were divided into eight zones. In the same year, a laboratory was established in Dhaka for chemical analysis of the soils where on-farm

Table 12: Number of On-Farm Fertilizer Trials Conducted by the Soil Fertility and Soil Testing Institute 1957-1984

Crop	Number of Trials per Year								
	1957	1958	1959	1960	1961-63	1970-75	1977-79	1980-82	1983-84
Rice									
Aus	-	378	431	640	481	710	818	368	208
T. Aman	116	380	453	658	412	624	667	505	258
B. Aman	-	-	-	13	23	122	90	-	-
Boro	-	40	131	150	103	95	329	304	250
Wheat	-	-	-	-	35	130	310	306	404
Potatoes	-	-	-	-	64	64	28	67	138
Sugarcane	-	-	-	-	54	72	-	-	-
Mustard	-	-	-	-	33	111	175	160	87
Maize	-	-	-	-	-	-	40	71	199
Groundnuts	-	-	-	-	-	25	16	6	-
Pulses									
Lentils	-	-	-	-	-	77	30	53	53
Gram	-	-	-	-	-	56	36	45	20
Mung	-	-	-	-	-	-	15	13	60
Mashkalai	-	-	-	-	-	-	25	57	52
Khesari	-	-	-	-	-	-	92	-	22
All Crops	116	798	1015	1461	1205	2086	2761	1955	1751

Notes: The same trials conducted at different locations have been treated as separate trials. Each trial was conducted in 2-10 fields and these have been treated as replications.

Source: Rahman, 1976; data provided by the On-Farm Research Division, BARI.

trials were being conducted, although actual analysis did not begin until 1961 due to lack of equipment. By the end of 1962 only 300 of the 749 soil samples collected during 1960-61 had been analyzed.

In 1960, statistical analysis of the trial data also began and was completed on all the experiments conducted during 1957-1962 by early 1963.

In 1963, a revised and expanded scheme became the East Pakistan Soil Fertility and Soil Testing Institute.[1]

The expanded program provided for facilities to conduct trials in 200 out of nearly 400 upazilas and for establishing four regional soil-testing laboratories in four administrative divisions. The number of staff tripled between 1960 and 1985 (Table 13) and the number of on-farm trials nearly doubled between 1960 and 1977/79 when it reached a peak of 2671 (Table 12). The range of crops included in the trials was also enlarged considerably (Table 12).

Table 13: Staff of the Soil Fertility and Soil Testing Institute, 1960, 1975, 1980

	Number by year		
Type of Staff	1960	1975	1980
Scientists by Discipline:			
Soil Science	3	35	39
Agronomy/Soil Agronomy	-	4	5
Botany/Chemistry/Agricultural Chemistry	-	3	4
Statistics	1	3	4
Subtotal	4	45	52
Field/Chemical Assistant	70	150	167
Other (Clerical, Manual)	36	75	118
Total	110	270	337

The On-Farm Fertilizer Trials Programme had three components: testing of fertilizer response, varietal performance, and effect of agronomic practices. By 1970, trials were conducted on rice, wheat, sugarcane, mustard, pulses, potatoes, maize, and groundnuts (Table 12). Many trials were conducted on local varieties, for example, during 1970-75, 10-15% of the Aus and T. Aman trials, 63% of Boro rice trials, 33% of

1 According to a senior scientist at BARI interviewed during this study, apart from developing soil test-based fertilizer recommendations and demonstration of the benefits of fertilizer use, the creation of the institute achieved another operative objective, i.e., an outlet for soil science graduates of Dhaka University.

wheat trials, and all potato trials were on HYVs; all other trials were on local varieties.

There were numerous operational problems in carrying out the on-farm program. The field assistants had a secondary-level education or higher secondary or higher secondary level education; some had training in agricultural extension, but most were inadequately trained to conduct trials properly. There were 10-12 field assistants under one district-level soil-fertility officer who could therefore provide little supervision. The regional laboratories were not properly equipped. Operational funds were insufficient, and the travelling and daily expenses allowed for in the budget were meager. Office and housing facilities were inadequate; some field- and district-level officials ran the office from their homes. The Soil Fertility and Soil Testing Institute was supposed to supply fertilizer and sometimes seeds for the trial plots, but irregular receipt of funds frequently made it difficult to conduct trials according to schedule (Beavers, undated). In 1976, the scheme was revised: more officers and other staff were recruited, bicycles were provided to the fieldworkers, and more funds were made available for offices and housing.

It was questionable whether a large number of trials were appropriate, useful, or related to farmers' needs and problems. Each season, a vast quantity of data was assembled at headquarters but analysis could hardly be completed by the next season. Each year, similar trials were suggested and conducted but many were not designed well and had little connection with practical problems faced by farmers. For example, in the 1978/79 wheat season, the institute conducted 330 on-farm trials in 200 upazilas: 100 varietal, 200 fertilizer, and 30 agronomy trials. For each trial there were between two and 10 plots. In the same season, however, a survey among wheat-growers around the institute's trial plots in the districts of Mymensingh, Jamalpur, Pabna, and Jessore revealed that the major problems in wheat production were due to unavailability of irrigated water or lack of adequate moisture in the soil along with problems of storing seed. Therefore, to facilitate wheat production without irrigation (equipment was not easily available and was costly), on-farm trials on seeding rate, sowing time, fertilizer use, and wheat variety production under rainfed conditions would have been much more relevant.[2] But the trials program in that and earlier seasons included few trials geared to solving these problems (Jabbar, 1981; Swenson et al., 1979).

The institute's research was also poorly linked with the on-station agronomy, plant breeding, and soil science programs of BARI, and with the extension system. From the 1974/75 season BARI quickly expanded its Wheat Research Programme. A new dimension of this program was a large on-farm demonstration-cum-trial program undertaken in collaboration with the Directorate of Agricultural Extension, but it had no link with the on-farm wheat trials undertaken by the Soil Fertility and Soil Testing Institute.

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2 Mr. M.A. Razzaque, a senior member of the BARI wheat research team also emphasized the importance of research on rainfed wheat at that time.

In 1978, the Soil Fertility and Soil Testing Institute was unofficially renamed On-farm Trials Division (OFTD). CIMMYT scientists working in the On-Farm Wheat Programme (described below) criticized the on-farm fertilizer trial program for being mechanical, removed from the work of other divisions in BARI, and poorly integrated with the extension service. They suggested that rather than conducting only fertilizer trials, the program should be expanded to test technologies developed by other divisions in on-farm trials throughout the country (Biggs, 1978a). Under OFTD, however, the program was not fully recast in line with these recommendations until 1984 when the On-Farm Research Division was created and given responsibility for all on-farm trials in BARI.

On-Farm Wheat Research

Until independence in 1971, wheat was a minor crop. Farmers produced some local varieties under rainfed conditions giving low yields. In 1971, the Directorate of Agriculture (Research and Extension) started an Accelerated Wheat Research Programme under which fifth-generation advanced lines from CIMMYT were used in field trials in Pabna in 1973. After Independence, Bangladesh had to import large quantities of foodgrains, particularly wheat, every year in order to meet food deficits. Wheat imports increased partly because donors offered wheat and partly because the same amount of money could buy more wheat than rice (the main staple) in the world market. At that time, some policymakers and researchers were arguing that self-sufficiency in foodgrains could be attained quickly if high-yielding varieties (HYVs) of wheat were introduced. HYVs required fewer inputs and less water compared to winter rice, and some varieties might be grown under rainfed conditions, whereas winter rice production was impossible without irrigation. Wheat acreage could therefore be easily expanded with or without replacing HYV rice acreage. As a result, the directorate stepped up the Wheat Research Programme.

In 1975/76, 4,000 tons of HYVs of wheat (Sonalika) seeds were imported from India and distributed through the Directorate of Agricultural Extension and BADC to farmers mainly in the northwest districts -- Dinajpur, Rangpur, Pabna, Jessore, and Kushtia. The Ford Foundation provided funds to meet travel expenses for a Bangladesh Agricultural Development Corporation (BADC) staff member to go to India to buy seeds and two vehicles. Directorate staff, in collaboration with scientists from the Directorate of Agriculture (Research and Extension), monitored on-farm performance of those varieties under different agroclimatic situations. Subsequently, more systematic on-farm verification trials were organized countrywide, primarily to decide which varieties should be imported and developed. The Wheat Research Programme was given top priority by giving it research division status after BARI became autonomous in 1976. Since development of varieties through hybridization takes a long time, BARI scientists used screening and selection of lines developed in CIMMYT, the International Center for Agricultural Research in the Dry Areas (ICARDA), and other countries' national programs to develop varieties. On-station and on-farm trials were conducted to study adaptive characteristics.

In the past, on-station researchers rarely took farmers' situations and problems into account when devising research strategies. However, while monitoring the field performance of imported varieties, the BARI wheat research team found that farmers were asking questions about the method of storing new seed varieties. Since farmers' storage of their own seed was crucial for rapid expansion of wheat acreage, the team then began research on seed storage and quickly conducted a survey among farmers who had experience in storing good-quality wheat seeds (Ahmed, 1977). The results were twofold: information on farmers' methods of storing wheat seeds was disseminated more widely through the extension system, and on-station research was undertaken to further improve the methods identified.

During this time, contact increased rapidly with international wheat centers, particularly CIMMYT, whose scientists visited Bangladesh once a year and made valuable contributions through reviews, criticism, and suggestions (for example, Biggs, 1978a). With their assistance, the on-farm wheat verification program was formalized, expanded, and standardized. CIMMYT scientists suggested that given the limited experience in wheat research and the limited research resources available in Bangladesh, priority be given to village-level research while leaving sufficient funds for on-station research. This would be a more cost-effective way in which applied research could contribute to expanding the area under wheat and increasing the level and stability of yields in farmers' fields. There would be two components of village-level research:

1) on-farm trials, with the objective of helping in the development, testing, and verification of technologies for the circumstances and problems of different types of farmers;
2) farm surveys, intended to identify the circumstances and problems of different types of farmers, and also to identify new innovations developed by rural people (Biggs, 1978b).

In this context, the CIMMYT scientists considered the BARI survey on seed storage to be an important innovation in rapid rural research and the method was later incorporated into CIMMYT methodology.

CIMMYT also encouraged in-country interinstitutional and interdisciplinary collaboration in wheat research. An example of this effort was a wheat farmers' survey conducted during the 1978/79 season by agricultural economists from BARI and Bangladesh Agricultural University using field staff from the Soil Fertility and Soil Testing Institute. The BARI Wheat Programme provided funds for the survey. The findings were intended to be available in time to help design the 1979/80 season on-farm wheat trials of both the Soil Fertility and Soil Testing Institute and the Wheat Programme so that the survey could make a contribution to wheat technology policy and program formulation. Unfortunately, the results were not available in time and were not published until long after the 1979/80 wheat season had started (Jabbar, 1981; Swenson et al, 1979). Thus, the main objective of the survey remained unfulfilled. The main reason for the delay was that the original short list of questions was converted into a 22-page, detailed questionnaire, and analysis of the

data therefore required a long time. The leaders of the study were guided by their experience in formal surveys and had not appreciated the importance of conducting a quick survey that would be of immediate use to biological scientists.

In 1984, the on-farm trial part of the Wheat Programme was incorporated into the newly formed On-Farm Research Division (OFRD).

Cropping/Farming Systems Research

BARI scientists, even though they were sitting next door to BRRI which initiated cropping systems research (CSR) in Bangladesh, took some time to accept the CSR concept. Later, they reportedly thought that BARI, being a multicrop institute, would be more suitable for CSR. There were a number of regional stations and substations, and the network of the Soil Fertility and Soil Testing Institute could be used for on-farm testing. In 1979, BARI invited Dr. V.R. Carangal, an IRRI cropping systems research scientist who also helped design the BRRI Cropping Systems Research Programme, to give some guidance on the development of CSR within BARI.

In 1980, BARI's Agronomy Division started a CSR project with BARC funding through its contract research program. Sites were selected in Hathazari, Jessore, and Jamalpur. CSR was initiated at the same time in the applied-research component of BARI's Extension and Research Project (ERP) operating in the northwest region as a complement to the training and visit (T&V) extension system (see next section). The Agronomy Division's CSR sites became part of the National Coordinated Cropping Systems Research Programme network first, and the ERP's sites were added a year later. In 1984, all CSR activities were placed under the control of the newly formed On-Farm Research Division (OFRD).

The shift from a cropping systems approach to the broader farming systems approach was gradual in BARI and its evolution closely parallels the developments at the national level discussed in the previous chapter. It is interesting to note, however, that during a 1984 BARI regional workshop at Ishurdi to review the CSR activities of the Extension and Research Project, the FSR concept was not mentioned once in the deliberations and recommendations (BARI, 1985). This is surprising since early in 1983 BARI scientists claimed that CSR had already been redirected as FSR in their institute (see Chapter 2).

Today, under the National Coordinated Farming Systems Research Programme, BARI has the largest number of projects compared with the other participating institutions (table 10). Since the program is still developing, not all the staff have been recruited. For those projects which converted CSR sites into FSR sites, the program is continuing with or without added components. Some new projects have had a slow start because of administrative problems.

With the change from CSR to FSR, it was felt that the skills of scientists and methods of field management and operation had to be reoriented and strengthened. To this end, the OFRD organized a training course in April 1985 for FSR workers of different institutes with support from BARI. Trainers were both local individuals and

expatriates working in Bangladesh. This training course may have been the most important practical action for moving toward an FSR approach. The papers are quite rich and have been published, and although the main focus still remains on crops, action on other FSR components has been initiated by OFRD (BARI, 1985).

Extension and Research Project

In 1975, an international development agency review of the agricultural sector of Bangladesh reported some deficiencies in the agricultural extension and research systems and proposed some solutions. The major deficiencies were as follows (GOB, undated):

a) Agricultural extension activities were distributed among too many organizations under several ministries, including the Ministry of Agriculture, the Ministry of Industries, and the Ministry of Land Reforms, Rural Development and Cooperatives. Moreover, some organizations had nationwide programs while others operated only in specific areas or regions.

   In general, this structure created problems of coordination and effective utilization of manpower. For example, in the five districts comprising 18,354 villages in northwest Bangladesh, there were 3,026 village- or field-level extension agents working in eight different organizations. Thus, there were six villages (about 6,200 people) per extension agent. In reality, coverage per agent was much higher (15 villages in the case of the Directorate of Extension, 25 villages in the case of both the Jute Directorate and Sugar Corporation, and still more for others) because of divided responsibilities.

b) Frontline extension workers had inadequate training, and most of them were not up to date on the technologies available.

c) The research system was also fragmented and activities were uncoordinated. The linkage between research and extension was very poor. Although extension is supposed to provide a channel for two-way communication between farmers and researchers, the existing structure was following a top-down approach - taking some of the research findings to the farmers but bringing very little from the farmers to the researchers.

The international development agency report suggested that a significant increase in agricultural production could be achieved by reorganizing and strengthening extension and agricultural research. It suggested introducing the training and visit (T&V) system of extension in the Directorate of Agriculture and, to complement the T&V system, undertaking a program of applied research through BARI, directly linking it with extension.[3] Implementation of these programs was expected to result in increased coordination within and between the extension and research systems.

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3 For a description of the T&V system of extension, see Banor & Harrison (1977), and Benor & Baxter (1984). In the latter report, the authors said that any extension system has to be adapted to local administrative and agricultural structure but the T&V system is quite rigid.

The government accepted these suggestions and with International Development Agency support initially set up the Extension and Research Project (ERP) in the five districts of northwest Bangladesh. The project had two components: the T&V extension system which was introduced in 1977, and the applied research component, which was introduced in 1978 (GOB, undated). These were subsequently extended to other parts of the country. The region was chosen mainly because the potential for increased production was much higher there compared to other parts of the country.

The main objective of the T&V system is to continuously update the knowledge of extension workers at all levels in order to make their services more effective. Its effectiveness depends greatly on quick answers to the many questions posed by farmers, extension agents, and policymakers. The applied-research component of the ERP was designed to find such answers. Its initial objectives were:

a) to define existing packages of practices for improved varieties of rice and wheat to fit local conditions and to delineate areas where present varieties could or could not be grown;
b) to develop similar production packages for improved local varieties to ascertain the margin between existing yields and those obtained under good management;
c) to define the role of newly introduced crops, new varieties of existing crops, and established high -alue crops in traditional and modified cropping systems. The results of work carried out on the status of tobacco, cotton, sugarcane, horticultural crops, and jute in the region should be taken into account in these studies;
d) to assess the possible role of increased areas of traditional or new leguminous crops on soil fertility. In these studies catch-crop pulses and forage crops should also be examined.

In order to introduce the T&V system of extension, the International Development Agency provided funds for recruiting additional manpower at district, upazila, and village level, for provision of training facilities including offices, houses, equipment, vehicles, expatriate assistance, and operational expenses. Support was also provided in the form of construction or improvement of seven research substations (including offices, housing, equipment, laboratories, irrigation facilities, vehicles, expatriate assistance, and local staff0. The international development agency's total support accounted for 75-80% of the cost of the project.

To implement ERP, several organizational changes had to be effected and certain new management mechanisms introduced:

1. The various extension services under the Ministry of Agriculture were merged with those of the Directorate of Agricultural Extension. Those under other ministries remained unchanged.

2. It was reportedly originally agreed (no written evidence is available) that ERP's applied-research component would be implemented through the Soil Fertility and Soil Testing Institute by renaming it the On-Farm Trials Division, and that seven research substations would be established or upgraded in the northwest region. The On-Farm Trials Division was expected to conduct experiments at these substations and on farmers'

fields. The Soil Fertility and Soil Testing Institute was not reorganized at that point, and the applied-research component was initiated as a separate project, known in BARI as the Extension and Research Project, under the direct control of BARI's research director. Two research substations were established at Thakurgaon and Rangpur, and substations at Bogra and Shympur (Rajshahi) were upgraded. Ishurdi, a BARI regional station, was made the project's headquarters. During 1979-80, BARI recruited 26 scientists, 19 field assistants, and 20 supporting manual and clerical staff for placement in the region.

3. In order to link the activities of the T&V system of extension and the applied-research component, two types of committees were established in 1980:

a) a Regional Coordination Committee with the divisional commissioner as chairman to approve the annual and seasonal extension and research workplans, and for overall project planning;
b) district coordination committees with the deputy commissioners (Heads of Civil Administration) as chairmen with the responsibility to approve the annual and seasonal workplans for both extension and research; review the quarterly progress reports prepared by the district-level officers of the Directorate of Agricultural Extension, BADC, the Integrated Rural Development Programme, and BARI; and report progress to the Regional Coordination Committee.

These committees were supposed to meet as necessary but not less than once every three months. Up to the end of 1979, none of the committees had met even once because the chairmen were too busy and the leaders of the project's extension and research components wished to avoid possible civil-service domination. Consequently, the project's intended extension-research linkage function did not get off the ground.

In early 1980, the extension and research workers involved in the project felt the need to improvrng the linkage function and without official reference to the regional and district coordination committees, they formed regional and district technical committees with the Regional Director of Extension and district extension officers as chairmen, respectively. The project's research component leader was made member-secretary of the Regional Technical Committee, and the senior researcher in each district was designated Member-Secretary of the District Technical Committee. Other members included representatives of BADC, the Soil Resources Development Institute, and the Directorate of Livestock Services. Subsequently, other development organizations were also represented.

The Regional Technical Committee was given a supervisory role and the district technical committees were given the following responsibilities:

a) to identify existing crop production practices in the area, and constraints to higher production;
b) to develop on-station and cropping systems research programs to solve local problems, and to test national

recommendations on crop production technologies for refining those recommendations;

c) to plan and conduct demonstration trials to support locally planned extension programs;
d) to determine potential points of impact and to package relevant information into lesson sheets to be used for training of block supervisors at upazila level;
e) to plan and conduct training programs for extension workers and farmers, organize field days and farmers' rallies at research stations and on farmers' fields, and set up internal review workshops;
f) to supervise national programs like Intensive Rabi Crop Production and Intensive Aman Crop Production;
g) to monitor field problems in order to ensure quick feedback to national extension and research systems;
h) to formulate extension recommendations for the area.

The committees facilitated the flow of information between research and extension in the following way: block supervisors talked to farmers to identify problems and then referred the problems to the Upazila centers when they attended fortnightly discussion and training sessions. The block supervisors would then convey any solutions suggested by the upazila agricultural officers back to the farmers. If the upazila officers could not suggest solutions, they would refer the problems to district level when they attended monthly discussion and training sessions. Problems identified at these sessions were referred to the district technical committees and any solutions suggested were referred to the Regional Technical Committee for approval as impact points. This committee's recommendations were then transmitted back through district- and upazila-level training sessions or, in some cases, through leaflets.

The district technical committee representatives of local research stations (mostly BARI and BRRI) referred problems for which the committee had no suggested solutions to the local research station for discussion or experimentation or to the main station(s) for appropriate action. Experimental results were then transmitted back through the same channels.

4. Since they were embarking on a new type of research, mechanisms had to be developed to assist researchers in working together to develop an effective research strategy and methodologies.

During 1979-80, the team conducted trials at various substations and on farmers' fields in Rajshahi Division with a view to selecting rice varieties suitable for different parts of the region, to refine fertilizer recommendations, and to develop an alternative package. Agronomic and varietal trials on winter crops were also conducted.

In October 1980, a two-day meeting was convened at Bogra Substation to review on-farm experiments conducted in seven substations during 1979-80 and to consolidate experience, diagnose problems, and plan the following year's trials, discuss input and equipment needs, and review interagency linkages under the Extension and Research Project. But the whole business was completed in two hours instead of two days. Due to lack of

experience, the participants were insufficiently prepared to make presentations, and future plans were not discussed.

The project leader proposed that rather than conducting unrelated trials, a cropping systems research approach should be adopted to develop location-specific and clientele-specific technology for which there was already an increasing demand from the extension service, voiced through the district technical committee meetings. He felt encouraged to adopt CSR because the Agronomy Division of BARI had just joined the National Coordinated Cropping Systems Research Programme and started on-farm CSR at three sites. ERP staff agreed at the review meeting to adopt a CSR approach but not to become a member of the National Coordinated Cropping Systems Research Programme.

During 1980-81, CSR sites were established in five out of seven substations under ERP's control. None of the scientists had any practical experience in CSR but they adopted the methodology suggested by the National Coordinated Cropping Systems Research Programme as a guide. Discussions with BRRI CSR scientists also helped. Initial work involved site descriptions, simple agronomic trials, and block monitoring to document plot by plot what farmers were actually doing. In 1981, cropping-pattern trials were set up in Ishurdi, Bogra, and Rangpur. The same year, the Ishurdi and Bogra sites were included in the program's network; thus, additional research funds started coming from BARC.

However, ERP scientists used the program's CSR methodology in its own way: rather than selecting research sites by themselves, researchers involved extension and soil resource development personnel in site selection, soil identification, and design and testing of cropping patterns. It was expected that this involvement would increase the extension workers' confidence in the technology developed and that it would also reduce the time required for training during preproduction evaluation.

Involvement of soil resource personnel also brought new ideas about zoning. Instead of the land types generally used as the basis for selecting different cropping patterns, ERP started using the 1982 soil series, assuming that there might be considerable variations in nutrient content, permeability, and texture of different soil series of the same land type (Abedin, 1983). ERP staff were provided with short training in soil survey and soil series identification.[4]

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4 In a workshop held in BARI in 1983 questions were raised about the validity and the usefulness of using soil series as the basis for selecting fertilizer and cropping-pattern trials. The debate remained inconclusive. While ERP continued to use soil series, CSR components of other research institutes continued using soil types. The issue was again debated in an OFRD internal review workshop in 1985/86 but the differences still remain. ERP scientists appear to be convinced about the usefulness of soil series but they have failed to convince others.

5. ERP's emphasis on research-extension-farmer linkages distinguished their on-farm research activities from those of other institutions conducting on-farm research, including BARI's Agronomy Division. In particular, ERP developed innovative procedures for planning, design, implementation, and evaluation of on-farm research involving representatives of the relevant institutions.

The disappointing experience of the Bogra workshop convinced ERP researchers of the necessity of convening workshops for reviewing and assessing their work and of devising appropriate research programs and methodologies. In early 1981, a second, more successful review workshop was held at Rajbari Substation in Dinajpur. This time, some extension officers were also invited.

Review workshops involving extension were subsequently institutionalized through the district technical committees. Three of the district technical committee meetings held in the beginning of three crop seasons (Rabi, early Kharif, late Kharif) were devoted partly or completely to reviewing ERP research activities and to planning research for the next season. In 1981/82, four of the five Committee meetings were research review workshops, and in 1983/84, three of the 10 meetings held were for internal review.

Seven farmers' field days were organized in 1980/81 and in 1981/82 in different parts of the northwest region to discuss the initial objectives and final results of some on-farm trials. In 1983/84, 10 such events were organized, in each of which 60 to 300 farmers and 20 to 35 extension and other development agency representatives participated. This type of event was later formalized as a farmer-researcher-extension linkage.

During field visits, ERP researchers learned about innovative practices which farmers had developed to suit their own needs and agro-ecological circumstances. Researchers considered it important to learn about such practices because:

a) these practices were developed under the conditions or the farming systems in which farmers actually operate;
b) they showed how farmers, particularly resource-poor farmers, managed to modify and exploit micro-environments;
c) knowledge about innovations could save scientists from "reinventing the wheel" (Abedin and Haque, 1987).

In its early years, ERP identified a number of innovative practices and organized innovative farmers' workshops around them in order to learn about the new processes and their utility, spread the innovations widely among potential users, and plan further research for their refinement. Two examples are given:

In 1981, the leader of the ERP research team was travelling with the Minister of Agriculture in the northwest region. At the request of the District Extension Officer of Rangpur, they

visited the area where farmers were harvesting potatoes twice from the same planting and at the same time intercropping with cabbage, radishes, wheat, and chillies. Total potato yield was no different from that of a single harvest but harvesting early helped get a premium price. ERP subsequently organized a field day to show the practice to other farmers, extension workers, and researchers. A two-day progressive[5] farmers' workshop was organized at Ishurdi Regional Station in September 1982. Four farmers were invited as resource persons and, with help from extension officers, presented their experiences before a group of 35 trainee scientists and extension officers. Group discussions and practical demonstrations were also held. On the recommendations arising out of the workshop, ERP undertook a number of on-station and on-farm trials in the following year to refine varietal suitability for double harvesting and different combinations of intercropping. In 1983, three similar workshops were held on innovative practices in oilseed, wheat, and watermelon production (Abedin and Haque, 1987).

These workshops not only helped the ERP improve its research agenda and design but also provided a forum for the exchange of information about further innovative practices. For example, ERP was planning to conduct zero-tillage experiments with a high-yielding mustard variety developed at BARI. A farmer participating in the Innovative Mustard Farmers' Workshop mentioned that he had grown the variety under zero tillage but with one irrigation and got good results. His experiences provided an important input for designing ERP trials.

Similarly, farmers participating in the Innovative Watermelon Farmers' Workshop provided ideas on methods of quick sprouting of watermelon seeds. Farmers in the Innovative Wheat Farmers' Workshop informed scientists that some farmers in Jessore were relay-cropping wheat with T. Aman paddy. This information helped ERP to design experiments, which were already being planned, on wheat production under zero/minimum tillage.

During its early years, ERP conducted a number of training sessions (eight during 1980/81-1983/84) of various durations (six days to two months) for block supervisors and selected farmers. During this period, 22 one-day regional extension and research workshops were organized, and extension and research officers from the region participated. These were intended to expedite the flow of information between research and extension and to enhance the understanding of each other's needs and roles in the process of technology generation and dissemination.

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5 In the beginning, the terms 'progressive' and 'innovative' farmers were used interchangeably. Later a distinction was made: 'progressive' farmers are generally considered to be adopters of new technology, while farmers who had successfully done something new within the framework of traditional or improved technology were considered 'innovative'. In the previous example, those who double-harvested potatoes were innovators.

6. ERP developed a new kind of relationship with the On-Farm Trials Division in the northwest region. Normally, OFTD trial programs would be decided at its headquarters but after discussion with the BARI administration, OFTD staff were encouraged to design trials in consultation with ERP staff. Gradually OFTD was also brought into ERP's internal review process. In 1982, at ERP's initiative, OFTD offices in the region were moved to the nearest substations, and after negotiations between ERP and OFTD headquarters, OFTD field staff were allowed to write up their own trial results instead of having them written up at headquarters. The same year, the Director-General of BARI ordered the ERP research leader to provide technical guidance to OFTD in the northwest region. Thus, although the ERP research component was not implemented through the OFTD as originally agreed, OFTD in the region did undergo a fundamental change as a result of its links with ERP.

   After completion of the first three-year phase of ERP (both T&V extension and applied research), the Project was extended first for three years, and then for two more years, and again for one year ending June 1988. The geographical coverage was also gradually extended. In the meantime, the status and organizational structure of the project had changed considerably (see below).

Fertilizer Distribution and Demonstration Project

This was originally a FAO/NORAD- and later a FAO/UNDP-supported project operating since 1982 in collaboration with BADC, the Directorate of Agricultural Extension, and BARI. BARI was concerned with the field trial part of the project, which it implemented through its On-Farm Trials Division. The main objective was to the monitor nutrient status of soil under continuous cropping situations, particularly the residual effect, and the micro-nutrient status and their effects on crops. This project provided little opportunity for direct farmer-researcher-extension interaction except that the cooperation of selected farmers was needed for monitoring. However, the findings were useful for revising fertilizer recommendations, and ERP provided a means of transmitting the results.

On-Farm Research Division

By 1984, there was considerable duplication in the on-farm work of the On-Farm Trials Division, the Wheat Programme, the FSR Project of the Agronomy Division, the Extension and Research Project, and the Fertilizer Demonstration Project. To minimize such duplication, it was planned that all on-farm research programs in BARI should be consolidated under the On-Farm Trials Division, which, in 1978, was given the official mandate for on-farm testing of technologies generated by other research divisions of BARI.

There was a problem concerning staffing. OFTD scientists and field staff in North Bengal had been in contact with ERP in its early years and had continued the contact when ERP extended its activities to other districts. However, experience had suggested that some of them were not oriented toward FSR and on-farm research,

particularly in regard to the way ERP worked with the extension service, and it was therefore not considered desirable to retain all staff in the newly organized OFTD if on-farm research was to be conducted efficiently. The problem was solved in 1984 by creating two research divisions:

a) the Analytical Services Division where most nonfield-oriented, nonagriculture staff of OFTD were placed for laboratory work;

b) the On-farm Research Division (OFRD), where the staff of ERP, the FSR projects of the Agronomy Division, the Fertilizer Demonstration Project, and the field-oriented staff of OFTD were placed. This division was given the mandate to perform all on-farm-related activities, including those previously done by other divisions, e.g., wheat.

The research of the On-Farm Trials Division network, which had over 200 trial sites in as many upazilas, was also reorganized after the creation of OFRD. These sites were reorganized into 83 multilocation testing sites in representative agro-ecological zones and the field staff were reallocated to them.

OFRD was officially made a program performing unit of BARI and was expected to conduct research activities and verification trials on farmers' fields throughout the country under researcher or farmer management.

OFRD's main objectives are (BARI, undated):

1. to generate location-specific and cost-effective technologies (e.g., on crops, livestock, vegetables) for different clientele groups: landless, marginal, small, medium, and large farmers with special emphasis on the poorer group;

2. to generate low-cost technology packages with optimum-level recommendations so that the poorer farmers also benefit from the research process and can increase their income;

3. to verify on-station technologies under a wide range of agroclimatic situations;

4. to give feedback to on-station scientists on the performance of their technologies and suggest desired improvements;

5. to analyze farmers' socio-agro-ecological situations and physical environments in order to better understand their needs, options, and abilities;

6. to accelerate transfer of technology by improving the mechanism of the extension-research linkage;

7. to establish an effective mechanism to identify farmers' field problems, including information on the general crop situation as well as on droughts, floods, excessive rain, pest outbreaks and deficiencies of soil nutrients;

8. to assist other research organizations by testing their technology on farmers' fields;

9. to identify innovations developed by farmers and take steps to incorporate them as impact points in the T&V extension system.

OFRD adopted the farming system research approach as a basic framework for generation of location- and clientele-specific technologies. Research activities to achieve the objectives are to be undertaken on the FSR sites already established. To strengthen the content of the research programs of the sites, strong linkages with the Department of Agricultural Extension and other research organizations have been viewed as highly important. Research is to be primarily aimed at improving rainfed agriculture and indigenous improved technologies, but wherever irrigation water is available, equal attention is to be given to irrigated agriculture.

Client groups are to be identified, not only on the basis of landholdings, but also according to their particular characteristics. Alternative packages requiring lower expenditure and lower risk are to be developed. Bottom-up research program planning and site-level review are to be continually promoted and institutionalized.

One of OFRD's programs is the Multilocation Testing Site Program, whose objectives are:

1. to verify and validate improved farming systems technologies in other similar areas in order to accelerate the spread and transfer of technology to more farmers over a wider area;

2. to educate farmers and extension workers concerning the value of the new technology. This would be a firm foundation for a successful production program: the extension worker becomes more capable and confident in applying the technology and the farmer cooperator will act as the motivating factor in achieving adoption of the demonstrated new technology,

3. to speed up implementation of a larger production program in an area utilizing technology thoroughly validated in the same area;

4. to obtain feedback about the adoption of technologies.

Multilocational testing sites are conducted in collaboration with the Directorate of Agricultural Extension. Current organization and management procedures of FSR, multilocational testing, and other activities of OFRD are discussed in the following section.

Summary of Evolution

The evolution of OFCOR within BARI may be summarized as follows (Table 14):

Table 14: Chronicle of Development of OFCOR within BARI

Year	Event
1957	On-farm fertilizer trials initiated.
1963	Soil Fertility and Soil Testing Institute established.
1973	Wheat research team started on-farm verification with collaboration of Directorate of Agricultural Extension.
1976	Agronomy Division started Cropping Systems Research Program with BARC funding; later became Farming Systems Research.
1978	Extension and Research Project (ERP) started in North Bengal under direct control of Director General of BARI.
	Soil Fertility and Soil Testing Institute renamed On-Farm Trials Division.
1979	ERP's Adaptive Research Programme started.
1981	ERP joined National Coordinated Cropping Systems Research Programme.
1982	ERP extended to more districts. Fertilizer Demonstration Project started operating through On-Farm Trials Division.
1984	On-Farm Research Division created by combining Extension and Research Project, Farming Systems Research, part of OFTD and On-Farm Wheat Programme.
1985	Cropping Systems Research broadened to a Farming Systems Research approach.

ORGANIZATION AND MANAGEMENT OF RESEARCH WITHIN THE ON-FARM RESEARCH DIVISION (OFRD)

Organization of Research

The research program of OFRD has evolved along with OFRD itself. The research projects for 1986/87 and 1987/88 are summarized in Table 15. The projects are implemented by a central management unit at the BARI headquarters in Joydebpur, five regional management units, and 24 implementation teams (Figure 4). The ventral management unit is headed by a chief scientific officer who leads the entire research program and also has specific responsibility for Learning from the Innovators and Household Fuel and Organic Matter Utilization Project. Three other members of the Unit lead two subprojects under

Project II (Field Trials of Advanced Technology) and subproject C (Pre-production Evaluation of Improved Farming Systems) under Project I (Farming Systems Research). Sub-projects A (Socioeconomies of Farming Systems) and D (Homestead Production and Utilization) of Project I are headed (respectively) by a member of the Agricultural Economics Division and a member of the Horticulture Division. Both of them are part-time members of the central management unit, their main responsibility being for their own divisions.

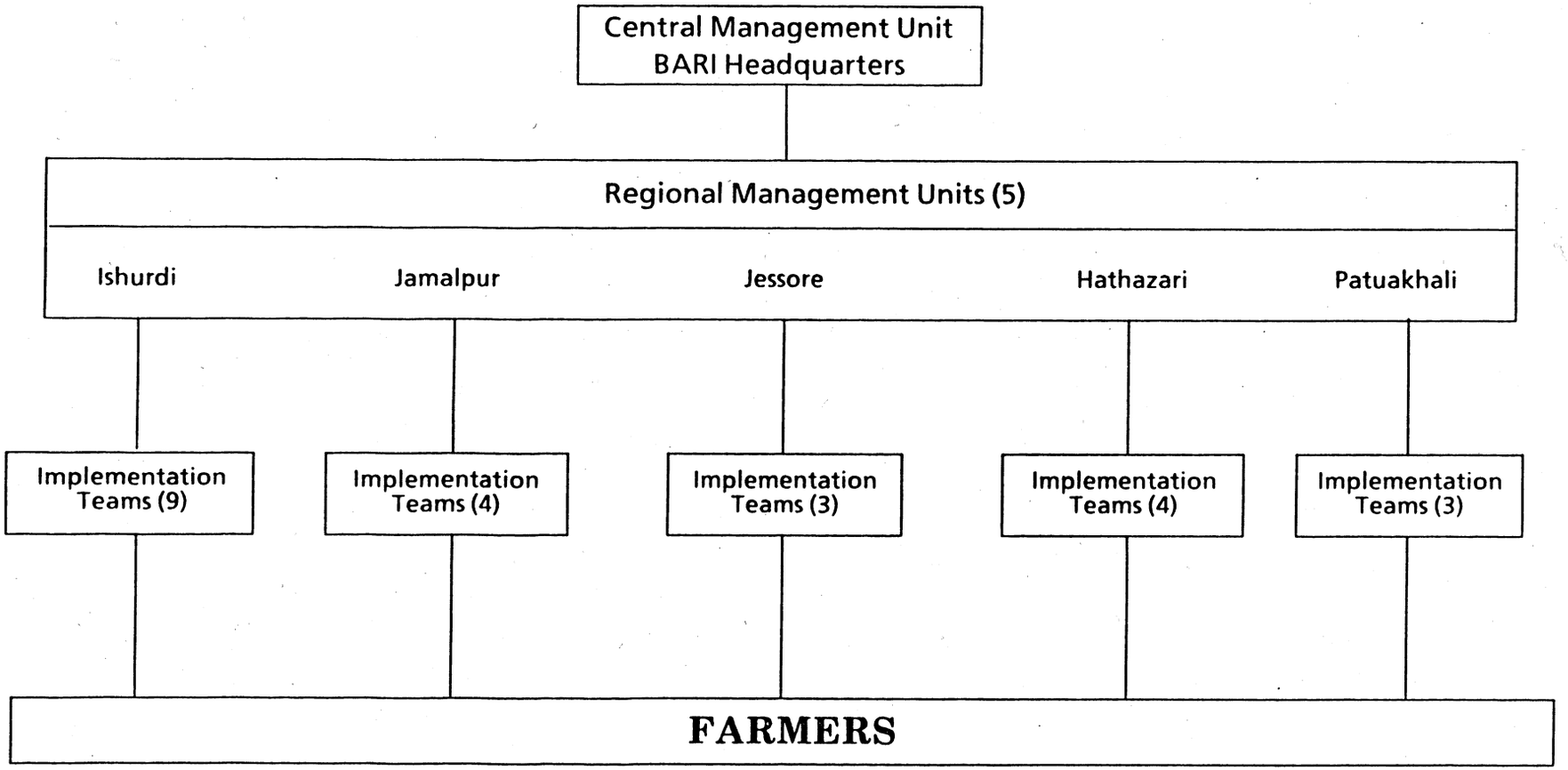
Table 15: Research Program of OFRD, 1986/88

Name of Project/Subproject	1987/88
Project I. Farming Systems Research	
Subproject A: Socioeconomies of Farming Systems	+
B: Improvement of Existing Farming Systems	
- Ishurdi Region	+
- Jamalpur Region	+
- Jessore Region	+
- Hathazari Region	+
- Patuakhali Region	+
C: Preproduction Evaluation of Improved Farming Systems	+
D: Homestead Production and Utilization	+
E: Fertilizer Management	-*
Project II. Field Trials of Advanced Technology	
Subproject A: On-Farm Fertilizer Trials	+
B: On-Farm Trials on Management Practices and Improved Lines/ Varieties	+
Project III. Learning from the Innovators	+
Project IV. Household Fuel and Organic Matter Utilization	+
Project V. On-Station Backup Research	-*

Note: * Project was in operation in 1986/87 but not 1987/88.

The regional management units are located in the regional stations of BARI, and each is headed by a principal scientific officer who leads the research program of the unit (Subproject B [Improvement of Existing Farming Systems] of Project I). Each regional management unit has a number of implementation teams under its control. There are 24 such teams: 11 of them have one FSR site and two or three multilocation testing sites, and the remaining 13 teams have only two or three multilocation testing sites each.

Figure 4: Organizational Flow Chart for OFRD



Planning and Review of Research

The process of planning and review of research in OFRD has come a long way from the brief two-hour meeting of the ERP team held in Bogra in 1980. Since then, the organizational, methodological, conceptual, and ethical issues in research planning and management have changed and are still changing. Some of the more important changes have taken place since the formation of OFRD in 1984, particularly during 1985/86 when OFRD had Dr. Anil K. Gupta as a consultant to guide its activities. During this time, OFRD scientists were encouraged to adopt a collective self-critical approach to their work.

In a 1985 internal research review meeting, a working group of OFRD scientists was formed to prepare guidelined for conducting on-farm research. The group met on a number of occasions, debated various issues and prepared guidelines which were approved in a subsequent review meeting. A workshop was organized in January 1986 at BARI to review the research activities of seven old FSR sites administered by ERP during 1980-85. In this workshop and in the regular internal review meetings, questions were raised and discussed and many decisions were taken. A summary of the important questions, suggestions and lessons derived from proceedings of meetings, as well as memoranda and other internal documents, is given in Appendix C. Some may appear trivial to experienced researchers but for the younger OFRD scientists, they were potentially important for improving their abilities. Some suggestions have been implemented, some are still being debated, and others remain as future possibilities.

The current standard official planning procedure is for implementation teams to prepare research plans three times yearly before the onset of a cropping season. The topics may be derived from the past year's or season's research, case studies, experiences of working with farmers, district technical committee and regional technical committee meetings, surveys, or direct contact with extension and development agencies and central research stations. The subjects for advanced technology trials are proposed by the various research divisions at BARI or other research institutes. The findings of the previous season's research and proposed programs are prepared by the scientists and consolidated by the implementation team. They are then scrutinized by the district technical committee. At this stage, implementation teams seek farmers' opinions about the relevance of the program recommended by the district technical committee. After revision, the proposed program is taken to the internal review meeting at BARI headquarters.[6]

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6 Up to 1985, the regional technical committee would also scrutinize the programs before internal review. This stage of scrutiny was eliminated after observing that most of the time the committee approved whatever the district technical committee had recommended.

Scientists from other divisions of BARI and other research institutes are either members of the committee or are invited to these meetings. The recommendation of the internal review is placed before the task force which consists of all heads of divisions/programs and members drawn from other research institutes and extension services and is chaired by the Director (Research) of BARI. The recommendations of the task force are finally reviewed and approved by the Central Programme Review Committee chaired by BARI's Director General. The approved programs are then sent by OFRD to the respective implementation teams, each of which then allocates the trials among scientists and field staff for implementation. At this stage, farmer-participants are also briefed on the details of the experiments, the potential benefits, and their obligations.

Implementation of Trials

Scientific supervision. During 1986/87, OFRD conducted a total of 799 trials in different programs, including 83 on-station back-up trials. OFRD staff work as a team. Scientists are recruited for specific projects but they may be involved in more than one research project/program. For example, 15 scientists (eight of them from OFRD) and 11 field assistants located at Ishurdi Regional Station were assigned 44 trials during 1986/87, an average of three trials per scientist and four trials per field assistant. The actual work schedule shows that each scientist was given responsibility for a minimum of two and a maximum of 15 trials, some of which were related to separate projects. While most scientists were given responsibility for two to three trials, two scientists were allocated 15 trials each, another 13, and another 10 trials.

Fifty-five OFRD scientists located in 20 centers reported their involvement in trials or surveys for 1985/86 and 1986/87 (Table 16).

Table 16: Distribution of Number of Trials/Surveys during 1985/86 and 1986/87

Trials/Surveys per Scientist	1985/86		1986/87	
	Number of Scientists	%	Number of Scientists	%
0	11	20.0	6	10.9
1-3	11	20.0	7	12.7
4-6	11	20.0	11	20.0
7-9	6	10.9	11	20.0
10-12	7	12.7	7	12.7
13-15	3	5.4	7	12.7
16+	6	10.9	6	10.9
Total	55	100.0	55	100.0

Each might be involved in more than one project. Those without involvement in any trial are located in the head office and/or recruited very recently. Those involved in more than 10 trials or surveys are usually site coordinators or regional leaders, and by virtue of their position, they have indicated themselves as being involved in nearly all the trials under the control of the relevant site. Such a skewed distribution of the work load does not appear to be rational.

Farmer participation in trials. There are two major categories of trials from the point of view of farmer participation:

a) researcher-managed trials in which farmers usually act as assistants to the researcher, mostly carrying out activities as they are advised;
b) farmer-managed trials in which farmers participate with scientists in decision making at all stages.

There are no set procedures to select the trial plot and the farmer; whether the plot or the farmer should be selected first is still being debated. In most cases, farmers are first identified by field assistants through frequent discussions (sometimes five to six visits are necessary before a farmer agrees to participate), and the final selection is usually done by the scientists individually or as a team. Farmers at multilocation testing sites are identified by block supervisors and finally selected by scientists and extension staff together. OFRD usually provides material inputs for the trial plots.

Once field trials are set up, regular monthly monitoring is done from headquarters. Since 1984, site teams have sent monthly reports on the condition of trials, extension-research linkage activities (e.g., district technical committee meetings), problems faced and action taken or required to be taken at headquarters, and the staff situation. Since October 1987, reports on the general field situation (e.g. crop condition, drought, rain, flood, disease, and pest infestation) are also sent. Scientists from headquarters, with or without prior notice, also visit the sites to monitor the trials. Scientists responsible for different sites also make reciprocal visits, particularly to see similar trials or innovations. This is a process of 'lateral learning'.

Trial plots may be located between 5 and 25 km. from the site or regional office. So, adequate provision of transport is considered essential for their efficient management. Each regional team has a four-wheel-drive vehicle and a number of motorcycles. Other scientists in implementation teams also have motorcycles, and field assistants either have bicycles or are located near the trial sites. Some sites may be difficult to reach, which discourages scientists from travelling there daily. Field assistants are therefore sometimes left to take decisions or actions about trials alone, thus impairing effectiveness. In one substation, scientists stopped using motorcycles because motorcycles were occasionally taken away by force for political meetings or even for pleasure rides. Complaints to higher levels did not produce any results. Under the circumstances, field supervision suffered badly because the sites were about 16-20 km away and scientists visited them less frequently.

Data analysis and output. OFRD seems to be collecting more data than can be fully analyzed in time to be useful. Each implementation team and regional unit produces a preliminary report of trial results as well as benchmark and other surveys for presentation at the various review meetings. These reports are mostly in raw or elementary form and are used as background for the next season's experiments. But the full implications of the experiments remain unexplored. However, the quality of presentation has improved over the years. All the results are supposed to be consolidated by the OFRD head office but facilities are not yet adequate for this purpose. A microcomputer has been acquired but a system of data storage and retrieval and reporting has not been developed, and trained manpower is also lacking. Unless attention is given to this area, the experience of the Soil Fertility and Soil Testing Institute will be repeated -- piling up data sheets without any analysis and use. The most recent available OFRD annual report is for 1983-84.

Another reason for the delay in transmission of trial results is that most junior staff are still incapable of writing and reporting survey and experiment results on their own. This is not unusual for young graduates (or for older graduates who were not previously asked to do this kind of work). Staff members who have had higher training, either degree or special short courses, have improved their writing and reporting abilities. Such training is an ongoing activity. Dr. Brook Green, an IADS economist, has conducted a number of statistics and writing training courses for FSR staff from different institutes to increase their analytical and writing skills. A by-product of this exercise has been the publication of nearly 20 small reports (of not very good quality) by BARC's Agricultural Economics Division, all using FSR data from different sites.

Dr. Anil Gupta spent part of his time guiding some field surveys and case studies from problem design through to write-up. This exercise achieved, among other things, three objectives:

1. New insights were learned about the reasons farmers choose existing cropping patterns; thus, helping design useful new trials.
2. The practical skills of researchers in conducting surveys and writing reports were improved;
3. A homestead survey added a new dimension to the FSR content.[7]

The importance of understanding farmers' perceptions of risks and the way they face them was emphasized throughout these exercises. Scientists from other disciplines and divisions of BARI were also invited to share experiences. This was emphasized for drawing up a more appropriate research agenda.

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7 The homestead survey was conducted in response to a request from the Horticulture Division to finalize a questionnaire which they wanted to use. Since no data existed to confirm or reject the order or the substance of the questions, the case studies were done immediately.

Such exercises are continuously needed to improve the quality of research. Unfortunately, OFRD lacks adequate senior, skilled and experienced staff for providing such guidance. Temporary expatriate staff may provide temporary support but because each expatriate has his/her own way of working, such support may not create any lasting impact on a program as large as OFRD.

OFRD publications are listed in Appendix D. Most results are distributed in mimeographed form. There are three problems with this:

1. Such reports are not valued as highly as articles published in professional journals, neither within BARI, for purposes of promotion and scholarship, not elsewhere. OFRD scientists complained that they had little opportunity to write journal articles because most on-farm trials were considered unsuitable for proper statistical analysis and for publication in journals.

2. Although each scientist is given responsibility for a certain number of trials, in most cases responsibilities are shared with other scientists and authorship is therefore a problem. A more capable partner may write up the results but other partners normally expect joint authorship. This may create a disincentive to write.

3. Since only limited copies of the reports are prepared for review meetings, the results are not very widely disseminated. Station-specific results may not be widely circulated, but consolidated results need to be circulated more widely than is done at present.

Management of Human Resources

Number and type of staff. As of February 1988, there were 104 approved positions for scientists and officers and 449 field and clerical staff in OFRD representing 12% of the total number BARI scientists and 17% of the field/laboratory staff, respectively. Out of these, 88 scientists and 329 field staff were on duty in February 1988. Eighty-three percent of the scientists and 93% of other OFRD staff were permanent; the remainder were either temporary staff recruited for the duration of a project or regular staff from other BARI divisions deputed to OFRD. Most of the deputed staff were agricultural economists. Temporary and deputed staff may be absorbed into a regular post whenever there is a vacancy. However, due to the uncertainty of temporary work, two types of attitudes are revealed: some work hard to prove their efficiency so that they get preference for absorption into regular posts, but others look for permanent positions elsewhere and leave at the first opportunity.

The job market for agricultural graduates in Bangladesh is not very stable, so permanent positions are not always available. This may be frustrating and discouraging because job security is important to job seekers.

Deputed staff have a different problem. Their seniority is recognized in the parent division, but their work is observed and evaluated in OFRD. Moreover, most deputed staff have to work away from the central station so they fail to maintain regular contacts

with their division superiors. They may therefore be overlooked when higher positions are filled in the parent division or even in OFRD, although willingness to work in field stations is sometimes rewarded.

Experience levels. The average age of the scientists was 32.5 years and of other staff, average age was 36.5 years. Average working experience of scientists and other staff was 6.8 and 14.4 years, respectively, and most work experience was in on-farm research or related activities in OFRD or preceding projects or programs. Approximately 55% of the scientists had less than five years of research experience. This compares unfavorably with the staff profile of BARI as a whole, in which only 34% of the researchers have less than five years of experience. Only 2% of the scientists were female. There was no expatriate staff in the division in 1988.

Table 17 shows the distribution according to length of service of 55 scientists responding to a survey administered for this study.

Table 17: Distribution of Respondent Scientists According to Length of Service

Length of Service (years)	Number of Scientists	%
Under 1	5	9.1
1 - 1.9	3	5.5
2 - 3.9	14	25.5
4 - 5.9	7	12.7
6 - 7.9	8	14.5
8 - 14.9	4	7.2
15+	14	25.5
Total	55	100.0

Disciplinary background. The disciplinary background of OFRD scientists reflects the history of the division. The Soil Fertility and Soil Testing Institute and later the On-Farm Trials Division were dominated by soil scientists. ERP recruits were mostly agronomists, with soil scientists transferred from the On-Farm Trials Division. After OFRD's formation, natural scientists (agronomists, soil scientists and horticulturists) constituted 86% and agricultural economists 14% of the research staff. OFRD's agricultural economists constitute 3% of all social scientists working in BARI.

The position of agricultural economics in OFRD has evolved along with the research program itself. Agronomists in the Bangladesh Rice Research Institute started CSR activities in Bangladesh but they recruited or associated with full-time agricultural economists quite early in the program, probably because of their familiarity with IRRI's multidisciplinary research approach. When agronomists

from BARI and other organizations started CSR, agricultural economists were invited to work on a part-time basis. The inclusion of agricultural economists in CSR team was not in fact voluntary: various donor agencies and consulting groups working for BARC suggested that the CSR teams should be multidisciplinary and that agricultural economists should have an important place on the team. Thus, CSR proposals without an economics component were not generally approved under BARC's contract research program. However, as team leaders were agronomists, so the main focus of CSR activities was in agronomy.

In a few cases, agricultural economists in the program have done good work. For example, an agricultural economist working in CSR under the ERP at Ishurdi with advice from a consultant and the agronomist team leader, started farm, livestock, and homestead production surveys long before CSR formally became FSR. But the general problem is that agricultural economists' reports are not usually written in a form suitable for use by biological scientists. These reports mostly identify problems but solutions are rarely suggested. These are left to be decided on by the biological scientists.

In spite of the emphasis on a multidisciplinary and team approach to CSR/FSR research, economists and natural scientists have tended to remain segregated. BARC's administrative procedure required that economic and other components of an FSR project be submitted as subprojects, scrutinized by separate divisions of BARC, and independently implemented. Analysis of socio-economic data was not mandatory for program design. When the components were implemented jointly, data analysis might be hampered by unequal access or by disputes over its propriety. For example, prior to 1984, vast amounts of data piled up at several FSR sites and remained unprocessed due to proprietary conflicts between the economics and on-farm research divisions. After the creation of a central coordination unit for FSR at BARC in 1984, FSR projects in OFRD are now better consolidated, and responsibilities for subprojects are more clearly defined.

Each FSR site now has provision for at least one agricultural economist, though some of them may be deputed from the Agricultural Economics Division. Out of 104 scientists in 1988, there are 15 economists and only one sociologist. Three statisticians working in the Agricultural Economics Division are reportedly contributing very little to OFRD activities. Apparently they are not consulted for designing trials because of their inadequate understanding of biological research (Ali, 1986).

OFRD is a multidisciplinary division; so, ideally, each scientist in it, irrespective of his/her disciplinary background, should have an equal opportunity to enter its hierarchy. Some OFRD scientists have indicated that it may be difficult to implement an 'equal-opportunity' system unless on-farm or farming systems research is considered a discipline. Instead, it is suggested that a number of positions for different disciplines at each level in the hierarchy be allocated and that this be adhered to.

Academic degree and caliber. Information on the academic caliber of all OFRD scientists could not be collected. In general, recent

recruits have better qualifications than those who were absorbed from the Soil Fertility and Soil Testing Institute and On-Farm Trials Division. In the early days, agricultural education did not attract the best students and the best soil science graduates did not join the institute if they could find a place elsewhere. That is why some senior staff are less qualified. These people had little opportunity for promotion in the institute and the On-Farm Trials Division, but creation of OFRD has given them an opportunity for promotion because seniority is given precedence.

After BARI was made autonomous in 1976, a rapid expansion program was undertaken with USAID/World Bank support. A large number of staff were recruited over a three-year period and virtually no attention to ability was given. In fact, BARI does not as yet have any official guidelines for staff recruitment and conditions of service. Some general principles are very loosely followed and personal relationships rather than academic ability sometimes influence recruitment decisions. Previously, only holders of master's degrees were recruited for research jobs. BARI changed the system and started recruiting graduates with bachelor's degrees who were then allowed to work for a master's degree while in service, but under this plan, both research and academic performance suffered. OFRD has not found a solution to this problem.

In OFRD in 1987/88, approximately one third of the scientists held only a BSc degree (Table 18); the largest share of the scientists (58%) held MSc's. Earlier data are only available for the Extension and Research Project. Of the 22 full-time scientists working in 1980/81, only one had a PhD, 19 had MSc's, and two had only BSc's. By 1983/84 the number of staff in the project had doubled and there were considerably more junior scientists with only BSc degrees. The distribution of degrees among staff in OFRD was comparable to that of BARI as a whole. OFRD had more researchers with only a BSc, but the difference was not significant.

Table 18: Distribution of ERP and OFRD Scientists According to Academic Degree

	% Scientists		
Academic degree	1980/81 ERP	1983/84 ERP	1987/88 OFRD
Bachelor	9.1	47.7	33.0
Master's	86.4	47.7	58.0
Master's from abroad	-	2.3	3.4
PhD	4.5	2.3	5.6
Total	100.0	100.0	100.0
TOTAL SCIENTISTS	22	44	88[1]

Note: 1) Out of 104 positions, 88 scientists were in service.

Out of 25 holder of bachelor's degrees in OFRD, 12% have two first classes and one second classes in the public examinations (secondary, higher secondary and bachelor), 72% have one first class and two second classes and 16% have three second classes. Out of 30 postgraduate degree holders, 13.3% have first class in all four public examinations, 30% have one first class and three second classes, 40% have four second classes, 10% have three second classes and one third class, and 6.7% have two second and two third classes.

If it is accepted that generally high academic qualifications are required for a research job, then OFRD may not be considered as having well-qualified scientists.

The question of qualification is possibly more important in OFRD than in the single-discipline divisions for two reasons:

1. While discipline-oriented scientists mostly work in the laboratory or in experimental areas, OFRD scientists in multidisciplinary fields have to work with farmers, extension workers, and people of many other backgrounds.

2. In disciplinary divisions, junior staff work under the supervision of senior staff so that they have an opportunity to work and learn; in multidisciplinary situations, OFRD scientists are mostly left to work by themselves.

Table 19 shows that at each of BARI's four Regional Stations, OFRD has one principal scientific officer and other staff are junior scientists. Substations and outstations have only junior workers, and some outstations have only one junior scientist. So it is highly improbable that these young workers can make the best use of their abilities without closer supervision. Possibly only the best ones can do some useful work.

Less than a quarter of the 55 scientists who responded to the survey had received special training in on-farm research methods. Twenty-four percent had received some training on CSR/FSR as well as training in one or more other areas, e.g., rice/wheat production technology at BRRI/CIMMYT, fertilizer management, and statistics; 47% received training in these other areas but not on CSR/FSR; and 29% had not received any special training. This lack of training affects their efficiency in research.

Of the 89 field and clerical staff in OFRD in February 1988, 0.7% had an MSc degree, 5.4% had bachelor degrees, 25.7% had higher secondary-level education, 47.8% had a secondary education and 20.4% had below secondary-level education. Some fieldworkers also had special training but details of the content of training and the number of fieldworkers receiving such training were not available. OFRD relies more on technical staff than other departments in BARI. In 1987 the ratio of technicians/clerical staff to researchers in OFRD was 4.3:1 compared to 3:1 for BARI as a whole.

Management of Financial Resources

OFRD receives funds from the following sources:

Table 19: Composition of OFRD Research Teams by Location 1986/87 (as of April 1987)

Location	Position[1]					
	CSO	PSO	SSO	SO	Total	Consultant
Headquarters	1	1	3	4	9[2]	1[3]
Ishurdi Regional Station	–	1	2	5	8	1[4]
Rajshahi Substation	–	–	1	1	2	–
Barind	–	–	1	2	3	
Pabna	–	–	–	1	1	
Bogra	–	–	1	3	4	
Rangpur	–	–	2	3	5	
Rajbari	–	–	–	1	1	
Thakurgaon	–	–	–	1	1	
Sirajgonj	–	–	1	2	3	
Jamalpur Regional Station	–	1	3	2	6	1[5]
Tangail Substation	–	–	2	3	5	
Mymensingh	–	–	–	1	1	
Kishoregonj	–	–	–	2	2	
Jessore Regional Station	–	1	2	5	8	
Khulna Substation	–	–	1	–	1	
Kushtia	–	–	1	–	1	
Faridpur	–	–	–	1	1	
Barisal	–	–	1	3	4	
Patuakhali	–	1	1	4	6	
Hathazari Regional Station	–	1	4	3	8	
Comilla Substation	–	–	1	–	1	
Sylhet	–	–	1	–	1	
Total	1	6	28	47	82	

Notes: CSO Chief Scientific Officer
PSO Principal Scientific Officer
SSO Senior Scientific Officer
SO Scientific Officer
1) Scientists on leave for higher studies not included.
2) 4 more agricultural economists are working on a part-time basis.
3) The consultant left in September 1986.
4) 20% of consultant time. Term expired 30 June 1987.
5) 20% of consultant time. He left in April 1987.

1. revenue budget for former Soil Fertility and Soil Testing Institute/On-farm Trials Division to pay staff salaries and allowances (100% local funding).

2. annual development plan for salaries, allowances, and house rent of some scientists and field assistants and operational expenses of ERP (60% local funding);

3. FAO/UNDP for operational expenses of on-farm fertilizer trials (10% local funding);

4. BARC for FSR activities funded through contract research program with USAID grants and with PL480 grants (100% foreign funding);

5. other research organizations for collaborative research program, if any (mostly local funding).

Table 20 shows funds available from 1983 to 1987. In 1986/87, 260,000 taka (about US$8670) was available per scientist and 49,000 taka (US$1630) per scientist and other staff taken together. The budgeted amount was higher than this.

Table 20: Funds Received by OFRD, 1983/84-1986/87

Name of Project	1983/84	1984/85	1985/86	1986/87
	million taka			
Extension & Research Project	8,000	9,100	11,797	15,800
Soil Fertility & Soil Testing Institute[1]	-	5,486	7,244	8,055
CSR Projects[2]				
Strengthening OFRD	-	-	1,490	-
Jamalpur site	56	62	60	-
Jessore and Hathazari sites	-	170	224	-
Rangpur and Ishurdi sites	125	100	-	-
FSR projects consolidated[2]	-	-	934	3,232

Notes: 1) In the government revenue budget, the Soil Fertility and Soil Testing Institute still exist. Once the funds are received by BARI, they are divided between OFRD and the Analytical Services Division.

2) Previously, each CSR site was an independent project, primarily because they were initiated at different times. Now a consolidated budget is prepared within OFRD but subprojects are independent projects. This mechanism has been adopted in order to avoid a regulation of BARC which requires that a research project budget exceeding a certain limit to be cleared by the planning and finance ministries.

In the first week of June each research team prepares a budget for the whole year showing separate estimates for the different project activities allocated to that station. It should be noted that a particular station may or may not be allocated trials for all the projects under OFRD's control. The proposed budget is then reviewed by the OFRD principal scientific officer at the relevant regional station. He consolidates it with the yearly and quarterly single sheet budget he has prepared for his region by the third week of June, then submits the consolidated budget to the head office. After being scrutinized by the head of OFRD, the budget is submitted to the Director General of BARI who receives funds from funding sources quarterly and releases them, also quarterly, to the teams through the OFRD chief.

The research teams are expected to submit statements of expenses along with requests for quarterly budget funds, which may be delayed if accounts are not submitted properly in time. Officials of two regional stations reported that the budget for the third quarter of 1986/87 was not received even though the quarter was almost over, the reason being that statements of expenses had not been properly submitted. The accounts staff of both these stations were reported to be inefficient. Original funding agencies may also delay the release of funds, which in turn affects the timing of the local release of funds.

A major difficulty in the management of accounts is that funds received from different sources must be accounted for separately, but because of the consolidated nature of OFRD activities, certain expenditures may cut across projects. Thus, there is a problem of apportionment. The other difficulty with expenditure is that, on average, no more than 70% of the budgeted amount is actually received from the Revenue and Annual Development Plan budgets. Taking all these problems into consideration, each regional and site team has to make various kinds of adjustments. For example, funds received for a particular project may be used in other projects; then adjustments have to be made when the other funds are received. Operational expenses are given top priority in order to continue trials and surveys, so whenever there is a shortage of funds, capital expenses are delayed. Failure of a trial in the farmers' field may have more serious consequences for OFRD than the failure of an experiment in the laboratory of a discipline-oriented Division. Activities under the Revenue and Annual Development Plan budgets are also implemented, assuming from experience that all the budgeted funds will not be obtained. Even after all these adjustments have been made, the irregular release of funds has been reported as a major problem for conducting on-farm research.

There is some feeling among BARI scientists that OFRD is more fortunate with funds than other divisions. However, in general, other divisions of BARI were not found to suffer from inadequate funds. Irregular release of funds sometimes creates problems but BARI has adequate reserve funds for such situations. The main difference with OFRD is that a larger proportion of OFRD activities are project-based and projects are better provided for in terms of both adequacy and regularity of release of funds. Some scientists also gave credit to OFRD for successfully negotiating with a number of agencies for projects. Others expressed doubt about the rationality of allowing OFRD to grow so big and manage so many

projects throughout the country; thus, creating problems for efficient staffing, funding, and research management.

Management of Linkages

Linkages among the following are of interest for the effective functioning of OFCOR: various centers of OFRD/BARI, farmers, farmer-experimenters, other research organizations, extension services, development agencies, and international agencies/centers. With the reorganization of the Soil Fertility and Soil Testing Institute into the On-Farm Research Division, much greater emphasis was given to developing and sustaining these linkages. The organizational structure of OFRD and the research management mechanisms described earlier indicate the type of contact OFRD maintains with other units and institutions and its clients, the farmers, as well as the kinds of linkage mechanisms used. The key mechanisms are summarized below.

Linkages with extension. The district technical committee is the principal mechanism for linking OFRD and extension services. These committees meet periodically to discuss problems brought up by upazila-level extension workers, and to review research results and the proposed research program before the onset of each cropping season.

The committees are supposed to meet once a month, but rarely achieve this. In the Tangail, Jamalpur, and Pabna districts, on average 10 district technical committee meetings were held during 1986.

However, OFRD scientists indicated that they had had to take the initiative and main responsibility for holding these meetings even though the Directorate of Agricultural Extension should have done so. The Extension Department takes some interest, but other development agencies take little interest in the district meetings. To solve this problem, Tangail Substation has introduced a system of rotation so that every month a different agency has the responsibility of organizing the meeting, usually in the relevant host's office.

There is also a problem for the district-upazila linkage in extension because Upazila-level officers and workers are now under the control of Upazila Parisad, so the district extension office can exert little influence on their activities. It is, however, now claimed that field days are more frequently organized and greater efforts are made to identify and contact innovative farmers.

Another extension linkage has been established through collaboration in multilocation testing, which is carried out with support from the Directorate of Agricultural Extension. There is a formal agreement describing the procedure in this respect. The Extension and Research Project provides a package of technology, field assistance, costs of operation, vehicles, and training for its own and directorate staff connected with the program. The directorate provides the services of upazila-level agricultural officers to implement, manage, and supervise the activities at multilocation testing sites, including help in selecting farmers and submitting data and reports to OFRD and the directorate. The results of these tests are reviewed along with FSR results at various levels.

Linkages with farmers. Apart from allowing trials to be conducted in their fields, farmers are to some extent involved in the selection and planning of trials. Formal surveys are also conducted to obtain their perceptions of problems and probable solutions which then serve as the basis for designing future trials. For example, ERP wanted to introduce chick-peas in a cropping pattern trial in the Barind area but farmers suggested that since the soil was not very permeable, the crop would be lost if it rained before harvest. The idea was then dropped.

Farmers' opinions are also sought through visits (primarily), informal discussions and formal surveys after the completion of trials. For example, in the Chittagong area, a high-yielding variety of brinjal was tested in farmers' fields. However, in the next season, the farmers refused to continue the trial because the variety was not suitable for mixing with dry fish, an important food item for that area.

In addition to farmer field days, which are held to demonstrate the results of successful trials, workshops with innovative farmers have also been an important mechanism for scientists to learn from farmers and to build on their local knowledge.

Linkages with other scientific programs. Scientists from other divisions in BARI are invited to the internal review meetings held three times a year at headquarters to review research results and evaluate the proposed programs of all OFRD research centers. Scientists are also invited to give specific advice, for example, a pathologist/entomologist may be invited to visit trial sites if there is a relevant problem.

On one occasion, women scientists of other divisions were invited to participate in a homestead production survey because it was felt that women working with the survey families would bring better results. This experience led to the deployment of women workers (deputed from the Directorate of Agricultural Extension) in a collaborative project with the Bangladesh Academy for Rural Development, Comilla, on women's roles in homestead production.

Linkage with Bangladesh Agricultural University. This linkage is maintained through the District Technical Committee of Mymensingh, the Regional Technical Committee of Jamalpur Region, the National Coordinated Farming Systems Research Programme network, of which the university is a member, and through invitations to seminars and workshops. The university carries out CSR/FSR activities in two sites under the leadership of an agronomist. This is likely to be expanded significantly with a grant from the Ford Foundation. However, the FSR approach is yet to be formally included in the university's courses. Some teachers familiar with the approach teach aspects of it in courses on agronomy, farm management, animal science, and economic development, but the coverage and treatment of the topic is rather insignificant. Closer links between OFRD and the Bangladesh Agricultural University are desirable.

Linkages with top policymakers and planners. This link is maintained through the national technical and coordination committees of the Farming Systems Programme and the Extension and

Research Project (Appendices A and B). Top policymakers are also invited to seminars and workshops, and field days organized by OFRD or BARI.

Linkages with international centers and donor agencies. Many of OFRD's main research activities are conducted through externally funded donor projects. Links are maintained through a variety of mechanisms: through long-term and short-term expatriate consultants who come for periodic project evaluations or to provide expertise on specific problems or topics, through project monitoring by donors, and through various training activities sponsored by different international agencies or research centers.

Experiences in BARI have also influenced international donors. The on-farm research-extension linkages developed under the Extension and Research Project through the framework of district technical committee and regional technical committee meetings are now included in the Training and Visit System manual prepared by The World Bank (Benor and Baxter, et al., 1984) (though no reference to the Bangladesh experience has been made).

Summary

Planning and management of research in OFRD has evolved out of earlier projects and programs such as the Extension and Research Project and the Cropping Systems Research Programme. The organizational, methodological, conceptual, and ethical issues in research planning and management have undergone changes and continue to change. The planning and review process starts with the individual scientist and passes through the site team and the district technical committee to the final review at BARI. Over the years, important questions and suggestions have been made at various stages of this process in order to improve the quality of research. Some have been implemented partly or fully, others are still being debated, while others are too difficult to implement. Some examples are given below:

1. In spite of suggestions to the contrary, implementation teams have continued to submit a large number of trial proposals to the internal review meetings. District technical committees have failed to screen trial proposals. For example, the Tangail, Jamalpur, and Ishurdi implementation teams submitted 41, 23, and 27 trials, respectively, for the 1987 Kharif-I season to the respective committees. The Committees passed all the proposed trials to the internal review meeting which then recommended only 8, 11, and 16 trials to the task force for approval. Funding and manpower was only available for that many trials. Since the internal review meeting had to scrutinize proposals from 23 teams within a short period of time, and since most teams had submitted a large number of proposals, choosing the most appropriate trials was a serious problem. Moreover, the proposals had not been circulated sufficiently far enough in advance of the meeting to allow participants to examine them and make critical contributions. A number of senior scientists from other divisions of BARI indicated during interviews that they did not have enough time either to attend the review meeting or to send written comments.

Asked why such a large number of proposals were sent to internal review, two implementation teams indicated that they wanted to prove the level of their activity. They expected 40-50% of the proposals to be rejected, so by submitting a larger number, they expected to end up with an adequate number of trials for implementation.

2. On-farm research guidelines suggest that any trial or survey added or dropped by a site team has to have justification for the decision, along with a review of the literature. Trial proposals are now submitted with justification but a review of the literature is not always done by all site teams because library and other reference materials are almost inaccessible.

3. It has been suggested that the ecological and socio-economic aspects of a problem should be clearly distinguished. How farmers validate proposals and their reactions, whether they accept them or not, should be explained. It was further suggested that the needs and priorities of different classes of farmers should be discussed with them separately. We will see in Chapter 4 that the level of farmer participation in planning and execution of trials and the validation of trial results by farmers of different categories is still very low. The conceptual and practical problems in achieving these objectives are considerable.

As OFRD evolves, improvement is expected, although, perhaps, slowly. OFRD with 88 scientists on duty is the largest division in BARI. Given that all staff are not adequately oriented toward on-farm research, that under OFRD there are at least four different projects with different objectives and methods of operation, and that the research activities are distributed among headquarters, four regional stations, 19 substations and 83 multilocational testing sites, the problems of supervision and execution of programs are tremendous. There is a strong feeling within BARI that without the present leader, the entire on-farm program could suffer a setback, even if only temporarily, because there is little leadership development. Some young staff are coming up but it will take years before they have gained sufficient experience to take up leadership positions.

Most research leaders at BARI expressed the view that OFRD has possibly over-extended its activities. The need for location-specific research has necessitated the creation of substations and outstations, but there are no limits to this. Each village in the country has unique agro-ecological characteristics, but that should not justify the creation of a separate research for each one station there. Some research leaders have felt that a large part of OFRD activities, particularly those related to multilocation testing sites and outstations, were more extension than research. This is debatable, but the urge to expand stations for location-specific research should be restrained and systematic research should be conducted in a limited number of locations. An important reason for the collapse of organizations is their extension beyond management capacity.

CHAPTER FOUR

ASSESSMENT OF PERFORMANCE OF OFCOR FUNCTIONS

INTRODUCTION

The OFCOR study guidelines issued by ISNAR suggested that ideally OFCOR should perform the following seven functions in a national research system:

1. support within research a problem-solving approach which is fundamentally oriented to farmers as the primary clients of research;

2. contribute to the application of an interdisciplinary systems perspective within research;

3. characterize major farming systems and client groups, using agro-ecological and socio-economic criteria, in order to diagnose priority production problems as well as identify key opportunities for research, with the objective of improving the productivity and/or stability of those systems;

4. adapt existing technologies and/or contribute to the development of alternative technologies for targeted groups of farmers sharing common production problems by conducting experiments under farmers' conditions;

5. promote farmer participation in research as collaborators, experimenters, testers, and evaluators of alternative technologies;

6. provide feedback to the research priority-setting, planning, and programming process so that experiment station and on-farm research are integrated into a coherent program focused on farmers' needs;

7. promote collaboration with extension and development agencies in order to improve the efficiency of the proper of generatio and diffusion of technology.

It should be noted that these functions are not mutually exclusive. Further, they may be considered as characteristics rather than functions because some of them may be regarded as 'ends' and others as 'means' of OFCOR.

The objectives and strategies of OFRD (described in Chapter 3, the section on the On-Farm Research Division) indicate that these designated OFCOR functions are explicitly or implicitly included in

OFRD activities. Farming systems research is the main strategy of OFRD and the guidelines of the National Coordinated Farming Systems Research Programme clearly state that ". . . the Farming Systems research Programme will be in principle farmer-based, integrating farmers into the research and evaluation process; problem solving; comprehensive considering farming system in the context of all its environmental influences; interdisciplinary with a team approach involving researchers and extension workers with different disciplinary backgrounds; socially responsible keeping public interests -- both present and future -- in mind; complementary providing feedback to disciplinary and commodity-based research; and dynamic" (BARC, 1985a). This is further evidence that the OFCOR functions are recognized by the OFRD except for one point of difference in emphasis. While the guidelines of the National Coordinated Farming Systems Research Programme consider FSR as 'farmer-based' and 'problem-solving' research, OFRD objectives show more clearly that the needs and problems of different categories of farmers, particularly poor farmers, are to be recognized.

The inclusion of certain functions in 'official objectives' is not a guarantee that these functions will actually be performed. In order to assess the performance of these functions, it was assumed that OFRD scientists were likely to be in the best position to assess the extent to which the OFCOR functions identified were being performed by the OFRD. In order to assess their perception of the objectives and methods of OFRD activities, a questionnaire of mostly open-ended questions was mailed to all OFRD scientists. Only 55 responded. Senior BARI scientists, a small number of field assistants and farmers at four research stations were also interviewed. Their responses, described below, indicate the extent to which lessons discovered have been learned.

RESULTS OF SURVEY

Knowledge of Objectives and Functions of On-Farm Research Division

Respondents were asked to describe the objectives and functions of OFRD in order to assess the degree of their familiarity with the division's official objectives and functions. The responses are summarized in Table 21. Each respondent described three to six functions, although some of them may not actually be different. Some of the answers shown in the table may not be mutually exclusive, yet they are presented in this manner in order to report the actual perceptions of the respondents. Taking all the categories of answers together, it may be said that OFRD scientists are familiar with most of the OFRD objectives in relation to the generation and diffusion of technology but they do not consider 'promotion of an interdisciplinary perspective to research' as an objective of FSR or OFRD. Answers also indicate that individually, scientists are not familiar with all the technology related functions of OFRD.

Interviews with senior BARI scientists also revealed that they were not fully familiar with OFRD objectives and functions. Most of them emphasized only 'on-farm testing of advanced technology' as the major function of OFRD. Some research leaders indicated that they

Table 21: Respondents' Perceptions of OFRD Objectives and Functions

Objectives and Functions	Responses No.	Responses % of Total
1. To test adaptability of technology/ cropping pattern in different agro-ecological situations	26	47.3
2. To conduct on-farm testing of advanced technology developed at research stations	24	43.6
3. To link extension and research with the farmer	20	36.4
4. To help socio-economic upliftment of farmers/poor farmers	19	34.5
5. To identify/generate technology/ cropping pattern for different categories of farmers	17	30.9
6. To disseminate research results/ technology to farmers	14	25.5
7. To get feedback from farmers about the performance of technology developed at research stations	12	21.8
8. To identify socio-economic problems of farmers and find solutions	12	21.8
9. To conduct research on all enterprises	9	16.4
10. To identify innovative farmers and technology and and help their dissemination	8	14.5
11. To generate low-cost, less risky technology for farmers/poor farmers	7	12.7
12. To ensure efficient use of farmers' resources	6	10.9
13. To conduct problem-oriented research and find new technology	6	10.9
14. To understand socio-economic/technical problems of farmers	4	7.3
15. Others	7	12.7

were not clear whether OFRD was working on 'generation of technology for different agro-ecological zones' or on 'testing advanced technology in different agro-ecological zones'. They suggested that this distinction should be made very clear, otherwise OFRD would be repeating on-station research on farmers' fields at great cost but with little benefit.Researchers were asked to describe the types of farms where research is conducted. Some respondents mentioned two or more types but in general the level of understanding of this subject appeared to be very poor (Table 22). It appears that a large number of respondents did not understand the concept 'farm' as a decision-making unit or organization. They possibly considered an experiment station farm as the 'farm' and a rural farm as a 'farmer's field'.

Table 22: Respondents' Perceptions of the Types of Farms Where Research Is Conducted

Type of Farm	Responses	
	No.	%
1. No answer	12	21.8
2. Farmers' fields	21	38.2
3. All types (small, medium, and large)	14	25.5
4. On-station fields	8	14.5
5. Multilocational testing site	4	7.3
6. Farming systems research site	2	3.6
7. Irrigated medium-sized farmers	2	3.6
8. Poor farmers' fields (small and marginal)	2	3.6
9. Homestead	2	3.6
10. High and medium-high land	1	1.8
11. Medium-sized farms	1	1.8

Distinction between On-Farm and Farming Systems Research

The evolution of OFRD involved fertilizer trials in farmers' fields, cropping systems research and farming systems research, and now the official strategy is the FSR approach. Scientists were asked whether there was any difference between OFR and FSR, and if so, what it was. The responses are summarized in Table 23. It appears that not only do working OFRD scientists have only a partial idea about the difference between OFR and FSR, but some of them are also confused as to what those terms mean. This confusion is not surprising given the divergence of views about FSR among expatriates working in Bangladesh and also among international centers.[1]

1 For conceptual differences presented in just one workshop, see Remenyi (1985).

The Interdisciplinary Perspective in Research

One of the desired functions of OFCOR is to give an interdisciplinary perspective to systems research. Interdisciplinary research implies that problems falling between a number of professional disciplines should be addressed and thus an attempt to solve problems which lie beyond the bounds of professional specialization should be made (Lipton, 1970). This is different from multidisciplinary research which implies that solving problems falls within the fields of several different professional disciplines (Epstein, 1975). However, the difference between inter- and

Table 23: Respondents' Perceptions of the Differences between On-Farm and Farming Systems Research

Differences	Response No.	Response %
1. No answer	2	3.6
2. No difference between FSR and OFR	3	5.5
3. OFR concerned with one aspect of farming, FSR takes everything into account	20	36.4
4. OFR is a part of FSR	11	20.0
5. FSR is a part of OFR	4	7.3
6. OFR is conducted to test on-station research findings, FSR is conducted to study components of farming system on farmers' fields	6	10.9
7. FSR may be conducted both on-farm and on-station, OFR is essentially done on-farm	3	5.5
8. OFR includes on-station research, FSR concerns all enterprises	2	3.6
9. FSR considers socioeconomic setting of farms, OFR does not	2	3.6
10. OFR includes component technology	1	1.8
11. OFR is done on farmer's field, in FSR and MLT sites; FSR is conducted only in FSR site	1	1.8
Total	55	100.0

multidisciplinary research is more operational than conceptual. For example, solution of a problem requiring knowledge in production economics, marketing, and econometrics may be handled either by one person having expertise in al three disciplines (interdisciplinary) or by two or three persons having specialization in one or more of these fields (multidisciplinary). On balance, OFCOR should be done by multidisciplinary research teams consisting of scientists who have an interdisciplinary backgrounds.[2]

It was shown in Chapter 3 that OFRD has scientists of different disciplines, but agronomists dominate and fishery and livestock scientists are absent. In order to understand the extent of multidisciplinary work done in OFRD, two questions were asked:

1. Describe the type of work which is done jointly by scientists of different disciplines.
2. Is the existing disciplinary composition of OFRD satisfactory, and if not, which other disciplines should be represented?

Answers to the first question are summarized in Table 24. Over 50% of the respondents mentioned selection of trials/research programs as multidisciplinary work. A number of other activities are performed by multidisciplinary teams though only a small number of respondents mentioned these activities. Some of the reported activities may not be mutually exclusive.

Table 24: Respondents' Perceptions of Work Done jointly by Scientists from Different Disciplines

Kind of Work	Responses	
	No.	% of Total
1. No answer/inappropriate answer	5	9.1
2. Selection of trials/experiments/ research program	31	56.4
3. Selection/description of site	15	27.3
4. Evaluation of technology	13	23.6
5. Conduct field day/farmers' day/meeting	13	23.6
6. Conduct agronomic/other survey	12	21.8
7. Analysis and/or reporting results	9	16.4
8. Problems related to plant diseases, soil, pest, economic aspects	8	14.5
9. Implementation of research	7	12.7
10. Depends on type of work	5	9.1

2 In an interview on Bangladesh Television in May 1987, Nobel Laureate Dr. Norman E. Borlang said that present-day Western scientists are highly specialized and most of them are unsuitable for work in less developed countries where scientists with a broader perspective are required to solve problems.

Opinions about the disciplinary composition of OFRD are summarized in Table 25. Most of the respondents considered the existing composition to be inappropriate and suggested that more scientists should be recruited, particularly in horticulture, agricultural economics, livestock, fisheries, plant protection, and soil fertility. At present, the assistance of most of these disciplines is sought from the relevant research divisions of BARI's Central Station but because of the shortage of manpower, the services of those divisions may not always be available, particularly to outstations a long distance away. There is, therefore, pressure to recruit OFRD's own staff scientists from of major disciplines, which may not be the most appropriate solution.

Table 25: Respondents' Opinions about the Disciplinary Composition of OFRD

Opinions	Responses	
	No.	% of total
1. No answer	12	21.8
2. Present composition right	5	9.1
3. More scientists needed in the field of		
- Horticulture	20	52.7
- Agricultural Economics	29	52.7
- Livestock	22	40.0
- Fisheries	22	40.0
- Entomology	19	34.5
- Plant Pathology	14	25.5
- Soil Science	13	23.6
- Non field crop enterprise	5	9.1
- Social Science	5	9.1
- Sociology	3	5.5
- Engineering	2	3.6
- Publication/Editing	2	3.6
- Family Planning	1	1.8

Criteria for Site Selection

Standard agro-ecological zoning of the country has already been done by various national organizations and has been revised a few times. Testing advanced technology in different agro-ecological zones and generation of technology for different types of farmers in different agro-ecological zones are important functions of OFRD. This should be reflected in the criteria used for the choice of research sites.

At present, trials are conducted on 11 FSR sites and 83 multilocation testing sites. In order to understand the basis of selection of these sites, respondents were asked to describe the

criteria used for their selection. Forty-five percent said that sites were selected 'to suit research objectives' and others mentioned one or more specific criteria (Table 26). Soil type or soil series appear to be the most important criterion for site selection. OFRD scientists indicated during personal interviews that soil type or soil series was considered the basis for demarcating agro-ecological zones.

Earlier it was shown that 31% of respondents mentioned that 'generation of technology for different categories of farmers' was an important objective of OFRD activities, but only 20% thought that farmer characteristics were used as criteria for the selection of trial sites. Irrigated cropping is not the main focus of OFRD activities, so few responses about irrigation as a criterion could be expected.

Table 26: Respondents' Perceptions of Criteria Used for Selecting Research/Trial Sites

Criteria	Responses	
	No.	% of Total
1. No answer	5	9.1
2. To suit research objectives	25	45.5
3. Soil type/soil series/topography	24	43.6
4. Cooperation from farmers	12	21.8
5. Socioeeconomic status/group characteristics of farmers/their needs	11	20.0
6. Communication/accessibility	9	16.4
7. Representative of agro-ecological situation	8	14.5
8. Availability of irrigation	5	9.1
9. Existing cropping patterns	3	5.4
10. Location having problems	2	3.6

In order to conduct meaningful on-farm research, a balance has to be maintained between distance, accessibility and communication, and agro-ecological representativeness of the selected sites. Whether and how this is maintained is not clear from respondents' answers. Some sites appear to suffer from 'roadside bias' and 'tarmac bias' and some are quite near the research stations, while others are located some distance away. Some senior scientists of BARI and BARC indicated that while reorganizing over 200 Soil Fertility and Soil Testing Institute/OFRD trial sites into 83 multilocational testing sites, representativeness was sacrificed in the interests of accessibility and communication, which may have reduced their usefulness. Some of these sites may suffer from the additional problem of bad management; thus, data may not be very useful.

Selection of Subjects for Trials/Research

Trials conducted at multilocational testing sites are mainly concerned with testing the advanced technologies developed at research stations and at FSR sites. Trials with diverse aspects, e.g., component technologies, cropping patterns, homestead production, or livestock and fish production, are conducted at FSR sites. All proposed trials are to be processed through local level review, the district technical committee, and finally through internal review at the head office.

OFRD scientists appear to be familiar with the official and standard procedure for selection of field trials (Table 27). The small differences between the two broad categories of answers may be more apparent than real or they may reflect the differences between the process of selection of trials for multilocational testing sites and those for FSR sites.

Table 27: Respondents' Perceptions of the Process of Selection of Subjects for Trial

Selection Process	Responses No.	Responses %
1. No answer	2	3.6
2. Primarily by OFRD scientists	5	9.1
3. Primarily by OFRD scientists, formalized through district and regional technical committees and internal review meeting	20	36.4
4. By OFRD scientists on the basis of problems identified from farm surveys, through discussion with farmers and extension agents and formalized through district and regional technical committees and internal review meeting	26	47.3
5. Imposed from above	2	3.6
Total	55	100.0

The procedure for selecting subjects for trials is supposed to include screening of trials to exclude those which, on the basis of experience, may be found to be inappropriate. Respondents were asked whether such screening was actually done. Of the 55 respondents, 16.4% did not answer the question, 7.3% said they did not know, 23.6% said no such screening was done, and 52.7% said one or more trials were dropped during review. Some respondents did not give any examples or reasons for screening while others gave one or more of the following:

a) The trial was found to be unacceptable to farmers. For example, in the Chittagong area, a trial on HYV brinjal was

discontinued because farmers did not like it. It was unsuitable for mixing with dry fish, an important food in the area. Similarly, a trial on bati sak (a leafy vegetable) in the Kharif season in the Khulna area was dropped because farmers were not interested.

b) The trial was not suited to the local soil or climate. For example, in the Rangpur area, the jute/HYV Aman/wheat pattern trial was replaced by a broadcast HYV Aus/transplanted Aman/Khesari pattern to suit local soil and climate. In the Comilla area, a trial on bati sak was dropped because it could not stand excessive rain. In Pabna, a pattern trial based on three crops for medium high land was replaced by a pattern trial based on two crops. In Barisal, a trial on wheat relay cropping was dropped due to unsuitability of the soil.

c) Farmers in the area were already aware of similar technology from other sources. For example, in Rajshahi, a trial on mustard was dropped because the variety was already known in the area.

d) The technology could not complete with other existing technologies. For example, in Barisal, a trial on China sak (a leafy vegetable) in the Rabi season was dropped because it could not compete with locally available vegetables in the market place.

e) The trial had been done for two to three years and further testing was unnecessary.

f) Farmers changed cropping patterns frequently, so some pattern trials were dropped. For example, in the Jessore area, the broadcast Aus/fallow/mustard pattern was replaced by a broadcast Aus/T. Aman/potato pattern to suit farmers' preferences. In Mymensingh, pattern trials were replaced by component technology trials.

Selection and Role of the Farmer in Research

One of the desired objectives of OFCOR is 'to promote farmer participation in research'. The FSR guideline which OFRD follows also say that the farmer has to be integrated into the research process. In order to assess how far that is done, respondents were asked to describe how the participant farmers were selected and by whom, and the role of farmers in the research conducted by OFRD.

Sixty-four percent of the respondents said that subject matter specialists from the Directorate of Agricultural Extension selected farmers in consultation with OFRD scientists. Some of them mentioned that village extension agents from the Directorate of Agricultural Extension and OFRD field assistants first identified and motivated potential participants. Thirty-six percent of respondents said that OFRD scientists selected farmers on the basis of identification and motivation work done by field assistants. The pattern of answers indicated that the first group of respondents described the selection of farmers in multilocational testing sites while the second group described selection procedures for FSR sites.

The responses on the role of the farmer are summarized in Table 28. Twenty percent of the respondents either did not answer the question or answered without understanding the question. Most of the other descriptions indicate that as yet researchers do not give farmers more than a secondary or tertiary role in research. Respondents' perceptions of subjects discussed with the farmers at various stages of research (from selection up to completion of trials) also indicate that farmers are secondary participants in research (Table 29).

Most research leaders at BARI and some OFRD scientists interviewed personally at a number of stations, indicated that benchmark surveys are conducted among all categories of farmers but most trials are conducted in the fields of farmers with small and medium-sized farms. Most of the farmers participate in the program in order to get free inputs. Only a small number participate with the additional objective of learning about new technology. Large farmers generally show a lack of interest in conducting trials, although their cooperation is sought for working in the villages. A small number of participant farmers were interviewed at different locations and they indicated that the opportunity to learn new things encouraged them to participate in OFRD activities and that free inputs were an additional incentive. Most farmers' perceptions of OFRD activities were that OFRD wanted to demonstrate new technologies to the farmers.

Table 28: Respondents' Perceptions of the Role of the Farmer in On-Farm and Farming Systems Research

Role of Farmers	Responses	
	No.	% of total
1. No answer/inappropriate answer	11	20.0
2. Help researchers to conduct on-farm research	12	21.8
3. Allow researchers to use land and/or work according to the instruction/ advice of researcher	10	18.2
4. Directly participate in research under supervision of researcher	10	18.2
5. Supervise on-farm trials	6	10.9
6. Learn by doing work with researcher and transmit good results/experiences to others	6	10.9
Total	55	100.0

Table 29: Respondents' Perceptions of Subjects Discussed with the Farmers

Subjects	Responses No.	% of total
1. No answer	5	9.1
2. Objectives and content of trial, expected results, role of the farmer in research/trial	39	70.9
3. Problems of farmers and their possible solutions through research	10	18.2
4. Role of farmer in different stages of trial/ farmer's knowledge about various farming operations at different stages of crops	9	16.4
5. Acceptability of trial to farmers	4	7.3
6. Expected benefits of trials to farmers	3	5.4
7. Suitability of trial in farmers' field	3	5.4
8. Time to be spent by farmer in trial and inputs to be given free	1	1.8
9. Usefulness of new technology	1	1.8

Respondents were also asked to describe how OFRD deals with a farmer trying, or intending to try, anything new. The words 'innovative farmer' were deliberately not used in the questions. Nearly half of the respondents either did not answer or did not understand the question (Table 30). A small number said they never found, or rarely found, such farmers. Other answers ranged from providing inputs to 'regular visit for monitoring'.

Table 30: Respondents' Perceptions of Ways of Handling a Farmer Trying or Intending to Try Anything New

Ways of Handling	Responses No.	% of total
1. No answer/wrong answer	25	45.5
2. Provide technology/inputs and advice/ visit regularly for monitoring	14	25.5
3. Discuss the rationality of the test, and possible results, and monitor	9	16.4
4. Discuss findings then include in research program through district and regional technical committees	8	14.5
5. Rare/not found any such farmer	4	7.3
6. Provide inputs	3	5.5

In Chapter 3, the section on Linkages with Farmers, it was mentioned that innovative farmers' workshops were held so that they could share their experiences with scientists. However, no respondent mentioned this in reponse to the question concerning handling of innovative farmers.

Influence of On-Station Research Priorities

An important objective of OFRD is to get feedback from farmers about the performance of technologies developed at research stations and also to identify problems unknown to on-station scientists; thus, contributing to the relevance of on-station research priorities. Respondents were asked whether they knew of any changes in priorities resulting from feedback of farm-level information.

Sixty-nine percent of the respondents either did not answer or said they did not know anything about such changes (Table 31). Other respondents mentioned one or more changes of which the change in relation to fertilizer recommendations was significant. Other stated changes are not sufficiently clear. However, the fact that some OFRD scientists are aware of this important role of OFRD and that some changes are underway at the central station is a good indicator that OFRD is on the right track.

Table 31: Respondents' Knowledge about Changes in the Priority of On-Station Research as a Result of On-Farm and Farming Systems Research Experiences

Changes		Responses	
		No.	% of total
1.	No answer/don't know	38	69.1
2.	Based on studies monitoring soil nutrient status, experiments are being conducted to determine fertilizer recommendation for cropping patterns rather than a single crop; experiments also being conducted on location-specific recommendations	9	16.4
3.	Based on findings of homestead survey, the Citrus and Vegetable Research Center is doing work on vegetables	5	9.1
4.	Late planting of wheat affects yield. To solve this problem farmers rotate wheat with Aman. Experiments are being conducted on this by the wheat program	4	7.3
5.	FSR site surveys encouraged Agricultural Economics Division to identify socioeconomic problems/characteristics of different agro-ecological zones	4	7.3
6.	Red ant of potato is a problem in some areas. Its control is now under study at the Potato Research Centre	4	7.3
7.	FSR survey encouraged experiments on mixed crops	1	1.8
8.	Attitude changed from 'research for publication' to 'research to solve problems'	1	1.8
9.	Attitude of station-based scientists not yet changed	1	1.8

Linkages among Different Centers of BARI

Respondents' opinions about the type and means of contact maintained among different research centers of BARI are summarized in Table 32. It appears that internal review meetings for planning and evaluation of research, mutual visits between centers, visits by superiors, and farmers'/field days are the major means of maintaining such contact.

Table 32: Respondents' Perceptions of Type/Means of Contact Maintained with Other Centers of BARI

Kind/means of contact	Response	
	No.	% of total
1. No answer	6	10.9
2. Mutual visit/visit by superiors	26	47.3
3. Internal review meetings for planning and evaluation of research	22	40.0
4. Attend field/farmers' days	14	25.5
5. Attend training programs	10	18.2
6. Lend/borrow seeds, other inputs	9	16.4
7. Planning research	7	12.7
8. Attend workshop/meetings	6	10.9
9. Visit to see new technology developed by other centers	6	10.9
10. Exchange publications/attend publications day	6	10.9
11. Lend transport/funding	3	5.4
12. All types of contact	2	3.6
13. Limited scope for contact	2	3.6

Linkage with Extension and Development Agencies

Linkage with the extension services is maintained through a number of activities, some of which (e.g., district and regional technical committee meetings) are part of the T&V extension system while others are related to OFRD activities (Table 33). OFRD's linkage with the extension service is possibly the most organized and efficient because OFRD has inherited the experience of ERP. The frequency of answers also indicates that OFRD scientists are aware of most of the means of maintaining linkages with the extension service.

Compared to the extension service, linkages with other development agencies were rather poor (Table 34). Twenty-seven percent of the respondents were silent on this issue. The Bangladesh Agricultural Development Corporation is the only agency having with links and this is because of the need for seeds and fertilizers for experimentation.

Table 33: Respondents' Perceptions of Type/Means of Maintaining Links with Extension Services

Means/Type of Contact		Responses No.	% of total
1.	Through district and regional technical committee meetings	38	69.1
2.	Through program planning/review meetings	28	50.9
3.	Combined visit of trial/research sites	23	41.8
4.	Invitation to farmers'/field days	19	34.5
5.	Selection and supervision of multilocational testing site/trial farmers	19	34.5
6.	Mutual invitation to workshops/training	16	29.1
7.	Directorate of Agricultural Extension keeps them informed of field problems for solutions	5	9.1
8.	Use Directorate of Agricultural Extension staff for survey	2	3.6

Table 34: Respondents' Perceptions of Type/Means of Contact Maintained with Development Agencies

Means/Type of Contact		Responses No.	% of total
1.	No answer	15	27.3
2.	BADC is contacted for seed/plant protection for pesticides	26	47.3
3.	Representatives of development agencies attend district and regional technical committee meetings	10	18.2
4.	Soil Resources Development Institute helps with soil identification/classification	5	9.1
5.	Joint research on homestead with the Bangladesh Academy for Rural Development, Comilla	4	7.3
6.	Agencies invited to attend field days	4	7.3
7.	BRRI helps with variety selection	3	5.5
8.	Combined program with Mennonite Central Committee/Tangail Agricultural Development Project/Water Board	3	5.5
9.	Agencies participate in training	2	3.6
10.	Very little scope for contact	6	10.9

Personal and Institutional Problems

It may be hypothesized that if OFRD performs all its designated functions effectively and efficiently, scientists should have few personal and institutional problems in conducting on-farm research. Respondents were therefore asked to describe such problems, if any. About 14% gave no answer about personal problems; 27% mentioned that they did not face any personal problem; while others mentioned one or more problems of which the main one was pressure of work or lack of time for work causing health and family problems (Table 35). Lack of training in FSR was mentioned by only 16% of the respondents. This appears to be underreporting, in view of the fact that few scientists reported earlier having had training in FSR methodology. Although few scientists mentioned other problems, the fact that there were problems mentioned should alert OFRD managers to take appropriate steps.

Table 35: Stated Personal Problems of OFRD Scientists in On-Farm Research

Problems		Responses	
		No.	% of total
1.	No answer	8	14.5
2.	No problem	15	27.2
3.	Too much pressure of work/no time/ schedule of work/personal and family life jeopardized/irregularity affecting health/pay not good enough	14	25.5
4.	Training in FSR none/inadequate	9	16.4
5.	Trained/competent research guidance not available	4	7.3
6.	Less scope for higher training	4	7.3
7.	Research sites too far/motorcycle driving difficult during winter, creates problem for health	4	7.3
8.	Less scope for promotion	2	3.7
9.	Expertise not used properly	1	1.8
10.	Family live in Dhaka, problem to manage	1	1.8

Table 36: Institutional Problems of OFRD Scientists in Research

Problems		Responses	
		No.	% of total
1.	No answer	13	23.6
2.	No problem	5	9.1
3.	Inadequate trained manpower/ inadequate manpower	11	20.0
4.	Transport inadequate/test site too far/ too much travel risky for health	10	18.2
5.	Weak administration/inadequate contact with headquarters/organizational problems	7	12.7
6.	Funds/research material not released on time	5	9.1
7.	Problems for higher training	5	9.1
8.	Work load/pressure higher than other divisions/too much time in research/ always remain on duty and tense	4	7.3
9.	Delay in getting approved research program	3	5.5
10.	Lack of clear program to reach goal	3	5.5
11.	Inadequate training in FSR/unclear about FSR objectives	3	5.5
12.	Resistance from station-based scientists	2	3.6
13.	Inadequate funds for travel allowance/ inadequate furniture in office	2	3.6
14.	Salary irregular due to deputation	2	3.6
15.	No room for independent thought	1	1.8
16.	Inadequate linkage with commodity programs	1	1.8
17.	Seniors talk about work but they really don't want it	1	1.8

Nearly 25% of respondents were silent about institutional problems but three of them said that they abstained from mentioning problems for fear of administrative action[3] (Table 36). A wide variety of problems were given by respondents but none was of particular importance for the OFRD as a whole. However, the experience of field visits, personal interviews with scientists at all levels, and the theoretical and actual working method of OFRD described earlier indicate that all the problems given are realistic and require appropriate attention.

SUMMARY OF PERFORMANCE OF FUNCTIONS

Performance of functions was examined at two levels:

1) to see whether the identified OFCOR functions are recognized in official OFRD documents and charters;
2) to ascertain the perceptions of OFRD scientists about the objectives and methods of OFRD activities.

Table 37 summarizes the authors' assessment of the present level of performance of various functions based on the survey results, interviews with OFRD staff, BARI administrators, extension officials, and farmers, as well as the analysis of research management mechanisms within BARI. It appears that OFCOR functions are explicitly or implicitly included in OFRD activities and methods. In practice, OFRD conducts a large number of trials every year on farmers' fields; holds regular meetings to review research results, plan new research, and to link these activities with the extension service; and conducts a variety of other functions to disseminate research results, evaluate technology, and identify innovators.

However, the perceptions of OFRD scientists of the objectives and methods of OFRD activities indicate that the majority of the scientists are not fully aware of them, and some are even confused about their own work. For example, the distinction between on-farm and farming systems research, or the concept of the farm as a decision-making unit, is not clear to a significant number of scientists. 'Promotion of an interdisciplinary perspective in research' was not considered as an OFRD function by any of the scientists although some of them could identify a number of activities in which scientists of different disciplines could work together. Most of them suggested that OFRD research teams should include scientists of several disciplines.

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3 Out of 94 OFRD scientists working in 1987, 55 returned the questionnaire. This number might have been higher but the remaining 39 scientists may either have had knowledge which they did not want to disclose or were reluctant to say what they had on their minds.

'Promotion of farmer participation in research' also was not considered by any scientist as an OFRD function and the present role of the farmer was given as a 'research supporter' rather than a 'research participant'. This situation is likely to change with more experience and with training of OFRD scientists in OFR/FSR concepts and methods. Though OFRD has a long history, most of its scientists are young graduates who came out of the university with no or little introduction to the FSR/OFR research approach. Moreover, most scientists are not of very high caliber; some senior staff have a rather poor academic record. Taken together, OFRD has an uphill task, the more so because of its very large size. Unless the intellectual capacity of the scientists can be improved and their perceptions made clearer, the conduct of hundreds of trials on farmers' fields will produce few fruitful results.

Table 37: Assessment of Present Level of Performance of Identified OFCOR Functions by OFRD

Functions	Assessed Level of Performance
1. a) Problem-solving research	Moderate
b) Systems approach	Weak
c) Farmers as clients	Weak
2. Interdisciplinary perspective	Weak
3. a) Agro-ecological zone-specific research problem	Moderate to Weak
b) Socio-economic group-specific research problem	Weak
4. a) Adapt technologies to specific situations	Strong
b) Develop technologies for specific situations	Weak
5. Promote farmer participation in research	Weak
6. Provide feedback to on-station research	Weak to Moderate
7. Linkage with	
a) Other centers of OFRD	Moderate to Strong
b) Other divisions/centers of BARI	Moderate
c) Other educational/research institutes	Weak to Moderate
d) Extension agencies	Moderate to Strong
e) Other development agencies	Weak
f) Policymakers	Weak
g) International agencies/centers	Weak to Moderate

CHAPTER 5

SUMMARY AND CONCLUSIONS

BARI is the oldest and the largest research institution in the country and has the longest experience in on-farm research through its on-farm soil fertility, variety, and agronomy trials. The present On-Farm Research Division, created in 1984, evolved out of the soil fertility program, the Cropping Systems Research Programme (later, the Farming Systems Research Programme and the Extension and Research Project.

The process of evolution has been influenced as much by internal forces and experiences as by outside agencies, particularly BARC and donor agencies. For example, the On-Farm Fertilizer Trials Programme had poor links with other research divisions of BARI and with extension, a deficiency which was first pointed out by expatriate consultants evaluating BARI's Wheat Research Programme. This ultimately led to the transformation of the Fertilizer Trials Programme into the On-Farm Trials Division of BARI. The Extension and Research Project was initiated by the International Development Agency to complement the training and visit extension system. At one stage, the Adaptive Research Programme of the Extension and Research Project, the Cropping Systems Research Project, the Wheat Programme, and the On-Farm Trials Division of BARI were duplicating each other's work and reorganization of all on-farm research projects and programs under OFRD was done partly to avoid this. With the formation of OFRD in 1984, all on-farm research in BARI was consolidated under this division.

OFRD's activities are still conducted around a number of major projects. Separate accounts and staff registers are maintained for them but operational procedures have been greatly simplified and standardized. OFRD staff work as a team and a scientist recruited for a particular project may be assigned duties in other projects. Research programs and results are evaluated first at local level, then at district level, and finally at the head office. The organizational structure allows scientists of other disciplines, divisions, and institutes, and extension and development workers opportunities to participate in the review process though there are indications of a lack of active and in-depth participation of non-OFRD scientists and other personnel.

An important problem of OFRD is its large size. In 1988 it had 88 scientists and nearly 400 other staff on duty dispersed in four regional stations, 19 substations, and 83 multilocational testing sites. At least 10 experienced research-cum-administrative leaders are required to guide and efficiently utilize the services of so many people but few in OFRD have leadership qualities. The problem is quite serious because most scientists are young graduates of mediocre calibre and have no orientation in on-farm research methodology and objectives. Consequently, a large number of trials

are mechanically conducted every year with, as yet, few fruitful results. It is alleged that some of these trials are a duplication of on-station trials or that they would be done better at research stations. In fact OFRD is collecting more data (some of dubious quality) than it can analyze in time for them to be useful. Data management (recording, processing, storage, and reporting) is still very poor due to lack of facilities and experience.

The disciplinary background of OFRD scientists is not ideal. Agronomists and soil scientists are in the majority with agricultural economists in third position. Research planning and evaluations are apparently carried out by a team of scientists of different disciplines but the execution of trials is managed more individually than collectively.

Many scientists feel that OFRD should recruit scientists of other disciplines. However, if this happens, OFRD will become as big as BARI itself. This suggestion seems to have arisen for two reasons: first, some believe that OFRD should conduct research on all aspects of the farming system -- crops, livestock, fisheries, and forestry. This is obviously a misunderstanding of FSR as a research approach. What is emphasized in FSR is that researchers may conduct research on any component(s) of the system but they should take a holistic view of the system because the interrelationship among its various components is neither unidirectional nor linear, so that a change at any one point of the system may generate different degrees of change in different directions (Jabbar, 1977). For example, rice breeders at Bangladesh Rice Research Institute were concerned only with increasing grain yield and were unconcerned about quality and quantity of straw, the main source of animal feed. Consequently, animal production suffered. Had they adopted a systems approach to research, the breeding objectives and strategy might have been quite different. The problem is in the process of being corrected.

The second reason for the urge to recruit OFRD's own scientists from different disciplines is that OFRD's outstations and multilocational testing sites do not get adequate advice or services from disciplines like horticulture, plant pathology, and entomology. Another major problem appears to be organizational: OFRD activities are dispersed throughout the country in too many places. The long and arduous travel required seriously hinder station-based scientists from providing the necessary advice and service when needed. OFRD's own management and supervision problems are also enormous.

The present level of OFRD funding is adequate mainly because most of its activities are related to short-term projects. However, there are problems arising out of the irregular release of funds, one reason for which is inefficient accounting management at all levels. It is doubtful whether OFRD will be able to maintain its present level of activity once the project funds are exhausted and the regular government budget is to be used. Experience suggests that once development projects are adopted as regular programs, government funds are adequate for salaries and emoluments but operational funds are too often inadequate and irregular, and staff therefore remain underutilized. This is another reason why OFRD should consider limiting its size.

The integration of farmers into the research process is an important function of OFCOR but OFRD has achieved less success in this regard mainly because of lack of training and experience of scientists in on-farm research objectives and methodology. However, using a self-critical approach, important lessons have already been learned and questions are being raised with a view to improving performance. A balance needs to be worked out between reaching farms directly and going through the extension service. A comprehensive and organized extension-research linkage system has been evolved. Research planning and evaluation is done with participation of extension people at District and upper levels. Multilocation tests are conducted at Upazila level under the supervision of Upazila agricultural officers. The findings are fed back to the Upazila and the frontline extension workers through the extension service. OFRD may therefore consider confining its main research activities including multilocational testing, at and around regional and substations, drastically reducing the number of multilocational testing sites, and disseminating all research results through the extension service, thus maintaining close links with it. This way, the number of Substations could be marginally increased.

The need for location-specific research and testing has necessitated the creation of sub- and outstations, but location specificity does not have any limit. Rather than managing too many ill-equipped substations, the existing organizational structure may be reorganized and the management procedure at regional stations and substations may be changed.

Because of external funding from donors, OFRD has frequent contact with international centers and expatriates, including short-term visitors and medium-term consultants resident in Bangladesh. OFRD also had a few consultants working exclusively for itself. OFRD has benefited from these contacts but possibly could not make full use of the services because its facilities and programs are still evolving. Given that OFRD has serious leadership and guidance problems, the possibility of hiring long-term local consultants may be considered. This will be useful for on-going research and, more important, for training staff. Short-term training personnel may also be hired. It will take years if a few scientists are sent abroad every year for short or long-term training.

On-farm research possibly has the weakest link with the agricultural education system which turns out future researchers and extension workers. The systems approach to study and research has yet to be formally introduced into the curricula. Few agronomists, animal scientists, and agricultural economists are involved in FSR but they try individually to teach this approach. They also try to promote a multidisciplinary approach to research but the vast majority are still single-discipline-oriented in their approach to teaching and research. Rapid change from within is highly improbable and it has yet to be worked out how to induce change from outside.

APPENDIX A

ORGANIZATION AND MANAGEMENT OF THE NATIONAL COORDINATED FARMING SYSTEMS RESEARCH PROGRAMME[1]

Program Organization

1. Executive Committee with the Minister of Agriculture as Chairman[2]

2. National Technical Coordination Committee

   A. Composition

1. Vice-Chairman, BARC	Chairman
2. All Member-Directors, BARC	Members
3. Heads of all participating Organizations	Members
4. National Programme Coordinator, BARC	Secretary

   More suitable members may be co-opted by the Chairman as and when necessary.

   B. Functions

   - To promote the farming systems research approach that enhances understanding of the way farmers operate their farming units in Bangladesh;

   - To promote staff development so that staff will be able to identify the needs and capabilities of the various groups of farmers operating in different agro-ecological zones of Bangladesh;

   - To provide assistance to the several agricultural research Institutes and their scientists to plan agricultural research based on the farmers' needs and capabilities mentioned above;

   - To promote the dissemination of the results of the research findings through the publication of bulletins and organization of seminars, workshops, and conferences;

   - To monitor and evaluate the progress of the research program at the several agricultural research agencies;

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1 Extracted from the Proposal of the National Coordinated Farming Systems Research Programme, Bangladesh Agricultural Research Council, 1985.

2 The composition and function of the Committee is not defined.

- To review and give final approval to all farming systems research proposals.

3. Coordination Unit at BARC

A Coordination Unit at BARC will be staffed with a full-time Programme Coordinator (Chief Scientific Officer), an Associate Programme Coordinator (Principal Scientific Officer), and Senior Scientific Officers. The staff will be drawn preferably from crop sciences, agricultural economics and social science, livestock, and forestry.

The functions of the Coordination Unit will be:

- To provide assistance to the participant institutions for the elaboration of the research plans related to farming systems research;

- To explore funding sources and maintain links with donors and participating institutions;

- To establish relations with international organizations involved in farming systems research or related research and to strengthen and improve existing relations with various organizations;

- To organize quarterly meetings with the principal investigators to discuss the progress of activities planned for that quarter;

- To organize an annual meeting to review the results of the research carried out in the preceding year and to elaborate or modify the work plans for the following year;

- To identify technologies which are deemed to be suitable for multilocational trials, pilot production and a general production program;

- To conduct annual field evaluations with the participation of experienced local and expatriate scientists;

- To make schedules for field visits from project coordinators and associate personnel for monitoring the progress of activities at different farming systems research sites;

- To organize seminars, workshops, and field days at farming systems research sites and at the national level;

- To provide training opportunities aimed at promoting and upgrading the technical capabilities of the farming systems research staff from different research institutions. The Coordination Unit will fulfill the requirements necessary to achieve the objectives of the Farming Systems Research Programme.

4. Participating Institutions

Bangladesh Rice Research Institute
Bangladesh Agricultural Research Institute
Bangladesh Jute Research Institute
Bangladesh Agricultural University
Sugarcane Research and Training Institute
Bangladesh Water Development Board
Forest Research Institute
Bangladesh Livestock Research Institute
Department of Agricultural Extension
Directorate of Livestock Services[3]
Bangladesh Institute of Nuclear Agriculture[3]
Fisheries Research Institute[3]
Nongovernmental organizations

Each institute will have an institutional project coordinator. If research in each institution is conducted at more than one site, each site will have a site coordinator. More institutions may be co-opted.

MANAGEMENT AND IMPLEMENTATION

Management at National Level

1. BARC Coordination Unit

The BARC Coordination Unit will examine the technical and financial programs submitted by the participating institutions in the context of contract research principles. Any change needed will be discussed with the relevant institutional project coordinator.

2. National Working Group

A National Working Group will be organized to assist the National Technical Coordination Committee for Farming Systems Research in reviewing the progress of the Farming Systems Research Program. The composition of this group will be:

a)	National Programme Coordinator	Chairman
b)	All Institutional Project Coordinators	Member
c)	Experts representing all possible disciplines of FSR (e.g., entomologists, animal scientists, soil scientists, plant pathologists, socio-economists)	Member
d)	One representative from each Division of BARC not lower than the rank of Principal Scientific Officer	Member

3 These institutes do not yet have any FSR activities/projects but they are expected to take up programs soon.

This Working Group will hold quarterly meetings to review the progress of the last quarter. In addition, it will hold an annual meeting in May to review the overall activities of the current year and finalize technical and financial plans for the next financial year for presentation to the National Technical Coordination Committee for Farming Systems Research.

Management at the Institutional Level

1. Task Force

Each participating institution will form a task force with representation from various disciplines (socio-economics, water management, pest management, plant breeding, soil science, etc.). The task force will review/scrutinize the technical programs of all the sites operated by that institution. It will make recommendations for future research activities on a site. The task force will participate in monitoring tours to oversee site activities.

2. Institutional Project Coordinator

The Institutional Project Coordinator stationed at the institution's headquarters will contribute to and/or oversee program planning and operations. He will coordinate other programs of the institution and will be responsible for their integration. He will organize meetings with the task force, site coordinators, regional investigators, and principal investigators to examine and finalize the technical and financial plans of the sites and submit them to the National Programme Coordinator.

Management at Site Level

1. Site Staff and Site Coordinator

The site is the operational unit of an institutional Farming Systems Research Programme. An interdisciplinary group of full-time scientists will be assigned to the site. A Site Coordinator, selected from the staff assigned to the site, will be appointed by the relevant institution and will be responsible for the technical administration of the site. The relevant institution will control the administration, and will provide the physical and technical support needed to carry out farming systems research in a site. The scientific officers (Scientific Officers, Chief Scientific Officers, and Principal Scientific Officers) will be assisted by the field assistants for the implementation of the work plan for the site.

2. Working Group

A working group will be organized at site level for planning, implementation, and evaluation of the activities of the site. The working group will have representatives of the farmers and the agencies involved in agricultural development activities (upazila-level officers of the Department of Agricultural

Extension, Department of Livestock Services, Bangladesh Rural Development Board, etc.). The Site Coordinator may be nominated as a member of the district technical committee in order to build strong links with the extension system.

3. Functions of the Site Coordinator

The Site Coordinator, with assistance from the Scientific officers and the staff, will:

a) Organize the site working group, including farmers and regional agricultural officers;

b) Convene monthly meetings of the working group to review the progress and constraints of project implementation;

c) Provide day-to-day supervision and participate in the socio-economic surveys and establishment of field experiments;

d) Organize periodic visits to the fields of the farmers participating in the project, and discuss and analyze the progress of the activities. These field visits will allow the farmers to be fully aware of the technologies under study;

e) Organize field days with the participation of farmers from the site, farmers from neighbouring areas, and regional agricultural officers and ensure that the farmers in the site are fully aware of the objectives of farming systems research;

f) Organize training for farmers and field assistants and meetings with the participant farmers to assess the technology under study;

g) Supervise proper data collection by the site staff;

h) Elaborate charts and graphs with information about the site;

i) Organize seasonal meetings with the working group to discuss the results obtained in each crop season and decide about necessary modifications to the work plan;

j) Organize annual meetings with the working group, regional agricultural officers and institutional and national coordination units to review the findings of the project, and propose changes based on farmers reactions;

k) Prepare and submit the seasonal and annual reports of the site activities to the institution's coordination units;

l) Monitor and maintain records of input supply and equipment and make local purchases.

Financial Management

Initially the National Farmings Systems Research Programme will be funded through BARC under the contract research program for a period of three years. The Programme will be evaluated after two years. Depending on the progress and achievements, a formal Project Proforma will be prepared for its inclusion in the Annual Development Plan. Thus, it is expected that the farming systems research activities will eventually be included in the core programs of all the participating institutions.

Financial management of the Programme will be organized in line with BARC's financial management rules for contract research. On recommendation from the Farming Systems Research Programme Coordinator at BARC, funds for a particular site will be released to the administrative head of the relevant institution and then sent direct to the Site Coordinator for meeting site-related expenditures. The salary and allowances of livestock officers at sites other than those of the Livestock Research Institute will be paid by the institute from its own budget.

A statement of expenditure endorsed by the Institutional Project Coordinator and the authorized accounts officer of his/her institution is one of the prerequisites for the subsequent release of funds.

Suggested Research Activities

1. Exploratory surveys
2. Site description surveys
3. Special purpose surveys
4. Study and description of operating farming systems in the project area
5. Agronomic and economic evaluation of cropping systems

a) Cropping Pattern Testing

- Evaluation of the performance of existing cropping patterns under farmers' management (F);
- Evaluation of existing cropping patterns under improved agronomic practices (FI);
- Evaluation of cropping patterns including different crops to the ones normally grown by farmers (FA).

b) Component Technology Studies

c) Variety Trials

d) Soil Management Practices

- Determination of fertilizer doses used by different groups of farmers in their cropping systems;
- Potential to increase production in existing cropping patterns by use of fertilizer;

- Determination of fertilizer management practices for improved cropping patterns;

- Determination of minor nutrient requirements in different cropping patterns;

- Determination of fertilizer rates for different intercropping and mixed cropping systems under rainfed conditions;

- Residual effects on rice of fertilizer applied to winter crops;

- Minimum tillage studies;

- Others.

e) Pest Management Practices to Increase Production of Cropping Systems

- Survey to determine the incidence of plant diseases, insects, and weeds in the Farming Systems Research Programme areas;

- Special studies to determine the economic impact of diseases, pests, and weeds on production in the existing cropping systems;

- The potential to increase cropping systems production by adopting control methods for seed-borne diseases;

- The potential to increase production of cropping systems by adopting integrated pest management practices;

- Study of indigenous methods for pest control in cropping systems;

- Insect population dynamics in different cropping patterns.

f) Water Management in Farming Systems

- Description of farmers' water management practices under irrigated and rainfed conditions (special purpose survey);

- Efficient use of residual soil moisture in sequence, intercropping, mixed cropping, and relay cropping systems;

- Determination of seasonal changes in soil moisture content under different cropping patterns and in different land types;

- Potential to increase land use and/or crop production by unit area by means of mulching (rice, straw, water, etc.);

- Determination of the potential to increase the effective utilization of rainfall for crop production;

- The potential to increase production of T. Aman rice by use of supplementary irrigation;

- The potential to produce winter fodder crops in irrigated and partially irrigated areas in the turnaround time between T. Aman rice and Boro rice;

- Evaluation of the performance of different cropping patterns under irrigated conditions;

- Others.

6. Socio-Economic Evaluation of Livestock Systems

a) Comparison of Livestock Production Systems

- Evaluation of the performance of existing livestock systems under farmers' management (LVS-F);

- Evaluation of the performance of existing livestock systems under improved management practices (LVS-FI);

- Evaluation of the performance of alternative livestock systems (LVS-FE).

b) Component Technology Studies

- Evaluation of balanced rations for cattle;

- Study of the use of cows for draft;

- Evaluation of a single bullock with improved harness for small plow and light work;

- Feeding culled cattle for special market related to sacrifice;

- Study of recommended vaccination schedules for cattle, buffalo, goats and sheep, and/or poultry;

- Evaluation of internal parasite treatment for cattle, buffalo, goats and sheep, and/or poultry;

- Evaluation of straw treatment with urea/urine in baskets, plastic bags, and/or stacks to test value both for storage and as measured by animal's performance during consumption of the same.

- Relay legume or maize crop for minimizing tillage for food grain and for forage to be fed directly or after storage;

- Evaluate milk and cheese production by goats;

- Study of poultry roost over fish pond to supplement fish diet;

- Evaluation of green forage production in waste and/or forest land, for balancing rations for milk cows and draft animals.

7. Socio-Economic Evaluation of Agroforestry Systems

a) Comparison of Agroforestry Production Systems

- Evaluation of the performance of the existing agroforestry systems (AFS-F);

- Evaluation of the performance of the existing agroforestry systems under improved practices (AFS-FI);

- Evaluation of the performance of alternative agroforestry systems (AFS-FA).

b) Component Technology Studies

- Management practices of fodder trees;

- Management practices of trees for multipurpose uses (fodder-fuel-wind barriers);

- Improving management practices for fruit trees (mango, jack fruit, citrus);

- Potential and methods for replacing local tree species with improved varieties (including fruit trees);

- Others.

8. Socio-Economic Evaluation of Homestead Production

a) Exploratory Survey

b) Comparision of Homestead Production Systems

- Socio-economic evaluation of the existing homestead production systems (HPS-F);

- Socio-economic evaluation of existing homestead production systems under improved practices (HPS-FI);

- Socio-economic evaluation of alternative homestead production systems (HPS-FA).

c) Component Technology Studies

- Studies of methods for benefiting crop by-products;

- Evaluation of methods for grain storage (rice, wheat, mustard, etc.) for seed and for human and animal consumption;

- Evaluation of methods for storage of tuber and root crops for seed or for human and animal consumption;

- Study of methods to improve nutrient recycling (cow dung and urine collection);
- Study of tree crops and animal by-products as sources of energy;
- Off-farm employment and cash investment;
- The role of women in household development and its economics.

APPENDIX B

NATIONAL TECHNICAL COORDINATION COMMITTEE FOR THE EXTENSION AND RESEARCH PROJECT

Project Organization

1. Composition of the Committee[1]

Chairman
Vice-Chairman, BARC

Members

1. Director General, Bangladesh Rural Development Board
2. Director General, Department of Agricultural Extension
3. Director General, Bangladesh Agricultural Research Institute
4. Director General, Bangladesh Rice Research Institute
5. Joint Secretary (Extension and Research), Agriculture and Forest Division, Ministry of Agriculture
6. Project Director, Project Implementation Wing
7. Director (Field Services Division), Department of Agriculture Extension

Member Secretary

Member-Director (Crops), BARC

2. Functions of the Committee[2]

1. To hold regular meetings for coordination of the activities of the institutions associated with the implementation of Extension and Research Project II (ERP II) and monitor the field activities of the project on a continued basis.

2. Organize annual review workshops for elaborate discussion of the on-going activities and planning of future programs.

3. Through regular committee meetings, coordinate the activities of implementing agencies and associated agencies involved with :

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1 Derived from Government Notification No. P & E (PMU-E and R) - ERP-4/83 (Part I) 1263, dated 23.9.1984.

2 Derived from Government Notification No. P & E (PMU-E & R) - ERP-4/83 (Part I)/10, 12.1.1985.

a) the progress of the ERP II;

b) the development of the extension services and on-farm resesarch throughout the country.

4. Through working groups, establish and test a mechanism for routine and continuous monitoring of extension linkages with:

a) the agricultural research system;
b) the formal agricultural education sector;
c) the cooperative movement and farmer cooperative societies.

5. Before each cropping season, review national research findings and regional farmer recommendations, and ensure that such recommendations are disseminated through regional and District levels and made available to farmers.

6. Foster the development of strong linkages and continuous coordination at all levels between key national agencies involved in assisting farmers to intensify and increase crop production. Such agencies are:

a) Department of Agricultural Extension;

b) Bangladesh Agricultural Research Council and associated institutes (Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Jute Research Institute, Bangladesh Institute of Nuclear Agriculture, Sugarcane Research and Training Institute);

c) Bangladesh Rural Development Board;

d) Bangladesh Agricultural University.

7. Coordinate and monitor the activities of the training wings of the institutions associated with the project, the training programs undertaken at the Agricultural Training Institute and Central Extension Resource Development, BRRI/BARI training programs for extension staff, and other field training associated with the implementation of ERP II.

8. Commission brief field surveys and regular evaluations on the impact of the agricultural extension service, the effects of on-farm agricultural research, the levels of coordination achieved between the field services of extension and research, and the linkage with the cooperative system, with the Bangladesh Agricultural University, with the Agricultural Training Institute, and with the Central Extension Resource Development.

9. Based on reviews of field surveys and studies, recommend as appropriate any structural or functional changes within each system and the linkages between systems to ensure

that the ever-changing needs and demands of the farmer continue to be effectively met by the field services of extension and research.

10. Ensure that changes in project activities/programs as suggested by the National Technical Coordinating Committee and as approved by the AFD are implemented by the particular agency and subsequently monitored by the committee.

APPENDIX C

SUMMARY OF THE IMPORTANT QUESTIONS AND SUGGESTIONS FOR IMPROVING THE PLANNING, IMPLEMENTATION, AND MANAGEMENT OF ON-FARM RESEARCH IN BARI MADE DURING THE INTERNAL REVIEW OF RESEARCH PLANNING AND MANAGEMENT IN 1986[1]

1. While a large pile of data remained unprocessed, the search for new data always continued, as reflected in the large number of trial proposals submitted by implementation teams. In order to discourage this practice, it was suggested that trial proposals should be rigorously prepared, processed, and scrutinized, so that the internal review would have to deal with fewer, but more appropriate, proposals.

2. OFRD should refrain from conducting trials on varieties already released and under demonstration by the Directorate of Agricultural Extension.

3. On-station scientists expected OFRD to produce an inventory of location-specific problems of poor farmers. In response, the possibilities of annually bringing out a document containing early signals as well as technical and socio-economic problems and trends was considered but a clear decision was not taken. OFRD has a large network to fulfil this role.

4. An inventory of trials classified by crop, sector, or problem was prepared by an OFRD scientist. This exercise revealed a serious imbalance in the research program, e.g., too many trials on fertilizer and wheat. It was suggested that the resource allocation at each site should be guided by the needs, aspirations, and practices of the majority of poor farmers.

5. The number of trials under rainfed conditions were considered to be low in view of the fact that 75% of the cropped area in the country was under rainfed conditions. It was therefore felt that more sites without irrigation should be used. Similarly, the number of trials on mixed cropping and on organic mixed with inorganic fertilizer should be increased because these practices are common. Studies on fertilizer adoption have shown that most farmers first use nitrogen, then phosphate, then potash and that recommended doses are rarely used. Therefore, trials should be conducted to find

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1 Derived from (Gupta, 1986a-i; BARI, 1986a-b: Gupta et al., 1986.

alternative packages to suit farmers abilities, e.g., a balanced but less than optional dose may be found for different crops and locations, so that farms with resource constraints may take best advantage of fertilizer use. An economic analysis of optimum and alternative mixes should be done.

6. Principal Scientific Officers should make a matrix of crops, treatments and proposed research so that any remaining gaps can be identified. For example, ecological mapping of the extrapolation area of the Kalikapur site revealed that the problems of one high-risk subregion were never examined.

7. The site team should discuss the research program in separate evening village meetings of cooperator farmers from the previous year's trials, noncooperator poor and tenant farmers, and noncooperator richer farmers.

8. An advisory group of landless laborers, tenants, and small and marginal farmers should be formed at each site to serve as a reference group for the site scientists and the staff. This group should meet once a month to discuss climatic and other contingencies, economic and social events, and feedback for policy-making.

9. Whether the trial plot or the cooperating farmer should be selected first and what the best method of selection was were matters of debate. It was suggested that whatever method was employed for selection, scientists and field staff should take a more active part in the selection process.

10. The high costs involved in some experiments may discourage small farmers and tenants to participate in a trial. In such cases, an OFRD subsidy should be provided for small farmers and tenants.

11. A trial should not be put into operation if optimal conditions for the trial do not exist or if the optimal time for sowing has passed or if materials do not arrive in time.

12. A log book should be maintained for each trial at the site, as done by the farming systems research site team in Tangail. Visiting scientists should record their comments and observations in the log book for follow-up.

13. The results of each trial should be validated at least by cooperating farmers and at most by other farmers, e.g., those participating in other trials, those who participated in the past, neighboring farmers not having trial plots, faraway farmers having similar resource endowments, and landless workers who worked on the trial plots. A high degree of consistency in the reports of these categories of farmers is desirable. It was also emphasized that farmers' reactions should be sought at various stages rather than only after harvest.

14. Because of the strong crop-livestock interaction in the farming system, both grain yield and harvest index should be calculated instead of only grain yield.

15. Some farming systems research sites either excluded or inadequately covered small and marginal farmers in the benchmark surveys; thus, including their concerns in the planning research program was made difficult. To avoid this, special-purpose, rather than full-scale, surveys might be conducted.

16. Some small and marginal farmers dropped out of the block monitoring process and some small farmers have reportedly shown reluctance to participate in trials. The reasons should be ascertained.

17. Whenever any experiment or replication fails, the stage, extent and reason, and farmers' reactions to such failure should be recorded. This is expected to help understand the implications for risk.

18. It was suggested that disease, pest incidence, and farmer's own risk adjustment practices should be recorded and presented as part of the results. In the case of new proposals for risky crops, each proposed trial should be accompanied by one or more contingency options. This requires application of scientists' ability to anticipate risk. Farmers' experiences in this respect should be taken into account.

19. The choice of cropping pattern trials was generally based on benchmark or other survey results. The validity of this approach was questioned because the Bangladesh Agricultural University farming systems research team found that farmers frequently changed cropping patterns in a particular plot, so development of the best pattern might have little practical use. The other view in this respect is that although the pattern of a particular plot may be changed, the dominant or the best pattern may be grown on other plots by the same farmer or by other farmers, so the search for the best pattern is quite relevant.

20. It was suggested that data on genetically fixed parameters or those showing low variance between on-station and on-farm trials should not be collected. This was essential to permit collection of more useful data from the field with limited resources of manpower and time.

21. It was observed that some implementation teams either did not use agroclimatic data to interpret results or used outdated data. More recent agroclimatic data were therefore collected by OFRD headquarters and supplied to all the teams.

22. It was suggested that principal scientific officers, who lead a regional team from OFRD, should make four types of consistency checks while interpreting results: (a) logical consistency, (b) consistency between replications and treatments, (c) consistency over time, (d) consistency between experiment and control. They should also ensure that the feedback from trials is appropriately reflected in the next year's research program. This was considered essential to influence on-station research priorities.

23. Trial results should be presented along with a review of the literature, a review of earlier experiments at the site, evidence from other institutions, and reference to unpublished sources or personal discussion. The standard deviation or coefficient of variation should be presented along with means.

24. Sensitivity analysis should be incorporated as an essential part of economic analysis in order to understand the implication of risk.

25. The tendency to generalize on the basis of only one year's data was discouraged. However, it was agreed that a useful inference for projection could be drawn from a cross-section of a large number of trials.

26. Involvement of women scientists in studying poor farmers' problems, particularly those related to homestead and home-based production activities, was emphasized. This is based on practical experience when BARI women scientists were used by OFRD for a homestead survey.

27. The tendency of not acknowledging each others' contributions and the contributions of field staff should be censured. Individual interests should not be allowed to overtake team, institutional, and professional interests.

28. In order to increase scientist-farmer interaction, the objectives of the trial and the criteria for evaluation of success should be communicated to the cooperating farmers and should be considered necessary. Farmers involved in similar types of trials/replications may be brought together to discuss the objectives, key hypotheses, methods, and data to be collected. In this way, both sides will understand mutual responsibilities and expectations. Without such communication, farmers' involvement in OFCOR could not be institutionalized.

29. The need for studying indigenous knowledge was underlined because the risky, humid, tropical conditions prevalent in Bangladesh did not exist at most centers of international agricultural research. It was suggested that while visiting fields, scientists should look not only for the most popular practices, but also for exceptions. Whenever any exceptional practices were found, observational trials or quick studies should be conducted. In this respect, indigenous plant protection practices and livestock medicine identified by OFRD teams should be tested by relevant on-station scientists.

30. To link on-station and on-farm research, it was suggested that the results of advanced yield trials should be reported to the relevant commodity scientists, who in their turn should invite the OFRD scientists concerned to their review meetings.

31. The official procedure is that junior scientists should send all communications to headquarters through proper channels, i.e., team leaders and principal scientific officers. In order to expedite headquarters-site interaction and to allow junior

scientists to express their opinions freely, it was decided that all scientists, regardless of their status, could write directly to the OFRD chief with copy to team and regional leaders.

32. OFRD implementation teams should develop proposals to fulfil site-specific objectives. Any trial or survey added or dropped should be properly justified along with a review of the literature. The agro-ecological versus socio-economic characteristics of a problem should be clarified. The method of validating proposals through farmers and their reactions, whether accepted or not, should be explained. Thus, for each trial the potential client and the way the trial result was expected to remove an existing constraint or open a new opportunity should be indicated. It was further suggested that the needs and priorities of different classes of farmers should be discussed with them separately.

33. For proposals submitted by other divisions of BARI or by other institutes:

a) proposals should be submitted 20 to 25 days before the task force meeting;

b) proposals should be routed through OFRD headquarters and should not be sent directly to the site teams where trials are to be conducted;

c) the number of treatments, size of plot, arrangement for seeds, germination report, and data-recording format should be clearly specified;

d) the number of treatments should not be so large as to make the trial too complex for the cooperating farmers;

e) relevant references should be mentioned along with the proposed trial; this was expected to broaden the skill and thinking among OFRD scientists.

APPENDIX D

PUBLICATIONS RELATED TO ON-FARM AND FARMING SYSTEMS RESEARCH IN BARI

Publications of the On-Farm Research Division, BARI

1. Annual Report, 1981-82, Extension and Research Project.

2. Annual Report, 1983-84, On-Farm Research Division, BARI.

3. Annual Report, 1983-84, farming systems research site, Kalikapur.

4. Annual Report, 1983-84, cropping systems research site, Janakinathpur, Rangpur.

5. Annual Report, 1984-85, OFRD (in press).

6. Annual Report, 1985-86, OFRD (in press).

7. Annual Reports, 1985-86, by Ishurdi, Jamalpur, Jessore, and Hathazari Regional Stations and 18 substations.

8. Research Reports on Rabi and Kharif Seasons, 1985-86, by four regional and 18 substations.

9. Socio-Agro-Economic Description of Multilocational Test Sites -- six reports in 1985, 11 reports undated.

10. Site Profile Report of Serajganj, 1986.

11. Multilocational Research Report on Rabi Crops, 1986, Khulna.

12. Broad Objectives of FSR Site, Panchlia, Serajganj, 1986.

13. Objectives of FSR Site, On-Farm Research Division, Tangail, 1986.

14. Farming Systems Research, Jamalpur, Extrapolation Area Constraints and Potentialities, Objectives and Strategies, 1986.

15. Problem and Objectives on MLT Site, On-Farm Research Division, Mymensingh, 1986.

16. Multilocational Research Report on Kharif Crops 1986, On-Farm Division, Khulna, 1986.

17. Fertilizer Utilization Pattern for Wheat Cultivation at Farming Systems Research Site, Kalikapur, Ishurdi, Pabna, 1986.

18. Some Important Farmers' Views from the FSR Site, Kalikapur, 1986.

19. Recommendations of the Internal Review Workshop held at the Regional Agricultural Research Station, Ishurdi, Pabna, during 23-26 June 1986.

20. Fertilizer Utilization Pattern on Wheat Cultivation Under Irrigated and Rainfed Conditions in the Wheat Growing Areas of Comilla (undated).

21. A Report on the Fertilizer Utilization Pattern on Wheat Under Rainfed and Irrigated Conditions by Satish Chandra Dham. On-Farm Research Division, Barisal Report-2 (undated).

22. A Report on the Fertilizer Utilization Pattern on Wheat Under Rainfed and Irrigated Conditions in Greater Jessore District (undated).

23. Research Report on Kharif II, 1984, and Rabi, 1984-85, OFRD, Jessore.

24. Bench-mark Survey Report on Farming Systems Research Site, Tilok, Barisal, 1984-85.

25. Technical Feasibility report on Proposed New Farming Systems Research Site, Barisal, Report No. 9, 1984-85.

26. Research Report 1984-85. FSR Site, Barind, Godagari, Rajshahi.

27. Report on Rabi 1984-85 Experiments, FSR site, Palima, Tangail.

28. Cropping Systems Research Programme, Annual Report, 1984-85. Hathazari, Chittagong.

29. Labour Utilization Pattern at FSR Site, Hathazari, Chittagong, 1985.

30. Reports of the Experimental Results of 1983-84 (FSR site on-station), Region I, Ishurdi, Pabna.

31. Activities of On-Farm Research Division, Jamalpur, No. I, 1985.

32. North West Regional Research Index No. 1, E & R Project, Rajshahi Division (undated).

33. North West Regional Research Index No. 2, E & R Project, Rajshahi Division (undated).

34. North West Regional Research Index No. 3, E & R Project, Rajshahi Division (undated).

35. Extension and Research Bulletin, Vol. 1, Nos. 1-4 (undated).

36. Extension-Research Linkage -- An Operational Manual (undated).

37. Some Achievements of the Extension and Research Project and On-Farm Research Division, Region-1, BARI, during last five years (1980-84), (undated).

38. Summary of Research Activities, 1985-86, Region 1, Rajshahi Division, OFRD, BARI, 1986.

39. Workshop on Research Extension Approaches, 1982. Proceedings (undated).

40. Multilocation Testing Guidelines, On-Farm Research Division, Joydebpur (undated).

41. Farming Systems Research Methodology, Training Course Resource Manual, On-Farm Research Division, Joydebpur (undated).

42. Perception of Traditional Cropping Systems at CSR Site, Kalikpur, Pabna (undated).

43. Research Highlights and Technical Achievement of BARI Farming Systems Sites (undated).

44. Technical Papers in Farming Systems, Vol. I, 1984-87, prepared by R.N. Mallick et al., On-Farm Research Division, Ishurdi, Pabna, 1985.

45. Technical Papers in Farming Systems, Vol. II, 1984-87, prepared by R.N. Mallick et al., On-Farm Research Division, Ishurdi, Pabna (1986).

Publications of Agricultural Economics Division, BARI

46. Swenson, C.G., J. Ahmed, Q.M. Alam, S.C. Barman, A.K.M. Haque, M.S. Hussain and F.S. Sikder. 1979. A Survey of the Economics and Agronomy of Wheat Production in Jessore and Pabna Districts. Research Report No. 79-1.

47. Swenson, C.G., F.E. Church, A.U. Ahmed, Q.M. Alam, A.K.M. Haque and J. Ahmed. 1980. 1979/80 Wheat Cultivation in Bangladesh -- An Economic Profile. Research Report No. 80-1.

48. Elias, S.M. and A.K.M. Haque. 1981. Bench-Mark Survey: Chittagong Cropping System Research Site. Research Report No. 81-1.

49. Elias, S.M. and A.K.M. Haque. 1981. Bench-Mark Survey: Jessore Cropping System Research Site. Research Report No. 81-2.

50. Elias, S.M., A.K.M. Haque, R. Karim and M. Rahman. 1981. Socio-Economic Evaluation of Improved Cropping Patterns at the Cropping System Research Sites in Jessore and Chittagong. Research Report No. 82-4.

51. Elias, S.M., A.K.M. Haque, M.S. Hussain, W.A. Zahan and R. Karim. 1984. Bench-Mark Survey: Jamalpur Cropping Systems Research Site. Research Report No. 84-6.

Publications of Agricultural Economics and Social Science Division, BARI

52. Karim, R. and A. Quasem. Agro-Economic Study of Country Bean Production. BARI, RARS, Hathazari, Chittagong, December 1983.

53. Sha, R.K. and Wajed A.S. Farm Resources at Kalikapur, CSRS Inshurdi, 1983/84. July 1984.

54. Karim, R. and S.M. Elias. Partial Budget Analysis of Fertilizer and Cropping Pattern Trials at Hathazari CSRS, 1982/84. December 1984.

55. Baksh, E. Analysis of Farm Resources at Janokinathpur FSRS, Rangpur, 1984. February 1985.

56. Alam, S. Fertilizer Price Analysis, FSRS, Jamalpur, 1984/85. May 1985.

57. Baksh, E. The Market Price of Agricultural Commodities, Janokinathpur FSR Site, Rangpur, April 1985-March 1986. November 1985.

58. Alam, S. A Study of Farm Resources at the FSRS Laherikanda, Jamalpur, 1984/85. November 1985.

59. Baksh, E. and M. Ahmed. Farm Income and Expenditure at Jonokinathpur FSRS, Rangpur, 1984/85. November 1985.

See also the references for this study.

Annex Table 1: Staff Positions in BARI, 1987

Location	Officer/Scientist	Other Staff
1. Director General's Office[1]	46	260
2. Bangladesh Agricultural Inst.	76	141
3. Patuakhali Krishi College	68	112
4. Institute of Postgraduate Studies in Agriculture	44	155
5. Plant Breeding Division	52	151
6. Soil Science Division	36	50
7. Agronomy Division	28	47
8. Agricultural Economics Div.	27	45
9. Entomology Division	23	38
10. Plant Pathology Division	21	32
11. Agricultural Engineering Div.	14	58
12. Analytical Services Division[2]	45	68
13. On-farm Research Division	104	449
14. Farm Division (Central Station)	11	67
15. Wheat Research Centre	34	71
16. Potato Research Centre	22	151
17. Oil Seeds Project	19	49
18. Citrus and Vegetable Seed Research Centre	16	38
19. Regional Station, Jessore	17	43
20. Regional Station, Hathazaii	24	95
21. Regional Station, Jamalpur	23	50
22. Regional Station, Ishurdi[3]	22	51
23. Regional Station, Rahmatpur	26	58
24. Regional Station, Akbarpur	5	14
25. Mango Research and Development Centre, Nawabgonj	4	14
26. Mango Orchard, Kajla, Rajshahi	5	22
27. Tobacco Research Station, Burirhat, Rangpur	11	35
28. Cotton Testing Station, Rangpur	3	16
29. Khagrachari Testing Station	10	37
30. Bogra Testing Station	1	11
31. Raikhali Testing Station	9	26
32. Comilla Testing Station	1	6
33. Pabna Testing Station	1	10
34. Pahartali Testing Station	1	19
35. Shyampur Testing Station	1	14
36. Nawabgonj Testing Station	1	10
37. Jaintapur Testing Station	2	55
38. Ramgarh Testing Station	7	26
39. Rajbari Testing Station	2	10
40. Dabigonj Testing Station	6	24
Total	863	2628

Notes: 1) Including offices of the Directors of Research, Support Services, and Training and Communication.
2) Including three regional laboratories in Comilla, Khulna and Rajshali. Forty percent of staff are located in the headquarters.
3) Including the Pulse Improvement Project.

REFERENCES

Abedin, M. Z. 1983. "Farming Systems." In Agricultural Research in Bangladesh, 126-37. Dhaka: Bangladesh Agricultural Research Council.

Abedin, M. Z. and M. K. Chowdhury, eds. Undated. Workshop on Research-Extension Approaches 1982 -- Proceedings. Ishurdi: E & R Project, Bangladesh Agricultural Research Institute.

Abedin, M. Z. and M. F. Haque. 1987. "Learning from Farmer Innovations and Innovator Workshops: Experiences from Bangladesh." 27-31. Paper prepared for the workshop on Farmers and Agricultural Research: Complementary Methods held at IDS, University of Sussex, Brighton, UK.

Ahmad, K. U. 1985. "Crops Research in Bangladesh." In Ten Years of Agricultural Research in Bangladesh, 23-38. Dhaka: Bangladesh Agricultural Research Council.

Ahmed, S. M. 1977. A Report on Survey of Wheat Seeds Stored by the Farmers for Sowing in 1976-77. Joydebpur: Bangladesh Agricultural Research Institute.

Akash, M. M. 1985. "Agricultural Credit Reform in Bangladesh: Lessons to be Relearnt." Bangladesh Journal of Agricultural Economics 8:75-84.

Alauddin, M. 1981. "Agricultural Research Organization and Policy in Bangladesh." Bangladesh Journal of Agricultural Economics 4:1-24.

Ali, M. A. 1986. Improving the Statistical Aspects of Agricultural Research. A Report for the Bangladesh Agricultural Research Council.

Anisuzzaman, A. M. 1985. "Chairman's Address." In Ten Years of Agricultural Research in Bangladesh, 7-9. Dhaka: Bangladesh Agricultural Research Council.

Badruddoza, K. M. 1985. "Welcome Address." In Ten Years in Agricultural Research in Bangladesh, 3-4. Dhaka: Bangladesh Agricultural Research Council.

Banor, D. and M. Baxter. 1984. Training and Visit Extension. Washington, DC: The World Bank.

Banor, D. and J. Q. Harrison. 1977. Agricultural Extension -- The Training and Visit System. Washington, DC: The World Bank.

BARC. 1981. Cropping Systems Research Methodology for National Coordinated Cropping Systems Research Programme. Dhaka: Bangladesh Agricultural Research Council.

-- 1983. Agricultural Research in Bangladesh Contributing to National Development. Dhaka: Bangladesh Agricultural Research Council.

-- 1985. Project Proposal on National Coordinated Farming Systems Research Programme. Dhaka: Bangladesh Agricultural Research Council.

BARI. 1985. Proceedings of the First Inter-Institutional Regional Workshop on Cropping Systems Research. Ishurdi: On-Farm Research Division.

-- 1985c. Memorandum of Agreement to Implement Multilocation Test Programme between BARI and the Department of Agricultural Extension. Joydebpur: On-Farm Research Division.

-- 1987. On-Farm Research Division -- Annual Report, 1983-84. Joydebpur: On-Farm Research Division.

-- Undated-a. Farming Systems Research Methodology Training Course -- Resource Manual. Joydebpur: On-Farm Research Division.

-- Undated-b. Proceedings and Feedback: Workshop to Review the Research Activities and Surveys (1980-85) at Seven Old Sites, January 21-23, 1986. Joydebpur: On-Farm Research Division.

-- Undated-c. Summary of Proceedings: Internal Review Workshop and Research Programme Planning, July 5-10, 1986, Joydebpur: On-Farm Research Division.

-- Undated-d. Extension and Research Project -- Annual Report, 1980-81. Ishurdi: On-Farm Research Division.

-- Undated-e. Extension and Research Project - Annual Report, 1981-82. Ishurdi: On-Farm Research Division.

Beavers, J. Undated. Strengthening and Development of Agricultural Research Methods and Procedures in Soil Identity and Interpretation in Bangladesh. Rome: United Nations Food and Agriculture Organization.

Biggs, S. D. 1978a. An Integrated Wheat Research and Production Program in Bangladesh: Comments and Suggestions. New Delhi: CIMMYT.

Biggs, S. D. 1978b. Wheat Production with Employment: Priorities for Wheat Research in Bangladesh. Asian Report No. 7. Mexico: CIMMYT.

Biggs, S. 1984. Farming Systems Research in Bangladesh -- A Review. Dhaka: Bangladesh Agricultural Research Council.

Bognar, J. 1969. Economic Policy and Planning in Developing Countries. Budapest: Akadimiai Kiado.

Clay, E. J. and S. Khan. 1977. Agricultural Employment and Unemployment in Bangladesh -- the Next Decade. Agricultural Economics and Rural Social Sciences. Paper No. 5. Dhaka: Bangladesh Agricultural Research Council.

Dhaka University. 1977. Nutrition Survey of Rural Bangladesh, 1975-76. Dhaka: Institute of Nutrition.

Epstein, T. S. 1975. "The Ideal Marriage between the Economist's Macroapproach and the Social Anthropologist's Microapproach in Development Studies." Economic Development and Cultural Change 24:29-46.

Gill, G. J. 1981. Operational Funding Constraints on Agricultural Research in Bangladesh. Report No. 9. Dhaka: Bangladesh Agricultural Research Council.

Gill, G. J. 1983. "Agricultural Research in Bangladesh -- Costs and Benefits." In Agricultural Research in Bangladesh, 169-84. Dhaka: Bangladesh Agricultural Research Council.

GOB. Undated. Extension and Research Project -- Project Proforma. Dhaka: Ministry of Agriculture, Government of Bangladesh.

-- 1985a. Statistical Pocket Book of Bangladesh, 1984/85. Dhaka: Bangladesh Bureau of Statistics, Government of Bangladesh.

-- 1985b. The Third Five Year Plan, 1985-90. Dhaka: Ministry of Planning, Government of Bangladesh.

-- 1986a. Report of the Bangladesh Household Expenditure Survey 1981/82. Dhaka: Bangladesh Bureau of Statistics, Government of Bangladesh.

-- 1986b. Bangladesh Economic Survey, 1985/86. Dhaka: Ministry of Finance, Government of Bangladesh.

-- 1986c. Socio-Economic Indicators of Bangladesh, Second Edition, Dhaka: Bangladesh Bureau of Statistics, Government of Bangladesh.

-- 1986. Report of the Bangladesh Agricultural Census, 1983/84. Dhaka: Bangladesh Bureau of Statistics, Government of Bangladesh.

Gupta, A. K. 1986a. Seeing Beyond the Visible: Comments on the Field Report by Md. Fazlul Haque (30.11.85 - 4.12.85) to Strengthen Field Visit Reports." Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986b. Comments on Data Collection and Analysis at FSR Site Godagiri. Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986c. Experimental Data Analysis: What PSOs Should Look into. Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986d. Schedule of Activities for Finalization of Research Programme 1986-87: A Note to Help the Institutionalization of Farmers' Participation. Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986e. Site Profile Preparation, Serajgonj: Guidelines and Chapter Outline for Writing Report. Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986f. Draft Guidelines for On-Farm Research, BARI. (Prepared through joint discussions of the policy group comprising OFRD scientists.) Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986g. Understanding and Improving Homestead Utilization Systems: Why Do We Need Women Researchers? Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986h. Why Are We Studying Women's Perspective in Homestead Utilization? Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K. 1986i. Half Yearly Report No.2 (January-June 1986): Strengthening Farming Systems Research Project. Joydebpur: Bangladesh Agricultural Research Institute, On-Farm Research Division.

Gupta, A. K., N. Alam, Z. Abedin and M. M. Rahman. 1986. "Generating Ecology and Class-Specific Research Priorities: Socio-Ecological Perspective on FSR." Paper presented at the International Conference on Farming Systems, University of Kansas, Kansas, October 5-7.

Jabbar, M. A. 1977. Farm Structure and Resource Productivity in Selected Areas of Bangladesh. AERSS Paper No. 3. Dhaka: Bangladesh Agricultural Research Council.

Jabbar, M. A. 1981. Wheat Agronomy and Input/Output Relationship in Mymensingh. Dhaka: Bangladesh Agricultural Research Council.

Jabbar, M. A. 1985. Commercialization of Agricultural Equipment Generated by R & D System in Bangladesh. World Employment Programme Research Paper No.2-22/WP 155. Geneva: International Labour Office.

Khan, A. Z. M. O. 1985. "Inaugural Address." In Ten Years of Agricultural Research in Bangladesh, 5-6. Dhaka: Bangladesh Agricultural Research Council.

Lipton, M. 1970. "Interdisciplinary Studies in Less Developed Countries." Journal of Development Studies 7:5-18.

Mandal, M. A. S. 1985. "The Economics of Minor Irrigation under Different Institutions in Two Areas of Bangladesh." In Evaluating the Role of Institutions in Irrigation Programme, 63-103. IWM Report No. 11. Mymensingh: Bangladesh Agricultural University, Department of Irrigation and Water Management.

Moseman, A. H. et al. 1980. Bangladesh Agricultural Research System -- Report of the Review Team. New York: International Agricultural Development Service.

Murshed, S. M. M., M. A. Jabbar and M. A. S. Mandal. 1984. Crop Sector Output and Employment Growth in Bangladesh, 1967-70/1979-82. Report prepared for the North-South Institute Study Group in Bangladesh.

Pray, C. E. 1979. "The Economics of Agricultural Research in Bangladesh." Bangladesh Journal of Agricultural Economics 2:1-34.

Rahman, A. F. M. H. 1976. Fertilizer Trials in Farmers' Fields in Bangladesh. Dhaka: Soil Fertility and Soil Testing Institute.

Rahman, M. M. 1985. "Farming Systems Research." In Ten Years of Agricultural Research in Bangladesh, 175-81. Dhaka: Bangladesh Agricultural Research Council.

Remenyi, J. V. ed. 1985. Agricultural Systems Research for Developing Countries. ACIAR Proceedings No. 11. Canberra: Australian Centre for International Agricultural Research.

Swenson, C. G., J. Ahmed, Q. M. Alam, S. C. Barman, A. K. M. Haque, M. S. Hussain and F. S. Sikder. 1979. A Survey of the Economics and Agronomy of Wheat Production in Jessore and Pabna Districts. Research Report No. 79-1. Joydebpur: Bangladesh Agricultural Research Institute, Agricultural Economics Division.

Wennergren, E. B., C. H. Antholt and M. D. Whitaker. 1984. Agricultural Development in Bangladesh. Boulder, Colorado: Westview Press.

World Bank. 1988. World Development Report 1988. Washington, D.C.: World Bank, p. 2.

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