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THE TECHNOLOGY TRIANGLE

Linking Farmers, Technology Transfer Agents, and Agricultural Researchers

Deborah Merrill-Sands and David Kaimowitz

with

Kay Sayce and Simon Chater

isnar

International Service for National Agricultural Research

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Summary Report of an International Workshop
held at ISNAR, The Hague,
20th to 25th November 1989

Deborah Merrill-Sands and David Kaimowitz
with
Kay Sayce and Simon Chater

ISNAR
International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, The Netherlands, on 1st September 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a nonprofit, autonomous agency, international in character and nonpolitical in management, staffing, and operation.

Of the 13 centers in the CGIAR network, ISNAR is the only one that focuses primarily on national agricultural research issues. Upon request, it provides advice to governments on research policy, organization, and management issues, thus complementing the activities of other assistance agencies.

ISNAR has active advisory service, research, and training programs.

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Contents

Executive Summary v
Workshop Summary Report v
Study on the Organization and Management of On-Farm Client-Oriented Research vii
Study on Research-Technology Transfer Linkages x

Preface xiii

INTRODUCTION 1

1 THE NEED FOR LINKS 3
Links with Technology Users: Luxury, or Vital Ingredient? 5
Ensuring the Relevance of Research 8
Ensuring Effective Technology Transfer 14

2 PUTTING THE LINKS INTO CONTEXT 19
Policy Factors 21
Resource Factors 27
Technical Factors 30

3 ORGANIZATIONAL CONSIDERATIONS 33
Grouping Tasks 35
Structural Linkage Mechanisms 40
The Issue of Size 45
Reorganization 46

4 MANAGING LINKAGE MECHANISMS 49
Types of Linkage Mechanisms 51
Different Links for Different Types of Technology 64
Principles for Using Linkage Mechanisms 66

5 HUMAN RESOURCE ISSUES 69
Status Differences 71
Managing On-Farm Research Staff 77

6 THE MANAGEMENT CHALLENGE 81
The Need for Active Management 83
Creating Institutional Conditions for Effective Links 85

A RESEARCH MANAGER'S CONCLUDING REMARKS 93
by Dr Gabriel Montes Llamas

References 97

Appendices 101

List of Text Boxes

1.1 Colombia: Integrated rural development
1.2 Misleading metaphors
1.3 Bangladesh: Innovative Farmers' Workshops
1.4 Colombia: Group diagnosis
1.5 Guatemala: Can on-farm research substitute for technology transfer?
1.6 Guatemala: Impact through integration

2.1 Zimbabwe and Colombia: Intervention by national policy-makers
2.2 Philippines: Impact of foreign donor involvement on links between technology development and transfer
2.3 Senegal: Experiences with donor-driven reorganization
2.4 The Gambia: Tailoring linkage strategies to suit resource capacity
2.5 Bolivia: Linking with NGOs for broader technology transfer

3.1 Colombia: Merging research and extension
3.2 Nigeria: Experience with an extension-research liaison service
3.3 Zambia: Experience with research-extension liaison positions
3.4 Zimbabwe: Building an influential liaison committee
3.5 Costa Rica: Reorganizing research and extension

4.1 Linkage mechanisms
4.2 Nepal: Joint planning in the field
4.3 Bangladesh: Institutionalizing joint 'internal review workshops'
4.4 Zimbabwe: Research-extension collaboration in field surveys and trials
4.5 Zambia: Joint responsibility for the release of recommendations
4.6 Côte d'Ivoire: Using informal links to complement formal links
4.7 Zambia: Seconding field staff from extension to research
4.8 Colombia: Implementing Communication Plans for Technology Transfer
4.9 Colombia: Using different links for different technologies

5.1 Colombia: Conflicts arising from status differences
5.2 Guatemala: Using rural leaders to reduce status differences
5.3 Tanzania: Avoiding status differences between research and extension

6.1 Leadership in the on-farm research context
6.2 Turning conflict into constructive debate
6.3 Institutional conditions which promote effective links between groups

List of Tables and Figures

Table 1.1 Comparative resource requirements for different modes of farmer participation
Figure 1.1 Impact of links on performance
Figure 3.1 Types of linkage relationships between organizations
Figure 3.2 Integration through direct supervision versus coordination
Figure 4.1 Linkage mechanisms: Frequency of use and assessment of impact on links between on-farm and on-station research

Executive Summary

Workshop Summary Report

Links between agricultural research institutes and their clients — farmers and technology transfer agencies — are vital for successful technology development and delivery. Direct links with farmers, developed through on-farm research, ensure relevance and rapid feedback. Links with technology transfer agencies ensure impact through a wider dissemination of technologies. The two sets of links are complementary, and both are necessary; one cannot substitute for the other. Research managers have found these links difficult to organize and sustain, particularly when addressing the needs of resource-poor farmers. Yet experience has shown that weak links have costs few developing country research systems can afford. Linkage problems not only reduce efficiency, they also impair performance and diminish the impact of agricultural research.

This document summarizes the presentations and discussions of an international workshop. The workshop was convened to review the findings of two on-going studies on how to strengthen links with farmers and technology transfer agencies. These studies, conducted by ISNAR in collaboration with a wide range of national agricultural research systems, have focused on five key areas.

Policy and institutional context of links

There is no single recipe for strengthening links. The policy and institutional context determines the types of strategies and mechanisms a manager can use to develop effective links. Key contextual factors influencing links are: agricultural development and research policies; the resource situation and organizational structure of the institution involved; and technical issues such as the existing knowledge base, the inventory of available technologies, and the diversity of agroecological conditions and production systems.

The policy context in which an institution operates is shaped mainly by external pressures from national policy-makers, foreign donors, the private sector and, in some cases, farmers' organizations. These pressures can stimulate institutions to improve performance, build stronger links, and address the needs of resource-poor farmers. However, they do have limitations. They tend to focus on short-term goals and often overestimate the capacity of local institutions to meet new demands.

5

Organizational factors affecting links

When developing linkage strategies, research managers need to consider organizational structure both as an entity within which they have to maneuver and as a variable they can manipulate. The size of an institution is a critical factor affecting links. Small institutions, for example, can benefit more from informal links among staff. Yet they often face severe resource constraints in terms of staff and funds, and have trouble sustaining even the most basic linkage mechanisms.

A second key factor, particularly for larger, more complex institutions, is how tasks and responsibilities are divided among organizational units. Merging research and technology transfer or on-farm and on-station research into one department or institution is often proposed as a solution to linkage problems. This can be successful, but only under certain conditions. The groups must share a common focus, such as a single commodity; they must have the same level of commitment to working together towards a common goal; and the institutions should not be too large. Although separating groups into different units sets up organizational barriers, it has some important advantages. It encourages specialization and the development of expertise, and often permits closer supervision and leadership. Which approach is more appropriate depends on the context.

Three types of structural mechanisms are commonly used to establish links between separate, but interdependent, units: direct supervision by a common manager; coordination units or positions; or permanent committees made up of representatives from the relevant groups. In this document, each mechanism is reviewed in terms of its advantages and disadvantages and respective management requirements.

Types of linkage mechanisms

In addition to structural interventions, managers can use four basic types of mechanisms to strengthen links: joint planning and review processes; collaborative professional activities; resource allocation procedures; and communication devices. The analysis shows that these various types of mechanisms are appropriate for different kinds of linkage problems, have distinct managerial and resource requirements, and vary in ease of implementation. Moreover, different types of technologies require different types of linkage mechanisms.

To build effective links with technology users, managers need to use a combination of various mechanisms and apply them at different levels of the institutional hierarchy. At the same time, recognizing that all linkage mechanisms cost time and money, managers need to choose them carefully, apply them frugally, and adapt or replace them with new mechanisms as technologies and

institutional conditions change. Above all, managers need to provide leadership and 'hands on' management in developing links.

Staff management issues

In the end, links are about people. No linkage mechanism can succeed unless staff working on research stations, on farms, and in technology transfer agencies are motivated to collaborate. The challenge for managers is to get these staff, with their differing backgrounds, skills, aspirations, and responsibilities, to work together and to recognize that they depend on one another to reach a common goal.

Perceived status differences between researchers and technology transfer workers, or even on-farm workers, often impede collaboration. Status problems have no simple solutions. Managers have three basic options: reduce the differences through training or increased professionalism; accept the differences, but work to minimize their negative impact; or, in very difficult situations, avoid status problems by finding alternative partners or building up their own capacity in technology transfer.

The need for active management

Managers make the difference between strong and weak links. Active management means providing leadership, maintaining flexibility and responsiveness, and having the ability to manage conflict.

Managers who are committed to strengthening links shape their institutions to create the conditions necessary for productive collaboration. They work with the groups to develop a common goal and sense of mission and to clearly define their respective responsibilities and tasks. They promote mutual respect and a feeling of interdependence between the groups. And they make sure that staff, not just the managers, feel that they benefit personally from collaboration.

Study on the Organization and Management of On-Farm Client-Oriented Research

Objective

To develop guidelines for research managers on how to integrate on-farm client-oriented research successfully into their research systems.

Rationale

In the past 15 years, many national agricultural research systems have launched major on-farm client-oriented research efforts with the goal of producing technologies relevant for resource-poor farmers operating in diverse, and often marginal, agroecological conditions.

Considerable progress has been made in developing effective, practical methods for on-farm client-oriented research. The use of these methods has often been hindered, however, by institutional factors — problems in research policy, organization, management, staffing, or logistical support for field operations. Experience has shown that if on-farm research is to succeed in building a strong link between researchers and farmers, sound methods are not enough. Managers must also develop favorable policy and institutional conditions.

Approach

The study aims to:

- identify common problems in implementing on-farm research;
- diagnose institutional factors leading to such problems;
- provide guidelines for research managers on how to develop institutional conditions which will promote productive and efficient research on farm and with farmers.

The approach has been to learn from research managers' and scientists' experiences in conducting on-farm research in developing countries. The analysis is built around case studies of nine national agricultural research systems. The systems selected all displayed a strong commitment to integrating on-farm client-oriented research, had at least five years' experience with this type of research, and covered a range of organizational situations.

Case study countries

Bangladesh, Ecuador, Guatemala, Indonesia, Nepal, Panama, Senegal, Zambia, and Zimbabwe.

Composition of study group

Deborah Merrill-Sands (Study Leader), 7 ISNAR advisors, 8 external advisors, 5 members of core team, and 25 case study researchers.

-8

Output
(as of August 1990)

Case study reports	Completed; 8 out of 9 published
Comparative study papers	5 out of 7 published
Synthesis papers	1 out of 2 completed
Discussion papers	In process
Guidelines for research managers	In process

Time frame

January 1986 — December 1990.

Donors

Government of Italy and the Rockefeller Foundation.

Key concepts

On-farm client-oriented research (OFCOR) is a generic term used to cover an array of methodological approaches (farming systems research, cropping systems research, and farmer-back-to-farmer) which have been used to develop stronger links between research and resource-poor farmers.

The analysis of organization and management focuses on the functions OFCOR performs within the research system. Seven key functions were identified:

- application of a problem-solving approach focused on farmers as the primary clients of research;
- identification and description of major farming systems and client groups in order to define the demand for technology;
- application of an interdisciplinary perspective to diagnose problems and set priorities;
- adaptation and evaluation of technology at farm level for targeted groups of farmers sharing similar production problems;
- promotion of farmer participation as collaborators and evaluators of alternative technologies;
- provision of feedback to priority setting within applied research programs to improve relevance of research to clients' needs;
- promotion of collaboration with extension and development agencies for more effective transfer of technologies.

Managing institutional links is central to the effective performance of all these functions.

Study on Research-Technology Transfer Linkages

Objective

To identify ways to strengthen the links between agricultural research and technology transfer in order to improve:

- the relevance of research efforts through a better flow of information to the research systems about farmers' needs;
- the transfer of technology to agricultural producers and other users of agricultural technologies.

Rationale

Poor links between research and technology transfer constitute a chronic problem in most developing countries. Such linkage problems almost guarantee that research results will not reach farmers, or if they do, farmers will not be able to use them. Practical attempts to improve links have been disappointing. Despite the extent and severity of the problem, this is the first major international study dedicated specifically to this issue.

Approach

The study is designed to systematically analyze the problem of research-technology transfer links across a range of institutional contexts with a view to providing simple, but not simplistic, suggestions on how these links can be improved in different situations.

The study has three stages:

1. developing a conceptual framework based on a comprehensive review of the literature and a series of theme papers analyzing research-extension linkage problems from different disciplinary perspectives;
2. carrying out case studies in seven countries; in each country, the studies have concentrated on specific subsets of the national research and technology transfer system and the links which have evolved in the generation and transfer of a small number of specific new agricultural technologies;
3. synthesizing the findings and conclusions into one set of clear, applicable guidelines.

Case study countries

Colombia, Costa Rica, Côte d'Ivoire, Dominican Republic, Nigeria, Philippines, and Tanzania.

Composition of study group

David Kaimowitz (Study Leader, 1987-89), Thomas Eponou (Study Leader 1990-), 6 ISNAR advisors, 6 external advisors, 11 theme paper authors, and 17 case study researchers.

10

Output
(as of August 1990)

Conceptual framework	Published
Theme papers	All 6 published as a book, *Making the Link*
Case study reports	75% completed
Case study discussion papers	7 out of the 20 planned papers published
Synthesis/guidelines paper	In process

Time frame

March 1987 -- December 1991.

Donors

Governments of Italy and the Federal Republic of Germany, and the Rockefeller Foundation.

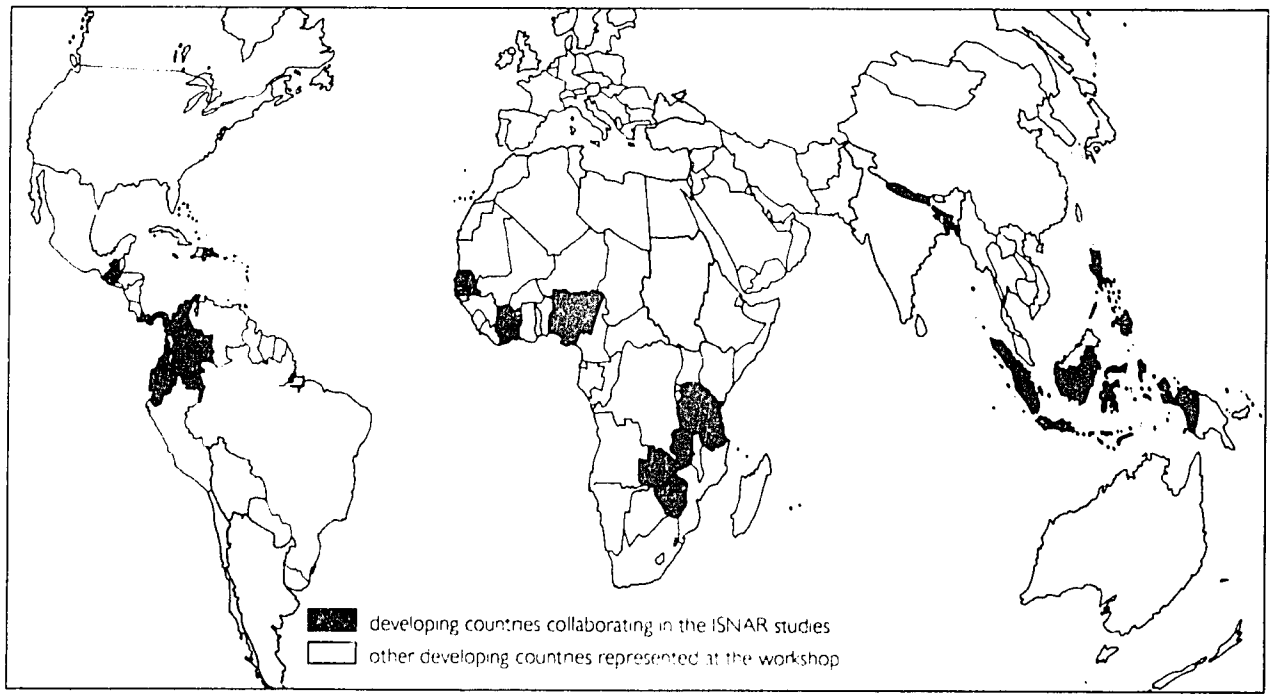
Key concepts

'Technology transfer' or 'extension'? The study has used the term 'technology transfer' because:

- it is important to include the role of inputs and services in the analysis of technology development and delivery;
- some activities associated with 'extension', such as informal education in nutrition and health, are not within the scope of the study;
- 'extension' is now usually associated with traditional public-sector extension services; 'technology transfer' refers not only to these services but also to those provided by other institutions, such as private firms, parastatals, nongovernmental organizations, educational institutions, and producers' associations.

The term 'technology transfer' is not restricted to meaning the one-way flow of materials and information from those who develop and deliver technology to those who use it. Rather, it implies a two-way flow of technical information between these groups.

Developing countries collaborating in the ISNAR studies on research-technology user links, and other developing countries represented at the workshop



Developing countries collaborating in the ISNAR studies

Bangladesh
Colombia
Costa Rica
Côte d'Ivoire
Dominican Republic
Ecuador
Guatemala
Indonesia
Nepal
Nigeria
Panama
Philippines
Senegal
Tanzania
Zambia
Zimbabwe

Other developing countries represented at the workshop

Argentina
Bolivia
Chile
The Gambia
Guinea Bissau
India
Rwanda
Sudan

-12

Preface

The International Service for National Agricultural Research (ISNAR) assists governments of developing countries to strengthen their national agricultural research systems. In response to requests from these governments, it provides assistance on research policy, organization, and management through its advisory, research, and training programs. ISNAR is a nonprofit organization and one of the 13 international centers of the Consultative Group on International Agricultural Research.

Studies on strengthening links with technology users

In the mid-1980s, ISNAR embarked upon two major research projects designed to provide practical guidelines on developing and managing links between agricultural research and technology users — farmers and technology transfer agencies. The studies have emphasized the linkage issues involved in generating and delivering relevant technologies to resource-poor farmers. Both projects were undertaken in response to requests from research managers for advice in this critical area of agricultural research management. They have been funded by the Rockefeller Foundation and the Governments of Italy and the Federal Republic of Germany.

The first study, initiated in 1986, focuses on the organization and management of on-farm client-oriented research as a means of strengthening the direct link between national agricultural research systems and resource-poor farmers. The second study, launched the following year, focuses on the role of research-technology transfer links in ensuring that relevant technologies are transferred to farmers effectively and efficiently. Summaries of the main features of each project are provided on pages viii to xi.

Both studies have used the comparative case study method. They have been carried out in collaboration with more than 40 researchers from 16 developing countries (*see* Appendix 3). ISNAR has taken the lead role in undertaking literature reviews and developing the analytic frameworks and methodologies for the studies. National research teams have carried out the case study research and prepared the analytic reports. ISNAR, with the active participation of national researchers, has then been responsible for the cross-country analysis and synthesis of findings and key management lessons. Both studies have been guided by external advisory committees composed of recognized experts in the field and an internal staff working group on links with technology users.

The workshop

The findings emerging from the two studies by mid-1989 showed a clear convergence on many of the issues related to researcher-farmer and researcher-technology transfer links. Thus, prior to completing the final stages of the projects (producing synthesis papers and developing practical guidelines for national research managers) ISNAR decided to convene an international

13

workshop with senior research managers to discuss the findings and preliminary conclusions emerging from the studies.

The workshop was held at ISNAR's headquarters in The Hague, The Netherlands, from 20th to 25th November 1989. The participants included 21 senior research managers and 11 researchers from developing countries, 10 international consultants involved in the studies as researchers or advisors, and 10 ISNAR staff working actively in the subject area (*see* Appendix 1).

The workshop consisted of presentations and working group discussions on key management issues. For each major topic, there was an overview presentation laying out the studies' principal findings and preliminary conclusions. This was followed by presentations from the country case studies which highlighted specific national experiences in dealing with the issues identified (*see* Appendix 2).

The workshop's objective was to give researchers and senior research managers an opportunity to:

- exchange ideas and experiences;
- provide critical feedback on the findings and emerging conclusions of the two studies;
- increase their understanding of the main issues involved in developing and managing effective links with technology users.

The summary report

This document summarizes the studies' findings and preliminary conclusions and the workshop deliberations on the central management themes. It draws selectively on the more than 25 workshop papers and working group reports to highlight the key points and issues emerging from both the country cases and ISNAR's on-going synthesis of experiences across countries. This document is the product of the ideas, experiences, and energy of the workshop participants and of all the researchers involved in the two studies; they are certainly not those of the authors alone. It is addressed, in particular, to research managers in national agricultural research systems in developing countries.

14

Introduction

IN THE PAST 15 YEARS, developing countries' concerns about persistent rural poverty and malnutrition, unsustainable agricultural production, lack of food self-sufficiency, and swelling urban populations have become increasingly acute. In response, many governments have undertaken major initiatives to help resource-poor farmer households improve their living standards and productive capacity. These farmers make up not only the majority of producers in many developing countries, but also a major share of the world's poorest and most vulnerable people.

The Challenge: Meeting the Needs of Resource-Poor Farmers

The task of responding to the needs of this client group is daunting. Technology development for the diverse and complex conditions within which resource-poor farmers strive to produce is difficult; moreover, these conditions differ greatly from those found on experiment stations. Technology constraints alone, however, do not account for the limited success in improving the productive capacity of resource-poor farm families. Institutional weaknesses are also responsible.

Most research systems in developing countries were organized to serve commercial farmers operating in more favorable and homogeneous agroecological conditions than those in resource-poor farming contexts. Traditionally, resource-poor farmers have lacked the power and organizational ability to exert pressure on the research systems to meet their needs. Their access to research information is restricted; their ability to articulate their needs is poor; their capacity to tolerate risk is limited; and the pressing concerns of their daily existence make it difficult for them to focus on long-term technological change. The challenge facing research institutions, therefore, is to develop a greater capacity to facilitate effective interaction between researchers, technology transfer workers and resource-poor farmers. This requires:

- shifts in research policies and priorities;
- changes in the organization and management of research and technology transfer agencies;
- the development of strong links between these agencies and resource-poor farmers.

The ISNAR study on on-farm client-oriented research shows that, to be effective, on-farm research depends on several sets of key institutional links. The most important of these are the links between the following groups: on-farm researchers and farmers; on-farm researchers and technology transfer agencies; researchers conducting adaptive research on farm and those working in applied research on experiment stations; and researchers working in various disciplines (Merrill-Sands et al., 1990).

The study on research-technology transfer links focuses on technology transfer agents as the clients of research. Although on-farm research activities, properly managed, can create effective

researcher-farmer links, they are not a substitute for technology transfer (Ewell, 1989). The establishment of more indirect links, with technology transfer agents acting as intermediaries between researchers and farmers, is essential to ensure greater impact of agricultural research upon farmers. The study has identified a number of key factors which influence research-technology transfer links.

Direct researcher-farmer and researcher-technology transfer links complement each other and, applied together, provide managers with a powerful strategy for meeting the needs of resource-poor farmers. Direct links with farmers contribute to the relevance of technology development by providing rapid feedback to researchers, and strong links with technology transfer agents ensure the effective dissemination of verified technologies to farmers. On-farm research cannot do this alone. The challenge facing managers, therefore, is to find a cost-effective approach that combines the high level of participation and situation-specificity needed for relevance with the wide dissemination needed to ensure impact upon agricultural performance in resource-poor farming contexts.

Making the Links Work

From the findings emerging from the two projects to date, it is clear that establishing strong links between and within the various components of a national agricultural technology system, and making these links work, requires an understanding of:

- the complementary roles played by research-farmer and research-technology transfer links;
- the policy and institutional context within which managers must develop linkage strategies;
- the organizational factors affecting links;
- the mechanisms which can be used to promote effective links;
- the staff management issues which must be addressed in order to achieve productive collaboration;
- the active role that managers need to play in developing and sustaining links.

These themes formed the basis of the workshop and provide the structure for this summary report. It should be noted that progress in the analysis of some themes is more advanced than in others. In some areas, such as the management of linkage mechanisms, the studies are in the final stages of synthesizing key lessons. In others, such as the contextual factors affecting links, the systematic analysis of case experiences is beginning. Moreover, the study of the organization and management of on-farm client-oriented research is concluding the final synthesis of case study materials, whereas the study of research-technology transfer links is just embarking upon this stage of analysis. Nevertheless, the two studies, drawing on the experiences of national agricultural research systems, have produced a wealth of insights and lessons which can help research managers build stronger links with technology users.

The observations of the research managers at the workshop to the issues raised by the two studies were effectively represented by one of the participants during the closing session of the workshop. His remarks provide the conclusion to this summary report.

16

Section 1

THE NEED FOR LINKS

"On-farm research and proper technology transfer are a must for the development of our countries, but farmer feedback has not been stressed enough. It is a key factor in better technology transfer. Concern for extension should start when setting the research protocol that will provide the technology. Although this requires more difficult research, it is clear that technology has to be tailored to the social, cultural and economic environment of the end user."

Dr B. Ouayogode,
Director of Research and Training Programs,
Ministry of Scientific Research, Côte d'Ivoire

"Perhaps the main points of Guatemala's experience are, first, our realization that extension teams have tremendous potential, and that they can disseminate new technology faster and on a much wider scale when they become partners with on-farm adaptive research teams in a joint venture; and, second, our discovery that rural leaders and farmers can be involved so as to improve the amount and quality of on-farm research and the transfer of technology."

Ortiz et al. (1989)

The Need for Links

To contribute to development, agricultural research must be innovative and relevant, and its results must be broadly disseminated. This means that research should maintain close contact with, and be responsive to, the users of agricultural technology — farmers and technology transfer workers. To ensure that relevant research results flow to farmers, research managers must forge and sustain three complementary and partially overlapping sets of links: direct links between researchers and farmers; links between on-farm and on-station researchers; and links between researchers and technology transfer workers. A fourth set of links, between technology transfer workers and farmers, is no less vital, but these links were little discussed at the workshop because they are the responsibility of technology transfer workers rather than research managers.

Strong links ensure that:

- research tackles users' priority needs and problems;
- farmers and technology transfer workers keep up with research developments;
- research results from experiment stations are applied to solving farmers' problems and expanding their opportunities;
- available technologies are adapted to suit local agroecological and socioeconomic conditions;
- successful technologies are promoted and distributed widely to farmers;
- users have access to the information, inputs, and services required to support a technology;
- researchers can capitalize on users' knowledge and ootain feedback on the relevance and performance of technologies.

The following discussion looks at why links are necessary and how they contribute to ensuring relevant research and effective technology transfer.

Links with Technology Users: Luxury, or Vital Ingredient?

ISNAR's studies, as well as reports in the literature, show that management of the links between research and technology users is a chronically weak area in agricultural technology systems. This raises two crucial questions for research managers:

- To what extent do weak links affect the performance of agricultural technology systems?
- Are links an optional extra, to be attended to some day when resources are more plentiful, or are they critical for the success of agricultural technology systems?

Developing and maintaining effective links costs time and money. If managers are to allocate scarce resources to strengthening links with farmers and technology workers, they must be sure that such efforts will improve performance.

18

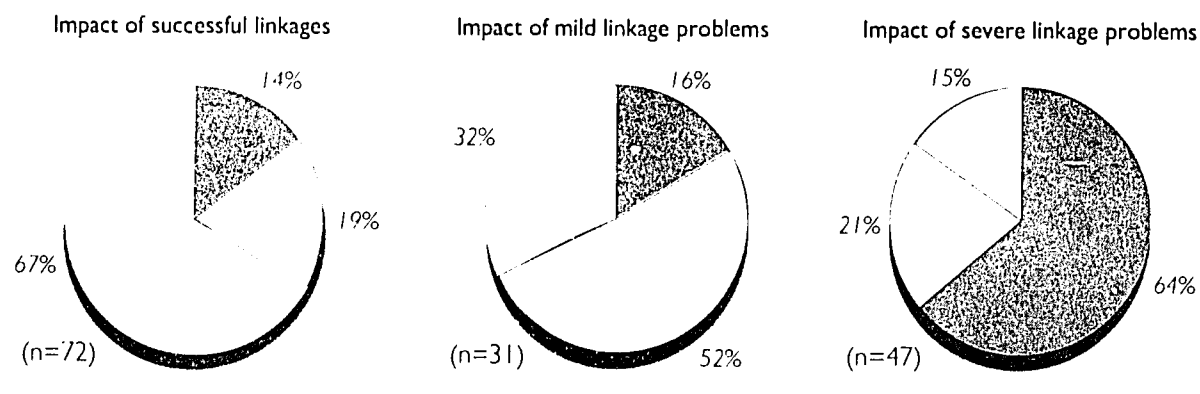
No systematic study has yet been done to determine the costs of ignoring the links between agricultural research and technology users in developing countries. However, quantitative studies have been carried out in the closely related area of links between research and development (R & D) and marketing in private-sector industrial companies. Analysis is easier in this sector, where profit and commercial success can be used as indicators of performance. We can learn from these studies because on-farm research and technology transfer perform functions similar to those of marketing in industrial firms. Moreover, managers responsible for managing the links between R & D and marketing face many of the same problems as those noted in the ISNAR studies on links between research and technology users.

Souder (1980) studied the impact on product development of 150 randomly selected R & D projects in 38 firms in the United States. Slightly more than half the projects had linkage problems, which Souder classified as mild or severe (*see* Figure 1.1). Mild problems were those in which there was poor communication or complacency about the relationship. Severe problems entailed negative relationships between groups, ranging from lack of appreciation of the other's contribution to distrust and outright hostility.

As Figure 1.1 shows, Souder's study indicates that linkage problems do seriously reduce performance and, therefore, impact. Mild linkage problems reduced effectiveness in product development; only a third of the projects with mild linkage problems were complete commercial successes. Severe linkage problems actually impeded new product development; two-thirds of the projects with severe linkage problems failed altogether.

These findings are important. They show that linkage problems have high costs. Severe linkage problems — including the common problem of lack of appreciation between groups observed in many of the ISNAR case studies — cripple performance. Even mild problems, such as poor

Figure 1.1
Impact of links on performance



Source: Based on data from Souder (1980)

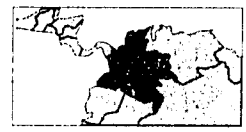
communications, considerably reduce effectiveness. How many research and technology transfer institutions can afford these rates of failure and reduced impact?

Research managers can draw two key lessons from Souder's study:

- strong links with farmers and technology transfer workers are not merely a matter of efficiency; they are vital for successful technology development and delivery;
- research managers themselves should give high priority to solving linkage problems.

Engel's (1990) study from Colombia argues that strong links can considerably improve the performance of agricultural technology systems in developing countries (*see* Box 1.1).

Box 1.1
Colombia: Integrated rural development



Small-scale mixed farming is the predominant source of agricultural production in Colombia's Nariño Highlands. The pre-1978 period was characterized by:

- weak links between the main institutions involved in technology development and transfer;
- poor and stagnant performance in the main agricultural activities of the region — dairy, wheat, guinea pigs, maize, beans, and barley; the only important exception was potatoes.

In the mid-1970s, Colombia implemented the Integrated Rural Development Programme (DRI) to improve agricultural performance in the peasant sector. To achieve this goal, it was necessary to coordinate the activities of the core technology development and transfer institutions. This coordination focused mainly on wheat, dairy, and guinea pigs. Among the specific linkage mechanisms developed were:

- regular meetings between the DRI and representatives from extension, training, input distribution agencies, and farmers, to assist the DRI in targeting, financing, and monitoring activities;
- monthly coordination meetings between the DRI and leaders of all institutions, to reinforce targeting and strengthen interinstitutional links;
- quarterly coordinating committee meetings, to identify technological problems and allocate resources accordingly;
- collaborative groups, to carry out specific research and extension tasks at district level;
- the use of subject-matter specialists to coordinate adaptive research, training, extension programs, and the production of extension materials;
- on-farm trials, conducted jointly by researchers, extension workers, and farmers;
- joint planning between researchers and extension workers, to increase the coverage and quality of extension activities.

The effects of the DRI began to be felt after 1978. In the 1980-85 period there were substantial increases in milk, wheat, and guinea pig production. Significantly, however, there was little increase in maize and bean yields, the two crops for which there had been far less integration between research and extension.

(Engel, 1990)

Engel's findings suggest that effective links within a system improve its impact. Managers are responsible for building and nurturing such links. The options open to them range from drastic, large-scale interventions, such as reorganization or mergers, to more subtle ones, such as the introduction of new management mechanisms or simply fine-tuning existing ones.

Ensuring the Relevance of Research

Direct links with farmers, the end users of technology, are needed to ensure that research focuses on their priority needs and problems. Experience has shown that user participation is essential for innovative and productive technology development, whether in agriculture or industry (Röling, 1989). Involving users helps to ensure that research is driven by demand (meeting the needs of diverse groups of clients) rather than simply by supply (meeting the needs of scientists). This reversal is essential if applied research is to produce the technologies required to fuel agricultural development (Röling, 1989).

Building links with farmers

While the need to involve farmers in technology development may seem common sense, research institutions have often had difficulties in forging effective links with farmers, particularly resource-poor farmers. The ISNAR study of on-farm client-oriented research shows that many of the constraints to developing these links are institutional. Röling (1989) also argues, however, that the language used by scientists and others to describe the development and delivery of technology has obscured the interactive nature of the research process (*see* Box 1.2).

Box 1.2
Misleading metaphors

Our understanding of the need for farmer participation is often clouded by the metaphors we use to describe the process by which technology is developed and delivered. We think of technology as a single, uniform product that is generated by researchers and 'flows downstream' to farmers in a one-way, linear process. The fact that some technology remains 'on the shelf' (not transferred) is ascribed either to the failure of farmers to appreciate its benefits or to 'bottlenecks' in the transfer process. Farmers tend to be seen as passive recipients — users of technology developed by other people. At best, it is acknowledged that some feedback on farmers' reactions to a new technology is desirable in order to refine that technology, but this is likely to be regarded as a need for mere fine-tuning.

These metaphors are misleading, as well as condescending. Farmers are not passive consumers, but active problem solvers who in fact develop for themselves most of the technology they use. For many hundreds of years before today's national agricultural research systems were set up, farmers did their own research. And, by integrating technology from different sources and continuing to adapt it on their farms, they still do so today. The technology used by farmers is a complex product undergoing constant change.

(Röling, 1989)

By combining on-farm trials, surveys, and meetings between farmers and researchers, on-farm client-oriented research forges a direct link between scientists and farmers. It helps research to respond to clients' needs, produce technologies that farmers can adopt, and draw on users' knowledge and ideas as a critical source of innovation.

ISNAR's nine-country study shows that national research institutions have been able to respond more effectively to the needs of resource-poor farmers through this type of research (Merrill-Sands et al., 1990). On-farm research efforts have raised scientists' understanding of clients' priority problems and technology needs. They have described principal farming systems and diagnosed key constraints and opportunities for research. And, in many cases, particularly in the more favorable agroecological environments, they have successfully adapted technologies and developed recommendations tailored to specific locations or client groups — a great improvement over the blanket recommendations extension services often promote.

The ISNAR studies also show that research institutions need direct links with farmers to ensure relevance in technology development. Input from technology transfer workers alone, although important, is not sufficient. In a review of surveys of researcher-extension worker links in 18 countries, Seegers and Kaimowitz (1989) conclude that although extension feedback to research is more common in higher-resource systems, extension workers are not the main source of researchable ideas in any country. Moreover, relying solely on extension to guide the research program tends to bias research towards the needs of more progressive, large-scale farmers and towards solving problems of immediate concern, rather than those requiring longer-term solutions. Lastly, much of the input from extension workers is anecdotal, making it difficult for researchers to evaluate.

Recognizing the importance of direct links with farmers for quality feedback, research managers have experimented with different approaches to on-farm research, involving varying degrees of farmer participation. Different modes of farmer participation are discussed here, as well as three important issues for implementation: working with farmer groups; appropriate selection of farmer collaborators; and the managerial requirements of on-farm research.

Modes of farmer participation

In his summary of the findings of the ISNAR study, Biggs (1989) identifies four distinct modes of farmer participation:

Contract participation

Scientists contract with farmers to provide land or services. In this approach the farmer's role is passive and participation is not an explicit objective. Researchers investigating the biological relationships between productivity, soils, and climate manage trials themselves so as to maintain tight control over the variables. Multilocational testing is a good example of contract participation. Although this mode cannot by itself be considered as client-oriented research, it can form an important component of such efforts.

Consultative participation

Scientists consult farmers about their problems and then develop solutions. This type of participation has been likened to the 'doctor-patient' relationship. Researchers use formal and informal surveys to define farming systems and diagnose priority problems. They then design experiments to test various solutions or to better understand identified problems. The emphasis is on adapting technology to the socioeconomic as well as the agroecological conditions facing farmers. Researchers involve farmers mostly in the diagnosis and then later in the evaluation of proposed solutions. Consultative participation was the dominant mode used in more than half the on-farm research programs reviewed in the ISNAR study.

Collaborative participation

Scientists and farmers collaborate as partners in the research process. This approach, found in about a third of the programs reviewed, involves more intensive and continuous interaction. Researchers actively draw on farmers' knowledge and experimentation in seeking solutions to identified constraints. Regular meetings are held between farmers and researchers to understand current farming practices, set priorities among research problems, develop potential solutions, monitor progress, and jointly review results.

Collegiate participation

Scientists work to strengthen farmers' informal research and development systems in rural areas. Here the emphasis is on increasing the ability of farmers to carry out research on their own, as well as to request information and services from the formal research system. This mode of participation is often used with large-scale commercial producers, but is much less common with resource-poor farmers.

The various modes of farmer participation are not mutually exclusive. Different modes are appropriate for different institutional settings and for different research problems and objectives; researchers can use them together or sequentially. The consultative mode, which is less intensive than the collaborative or collegiate modes, is often most appropriate for areas where researchers already understand the basic agroclimatic conditions and believe they have technologies that, with some fine-tuning, could solve identified problems. In this mode, farmers manage technology that has already been developed, testing its appropriateness for their circumstances (Ashby, 1990; Biggs, 1989).

On the other hand, the collaborative and collegiate modes are often more effective when agroecological and technical problems are poorly understood, interactions within farming systems are complex, and researchers believe new technology will be needed to overcome constraints. These modes are also used more in research programs that require routine monitoring and collection of data on farmers' circumstances, such as livestock and pest management research projects (Biggs, 1989; Merrill-Sands et al., 1990).

Ashby (1990) argues that collaborative and collegiate modes of participation should be used to get farmers' reactions to prototype technologies early in the technology development process.

Box 1.3
Bangladesh: Innovative Farmers' Workshops

The Innovative Farmers' Workshops that have become a central feature of the Extension and Research Project in Bangladesh arose out of a specific incident. In 1981, at the request of local extension workers, the leader of the project's research team visited an area in which farmers were reported to be harvesting intercropped potatoes twice from the same planting. The farmers had discovered how to open the furrows, harvest marketable tubers, and close the furrows again, without damaging the crops. The advantage of the practice was not that it led to a higher potato yield but that it raised incomes, since the early potatoes could be sold at a high price.

The visitors considered the innovation an excellent one. In 1982 a two-day Innovative Farmers' Workshop — the first of its kind in Bangladesh — was organized to present the idea to a wider audience. A second workshop was held the following year, featuring different innovations. These workshops are now common and a total of 43 farmer innovations have been presented.

Each workshop lasts for several days, but does not cover more than two innovations. The number of participants is usually restricted to 30, to facilitate good discussion. The atmosphere is kept informal, so that farmers do not feel shy or nervous in describing their ideas and practices. The innovative farmer is usually helped by an extension worker or a researcher to write a paper for the workshop. After the paper is presented, the innovation is discussed in detail; the discussion is recorded and a report is prepared which is read to the participants, including the innovative farmer, to make sure the innovation has been properly understood. The participants then decide what further action is needed by research or extension.

The novelty of these workshops is the reversal of roles between extension workers/researchers and farmers. The farmers become the teachers and the other participants the learners.

(Abedin and Chowdury, 1989)

In the consultative mode, researchers typically involve farmers later, after they have already screened, through controlled experiments, many technological alternatives. The risk is that researchers may have already excluded technological options that farmers might have found promising. Early involvement of farmers means that they can evaluate a wide range of options and work with researchers to decide *what* should be tested and *how* it should be tested on farm.

Experience with the collegiate mode is limited, but Abedin and Chowdury's (1989) discussion of the experiences with Innovative Farmers' Workshops in Bangladesh illustrates its potential pay-offs (*see* Box 1.3).

The challenge facing the future development of the collegiate approach is its compatability with accepted methods of scientific verification. Since a key objective is to strengthen research-minded farmers' capacity to take on responsibility for adaptive research, farmers will have to learn basic methods of experimentation and systematic data collection and analysis. So far, methods for increasing farmer participation have focused on improving scientists' ability to work with farmers. Future efforts may need to focus more on the need to improve farmers' abilities to work with scientists (Ashby, 1990).

Lessons

Two key lessons can be drawn from the ISNAR study on farmer participation. First, managers need to be flexible in their use of different modes of participation. The modes require different skills and have distinct organizational and managerial requirements (Biggs, 1989). Managers' decisions on how to involve farmers should depend on their research objectives and their assessment of what is feasible given the resources and staff they have available.

Second, involving farmers in research is not easy. In all the cases reviewed, managers had discovered that organizing and sustaining all types of farmer participation was more difficult than initially expected. The more intensive modes of participation, those where farmers are actively involved in priority-setting, planning, and review of research, have proved to be the most challenging to institutionalize (Merrill-Sands et al., 1990). And yet Ashby (1990) and Röling (1989) argue that the full benefits of participation are gained only when farmers have an active role in setting the course for research.

Managers present at the workshop strongly confirmed the need for farmer participation, but they were concerned about the feasibility of the more intensive modes for developing country research systems. They called for a systematic comparative analysis of the costs and benefits of the different modes of participation to guide them in their choices.

Working with farmer groups

Many researchers striving to increase farmer participation and also reduce costs have turned to working with farmer groups rather than with individuals, as is typical of the consultative mode. Ashby (1990) provides a Colombian example (*see* Box 1.4).

Box 1.4
Colombia: Group diagnosis

The Instituto Colombiano Agropecuario (ICA) has developed a method for group diagnosis of farmers' problems. Members of the local community attend group meetings in response to an open invitation, and thus groups form on the basis of self-selection. The meeting dedicates several hours to a brainstorming session in small groups, each of which ranks problems in order of importance and assigns a score to them. These scores are used to arrive at a plenary consensus about the problems of most interest to the community

This approach, constituting a direct input by farmers into the research planning process, has proved highly effective, but it has also been found to mask information about the needs of subgroups. The most important subgroup is women, who are usually under-represented at public meetings in Colombia. Efforts are now being made to form special interest subgroups to carry out the same diagnostic process.

(Ashby, 1990)

Working with groups often stimulates better discussions and increases farmers' commitment to the research. It also provides a more formal mechanism for researchers to discuss results with farmers and systematically obtain their feedback (Ashby, 1990). Perhaps most importantly, groups give farmers more power to influence the research agenda.

Organizing farmer participation through groups can also improve efficiency in resource use — an important concern for managers. Ashby presents data from the ICA comparing the human resource requirements of two diagnostic methods: the informal survey typical of the consultative mode; and the group diagnosis typical of the collaborative mode (*see* Table 1.1). The number of researcher person-days per farmer contact was considerably lower in the group method, indicating that a strong participatory approach is not necessarily more resource intensive.

Table 1.1
Comparative resource requirements for different modes of farmer participation

	Group diagnosis	*Informal survey*
Number of persons visited	27	14
Professional person-days per visit	8	10
Contacts per person-day	3.4	1.4

Source: 1988-89 Activity Report to the Kellog Foundation on the Project on Farmer Participation in Technology Design, Centro Internacional de Agricultura Tropical (CIAT, Colombia)

Despite these advantages, managers should also be aware of some of the limitations or complications of working with groups. The composition of groups can be difficult for researchers to control. They may become dominated by specific interest groups, resulting in distorted information or false consensus. And staff need skills in managing group processes.

Farmer selection

This is a second key area requiring managers' close attention. The ISNAR study showed that farmer selection was a very weak area in most on-farm research programs and across all modes of farmer participation. Researchers often selected farmers on an ad hoc basis which biased samples toward wealthy, politically active, male farmers (Merrill-Sands et al., 1990).

Researchers need to select farmer collaborators systematically, whether working with groups or individuals. This is essential for the credibility of on-farm research results. It is also a prerequisite if feedback from farmers is to be used effectively as an input into research priority-setting and planning.

Managers have to make sure that researchers select farmer collaborators in accordance with their research objectives (Biggs, 1989; Ashby, 1990). If researchers are trying to mobilize farmers' knowledge, then they should work with research-minded farmers, as in the Innovative Farmers' Workshops used in Bangladesh (*see* Box 1.3). If they are trying to obtain farmers' feedback on various technological alternatives in order to find out which should be formally recommended, then they need to involve farmers who are representative of the targeted client group. On the other hand, if researchers are working with farmers to demonstrate and disseminate technologies, then involving respected community leaders may be the best strategy, as observed in Guatemala (*see* Box 1.6).

Managerial requirements

Introducing farmer participation in research often requires new professional attitudes and institutional procedures. Drawing partly on the results of the ISNAR study and partly on her own work, Ashby (1990) identifies eight managerial requirements for effective farmer participation:

- define which farmers are to be involved, and how;
- acquire financial support for links with these farmers;
- promote values among researchers which encourage participation;
- train staff in the skills and attitudes needed to implement participatory research;
- allow flexible operations, in terms of research approaches and methods;
- decentralize administrative control;
- emphasize the management of information;
- legitimize the relevant criteria for monitoring and evaluating research for and with farmers.

Managers often monitor the costs of on-farm research more closely than the output. Some useful indicators for assessing the benefits of on-farm research are: improved rates of technology adoption among farmers; heightened awareness among scientists of farmers' priority needs and problems; scientists' more systematic use of information from farmers when defining their research agendas; and farmers assuming more responsibility for technology testing.

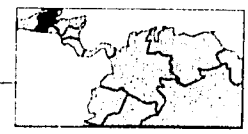
Ensuring Effective Technology Transfer

While on-farm research is vital for the relevance of research, links between research and technology transfer agencies are equally important for the effective dissemination of research results. Direct researcher-farmer links cannot substitute for links with technology transfer agencies. Sometimes good technology can diffuse spontaneously from trials in farmers' fields, but most technologies cannot. Many technologies require the production and distribution of inputs, intensive training in their use, or collective action.

Moreover, where a large number of producers must be reached, technology transfer efforts require resources well beyond the capacity of specialized researchers. Even in the case of a

relatively simple technology such as new seeds, researchers' efforts alone will probably succeed in reaching only the more progressive farmers in the more accessible areas. As the case of Guatemala shows, specific links with technology transfer agencies must be developed (Ortíz et al., 1989) (*see* Box 1.5).

Box 1.5
Guatemala: Can on-farm research substitute for technology transfer?



Founded in 1973, Guatemala's national agricultural research institute, the Instituto de Cienca y Tecnología Agrícolas (ICTA), was a pioneer of the farming systems approach to research. At first the new institute developed its own strategy for technology transfer, making little or no attempt to link with the government extension service. The assumption, typical of early farming systems research efforts, was that the technology emerging from on-farm trials would be adopted and disseminated directly and spontaneously by farmers.

This assumption proved partly right. Several new crop varieties have spread spontaneously among commercially oriented small-scale farmers in the more favorable lowland environments. However, a different approach was needed to reach resource-poor farmers in the more complex and marginal highland areas. To reach these farmers, ICTA had to develop more systematic links with the extension service. After several unsuccessful attempts to build these links, the two institutions have now launched an integrated research-extension program that appears to be highly effective.

(Ortíz et al., 1989)

On-farm research can provide a focal point for building links between research and technology transfer. Involving technology transfer workers in technology development and testing on-farm can strengthen integration by giving these workers more confidence in the research and more knowledge about its results. Despite these clear advantages, however, links between on-farm research and technology transfer workers were assessed as weak in almost all of the nine countries in ISNAR's on-farm research study (Ewell, 1989). Not only did a number of institutional factors, such as scarce resources, inhibit linkage activities, but in most cases research managers had not given high priority to forging these links. Many managers thought that links were not needed until the final stages of the on-farm research process; some believed they could do without them altogether. In contrast, the study shows not only that on-farm research can help build stronger three-way links between researchers, technology transfer workers, and farmers, but also that, to be effective, these links should be developed early in the research process.

Recognizing interdependence

According to Zuidema (1989), the traditional weakness of the links between research and technology transfer persists in part because of the lack of awareness of their interdependence. In one study from developing countries, extension managers ranked the lack of links with research

as seventh in order of importance out of nine problems they faced (Sigman and Swanson, 1982); in another, researchers considered the need to link with extension as the least important factor affecting their research output (Balaguru and Rajagopalan, 1986).

There are signs that these attitudes are changing. As noted above, on-farm research is strengthening the links between farmers and scientists. A greater sense of the interdependence between research and technology transfer is also emerging. This is reflected in the changing roles of technology transfer workers, as they participate increasingly in on-farm experiments, constraint diagnosis, and technology evaluation and adaptation.

Zuidema (1989) outlines the major areas of interdependence between research and technology transfer:

Problem definition	Researchers need technology transfer workers to help them understand farmers' problems and conditions and to facilitate contacts with farmers; technology transfer workers need researchers to identify the scientific approaches required to address specific problems.
Experimentation	Researchers need technology transfer workers to help identify representative locations for trials, develop realistic experimental designs, and explain objectives and procedures to farmers; technology transfer workers need researchers to establish proper procedures and provide advice during implementation.
Technology adaptation	Researchers need technology transfer workers to help farmers choose the right option for their particular circumstances; technology transfer workers need researchers to propose the options for modifying technology to suit local conditions.
Technology verification	Researchers may need technology transfer workers to help manage on-farm trials; technology transfer workers need researchers to ensure scientific rigor and to organize and process data from the trials. Researchers, technology transfer workers, and farmers may all have valuable insights to contribute to the interpretation of trial results.
Technology packaging	Researchers need technology transfer workers to ensure that the inputs required by new technologies are available to farmers; technology transfer workers need researchers to explain the context in which a new technology should be used.
Provision of information	Researchers need technology transfer workers to produce and deliver effective messages to farmers; technology transfer workers need researchers to ensure that these messages are accurate and sufficiently detailed.

Provision of services	Researchers need technology transfer workers to provide specialized communication services in order to disseminate technologies; technology transfer workers need researchers to provide specialist services such as soil testing, pest identification, and seed certification.
Provision of feedback	Researchers need technology transfer workers to tell them about farmers' reactions to new technology; technology transfer workers need researchers to turn feedback into researchable problems.

The Guatemalan project described by Ortíz et al. (1989) recognized these interdependencies. It has achieved significant increases in agricultural production by developing three-way links between researchers, extension workers and farmers (*see* Box 1.6 *overleaf*).

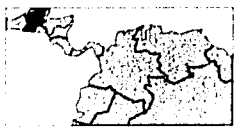
Building on strong on-farm links with farmers, the project focused on complementing these through strengthening links with extension to achieve the broad transfer of technologies. Of particular interest is the role played by rural leaders, who are farmers employed by the Ministry of Agriculture to mobilize the rural community and promote the adoption of new technology (*see* Box 5.2). For many national agricultural systems, this role represents a critical 'missing task': extension workers in most developing countries are expected to link directly with all members of the farming community, a task that, in terms of sheer numbers, is clearly beyond their capacity.

Research managers at the workshop found the Guatemalan experience very instructive but queried its replicability. They pointed out that the success of the project appeared to depend on an unusual set of institutional conditions: generous funding, high-level political commitment, the availability of simple and relevant technologies, and a strong client-oriented philosophy in research.

Lessons

From the presentations focusing on the need for links, managers at the workshop highlighted several key lessons for ensuring the relevance of research and the effective transfer of technology:

- on-farm research cannot substitute for technology transfer;
- researchers and technology transfer workers must work together to ensure both the broad coverage required for impact and the site-specific selection and adaptation of technologies;
- if funds and training are provided, technology transfer and development agencies can assist in running simple verification trials to test the acceptability of new technologies;
- for rational use of resources, managers must set priorities among recommendation domains and client groups.



Box 1.6
Guatemala: Impact through integration

Launched in 1986, Guatemala's integrated research-extension project, involving 72 agricultural extension teams backed up by 20 on-farm researchers, has had a rapid impact on food crop production. It has resulted in an estimated increase in the 1989 harvest of some 16,200 tonnes of staple grains and potatoes, enough to meet the annual basic food requirements of some 26,000 rural families. The project has resulted in about 80,000 resource-poor farmers — approximately 10% of Guatemala's farm families — adopting new, low-cost technology. The following factors account for the project's success:

Relevant technology

The project was able to draw on the results of 10 years of research by ICTA, whose client-oriented approach had ensured the development of relevant, low-input technology. In addition, seed production, which is frequently a 'missing task' in the national systems of developing countries (see Section 3), was successfully integrated in the technology development and transfer cycle by relying on the efforts of farmers rather than seed companies.

New model for technology transfer

To launch the project, a new model for technology transfer was introduced to participants in the five regions to be covered. The model stressed the involvement of researchers, extension workers, rural leaders, and farmers as vital links in a single chain, reaching over 2,400 families a year in each region. It served as an important means of fostering a sense of interdependence and a shared set of objectives.

Joint training

Extension workers were jointly trained with researchers in on-farm research and technology transfer. This enabled them to understand the process through which technology goes before being selected for transfer, helping them to believe in the technology and to 'make it their own' through their knowledge of how it performed and how it should be managed.

Specialization in technology transfer

The joint training led directly to a change in extension strategy. The traditional approach based on adult education and technical assistance was replaced by a new approach with a sharper focus on technology transfer. Extension workers thus became specialists in technology transfer, relinquishing the other tasks for which they had previously been responsible.

Use of rural leaders

Rural leaders acted as a critical link between extension workers and farmers, enabling new technology to reach far greater numbers of farmers than had previously been possible. As well as promoting new technology, rural leaders acted as a channel for feedback to guide the research program, and helped establish a seed distribution system.

Active farmer participation

Farmers also became actively involved, not only in field activities but also in the planning of all research and technology transfer activities. Special consultative groups were formed to ensure participation in planning. The research-extension team presented its proposed work plan to each group for the coming season.

Links at multiple levels

Besides joint field activities, the project had three groups at different hierarchical levels which planned and coordinated its work. Links at more than one level are a key feature of successful, integrated systems (see Section 4).

(Ortiz et al., 1989)

Section 2

PUTTING THE LINKS INTO CONTEXT

"International agencies influenced the links among technology development and delivery institutions in the Philippines in different ways. In one case, bilateral agencies and private foundations indirectly strengthened links by improving institutional capability. In another, two international agencies' simultaneous, but separate, support for closely related projects weakened existing links between their national partners. In the third case, where linkage was a clear goal, links were established, collaboration was enhanced, and one key linkage mechanism was institutionalized."

Bernardo (1989)

Putting the Links into Context

THERE IS NO SINGLE FORMULA for effective links between agricultural research institutions and technology users. Each institution operates within a specific context over which managers often have little direct control. However, to make good decisions about links, they need to diagnose the constraints and opportunities present in their particular situation. A thorough and realistic diagnosis will indicate which links are appropriate and define a manager's 'room to maneuver'.

The key contextual factors which managers should consider fall into four main categories: policy factors; resource factors; technical factors; and organizational factors. In this section we focus on the first three; issues relating to organizational factors are dealt with in Section 3. Emphasis is given to policy factors since the analysis in the ISNAR studies is most developed in this area.

Policy Factors

The policy context is defined, to a large extent, by the external pressures on research institutions to improve performance, develop links, and address the needs of resource-poor farmers. What incentives do external sources provide to achieve these goals? What resources do they make available for that purpose? To answer these questions, managers must look at the four main sources of external pressure:

- national policy-makers;
- foreign agencies and donors;
- farmers and their organizations;
- the private sector.

External pressure is not the only thing which motivates institutions to develop and deliver relevant technologies to resource-poor farmers, but it is an essential ingredient in this process (Sims and Leonard, 1989). Without pressure, it is likely that: research will become less applied; technology transfer agents will become less motivated; researchers and technology transfer agents will devote more time to meeting the demands of richer farmers; and links between on-station and on-farm research and between researchers and technology transfer agents will be weak.

However, external pressure has important limitations which managers should take into account:

- external groups' interest may fluctuate or be short term, whereas technology development and delivery is a long-term process;
- institutions may try to create the impression that they are responding to external demands without really doing so; this makes underlying problems more difficult to identify and solve;

- institutions may compete for support from external sources; this can damage effective collaboration between them;
- demands made by external sources may conflict with each other, pulling an institution in several directions and reducing overall performance;
- pressure from some sources, particularly foreign donors, may not reflect national priorities;
- demands made on institutions may not take sufficient account of the capacity of institutions to meet these demands.

Direct pressure exerted by resource-poor farmers themselves is limited. Historically, these farmers have had neither the power nor the organizational resources to promote their point of view within the policy-making levels of national agricultural research systems. On-farm client-oriented research has been developed precisely to give resource-poor farmers a voice in the research system. Commercial farmers, on the other hand, because of their role in the national economy and their socioeconomic status, have been able to form effective pressure groups. In the study by Martínez Nogueira (1989), a clear historical trend of farmer pressures on research systems in Latin America emerges, with commercial farmer organizations dominating the scene until recently, when the need to incorporate a resource-poor farming perspective into research became paramount.

Private-sector pressure, though of growing importance, tends to focus more on the needs of medium- and large-scale farmers, and was not discussed at the conference.

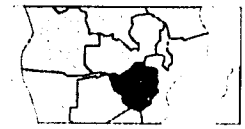
In the ensuing discussion, the emphasis is placed on the two main sources of external pressure on institutions concerned with resource-poor farmer needs — national policy-makers and foreign donors.

National policy-makers

Generally, policy-makers intervene forcefully in technology development and delivery only where a particular commodity forms the basis of the national economy, or in exceptional circumstances, such as crop failures and famine, disease outbreaks, rapidly rising food prices or imports, rural unrest, or a radical change in government. As a result of this intervention, there are usually dramatic improvements in agricultural performance. Clear goals are set, special programs are established, bureaucratic hurdles are overcome, and specific resources are provided to support linkage strategies. The effect of national-level intervention is well illustrated by the case studies on Zimbabwe (Avila et al., 1989; Shumba and Fenner, 1989) and Colombia (Engel, 1990) (*see* Box 2.1).

Over time, changes in national policy affect the links within national agricultural research and technology transfer systems. In his paper on Latin America, Martínez Nogueira (1989) shows that, until the 1930s, policy-makers were concerned only with the production of a few export commodities. There were few institutions involved in technology development and delivery and, within them, little distinction between research and extension. Links between the two activities,

Box 2.1
Zimbabwe and Colombia: Intervention by national policy-makers



Zimbabwe

The current strength of on-farm research and its links with extension in Zimbabwe stems from national-level intervention following a radical change in government in 1980. Prior to 1980, the main focus of agricultural policy was the commercial farming sector, which produced most of the internal food crop requirements and export commodities. The government that emerged after independence in 1980 had a strong orientation towards rural development, which included stimulating agriculture in the peasant farming sector.

The on-farm client-oriented research initiative in Zimbabwe was in direct response to this policy shift. Within six years of the implementation of the new policy, nine out of the 17 semi-autonomous research institutes and stations which form part of the national research system had expanded their research agenda to include an on-farm research component. Peasant farmers are now seen as an important client group and most scientists view on-farm research as an effective complementary means for generating technology to meet this group's needs.

(Avila et al., 1989; Shumba and Fenner, 1989)

Colombia

In the Nariño Highlands in Colombia, the dramatic improvement in output by peasant producers in the 1978-85 period was directly related to the high level of system integration at the time. This integration was facilitated by the national government's decision to increase state involvement in the modernization of peasant agriculture.

The government established the Integrated Rural Development Programme (DRI), gave it the task of strengthening the role of the peasant sector in the national economy, and provided it with considerable resources to achieve this goal. This enabled the DRI to play an active part in coordinating the activities of the core technology development and transfer institutions. As a result, several important linkage mechanisms were developed (see Box 1.1).

In 1985 the focus of national policy shifted from the highland peasant farming areas to the lowland agricultural frontiers. As a result, DRI budgets have been cut and funding for agricultural technology programs has been severely reduced. This has contributed to a decline in system integration. Many of the effective linkage mechanisms have disappeared, with collaboration between research and extension reverting to largely informal links. Although agricultural performance is still high in some sectors, it relies upon past, rather than new, achievements.

(Engel, 1990)

therefore, were not an issue. During the following 40 years, the policy focus shifted in response to the need to direct attention to an ever-widening spectrum of clients, commodities, and agroecological conditions. The number of institutions increased considerably and a clear distinction between research and extension became apparent. To tackle the emerging linkage problems between the two activities, policy-makers attempted to coordinate them through highly centralized control.

By the 1970s, overwhelming problems in the agricultural sector and the failure of centralized control forced the policy-makers to seek short-term solutions. This involved frequent changes in the organization of research and extension, which disrupted what links there were between them. Ultimately, as the need to improve agricultural performance has become urgent, a major reorganization has been necessary. This is based on decentralization and the creation of formal linkage mechanisms between research and extension.

Foreign donors

The term 'foreign donors' includes multilateral and bilateral aid and technical assistance agencies, externally funded nongovernmental organizations (NGOs), and, with regard to technical assistance, international agricultural research centers (IARCs).

These groups provide a large proportion of the resources required by agricultural institutions in low-income developing countries, particularly in terms of funding operating expenses, equipment purchases and maintenance, and training. This often gives them considerable influence in institutional organization and orientation. They sometimes use that influence to exert pressure on institutions to improve research-technology user links and place far greater emphasis on meeting the needs of resource-poor farmers.

Foreign donor pressures are most likely to have a positive effect on institutional performance when:

- the donors work with both research and technology transfer institutions;
- they create incentives for farmer participation in the technology development process;
- an explicit goal of donor involvement is to build sustainable links;
- they provide resources specifically for developing and sustaining links.

The influence of foreign donors on the links between national research and extension institutions is the focus of Bernardo's (1989) analysis of three case studies on technology development and transfer in the Philippines (*see* Box 2.2). In one case, foreign agencies indirectly strengthened links by improving institutional capacity. In another, simultaneous but uncoordinated support for closely related technology development projects weakened existing links between institutions. In the third case, the establishment of effective links was a clear goal of the foreign agency concerned, resulting in improved collaboration.

Box 2.2
Philippines: Impact of foreign donor involvement on links between technology development and transfer

Donor involvement in the Philippines had very different effects on the linkage mechanisms created to develop and transfer three types of technologies — corn downy mildew control, seed potato production, and soil improvement and erosion control in hilly lands.

Corn downy mildew control: Foreign donor involvement in this case was limited to the scholarships provided by the United States Agency for International Development (USAID) for foreign training of university professors, and the provision of germplasm by an international agricultural research center (IARC) to develop resistant varieties. In terms of links within the national system, the effect of IARC involvement was that:

- it contributed to the university's capacity to develop relevant technologies, thus creating favorable conditions for links to be strengthened and sustained.

Seed potato production: There was extensive involvement by two foreign agencies in developing and funding production technologies. One worked closely with the Bureau of Plant Industry, a national institution; the other worked closely with the Northern Philippines Root Crops Research and Training Center. In terms of links, the effect of foreign involvement was that:

- both national institutions established strong but separate links with extension workers and farmers;
- the uncoordinated support provided by the foreign agencies to the national institutions promoted competition rather than collaboration, leading to an almost total breakdown of communication between the institutions; this resulted in task overlaps and duplication of efforts, and attempts made at top government levels to rectify this met with little success.

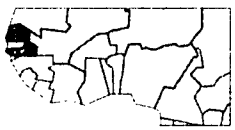
Soil improvement and erosion control: In this project, an international agency helped to prepare a farming systems development project and financed Cornell University's participation in the project. Cornell worked closely with the local university involved and with the relevant government department. In terms of links, the effect of international involvement was that:

- the foreign donor and university developed a good rapport with personnel in the government department and the local university, enabling them to achieve a key project objective — to promote collaboration between the two institutions;
- a Farm Resources Management Unit was set up within the local university, and now serves as a mechanism for sustaining collaboration between the university and the government department in various ways, including staff exchanges.

The third case illustrates the basic conditions necessary to ensure that foreign involvement has a positive impact on links. The agencies worked with all relevant national institutions; they made improved inter-institutional collaboration an explicit goal; and they allocated sufficient time and money to the realization of this goal.

(Bernardo, 1989)

Whereas the Bernardo paper illustrates the effects of various donor pressures on separate components of a national research system, the study conducted in Senegal by Faye and Bingen (1989) deals with donor involvement in reorganizing the national research institution and introducing a large on-farm client-oriented program (*see* Box 2.3).



Box 2.3
Senegal: Experiences with donor-driven reorganization

Senegal's national research institute, the Institut Sénégalais de Recherches Agricoles (ISRA), was established in 1974. Nationalizing various programs that had previously been managed by several French tropical research institutes, the new institute inherited a complex organizational structure and a disciplinary emphasis that made coordination and integration difficult.

In 1975, ISRA prepared a five-year national research plan. In 1982, the institute accepted a major organizational reform proposed by the World Bank in order to implement the plan. Among the changes were the formation of multidisciplinary commodity teams and the transfer of managerial responsibility for research programs from regional center heads to the directors of research departments. A major component of the reorganization was the establishment of a new Production Systems Department. This was a large multidisciplinary department with several functions — regional on-farm client-oriented research, research-technology transfer links, and factor research on soil and water management as well as animal traction.

Given the international interest in farming systems research at the time, considerable financial and technical resources quickly flowed into the new department. This made it vulnerable to charges of empire-building from other departmental directors and center heads, who were seeking to protect their own programs and positions in an uncertain institutional environment. Competition over resources isolated the Production Systems Department and actually served to seriously undermine links with other research programs as well as with technology transfer and rural development agencies.

From 1978 to 1989 ISRA had five successive Directors General, each of whom took a different approach to the complex issues raised by the reorganization. This rapid turnover did little to resolve matters. The deepening institutional crisis overflowed into the political arena when the government, in response to international pressure to reduce public-sector employment, laid off a third of ISRA's staff. Eventually, an uneasy compromise was reached between the former organizational structure and that based on the World Bank-sponsored reform.

Ironically, despite reorganization and donor intervention — perhaps even because of them — ISRA's programs have continued to operate much as before. The Production Systems Department remains isolated; interdepartmental collaboration in general is still weak; procedures for coordinating research activities at the regional centers are lacking; and research priorities have yet to be revised.

The moral

When reorganizing, adopt an evolutionary rather than a revolutionary approach. The impetus for change should come from within the institute, not from outside it. Change must take place in a participatory, not a top-down, fashion. When considering adding new units or activities, government and donors must gauge the institute's capacity to absorb them, and weigh the costs and benefits of the proposed changes to existing interest groups.

(Faye and Bingen, 1989)

Too often, foreign donor pressures have an adverse effect upon links not only because they fail to take into account institutional sentiments and capabilities, as in the Senegal case, but also because their interest fluctuates or is short-term. In the case of the Nariño Highlands in Colombia, the termination of the Dutch/Colombian bilateral project was a key factor in the decline in system integration (Engel, 1990).

Resource Factors

To build and sustain effective research-technology user links, financial and human resources must be allocated to support linkage activities. In most low-income countries, however, resources are constrained and unreliable. This imposes limitations on what can be achieved and has important implications regarding what type of strategies are appropriate. Institutions in a low-resource context tend to have fewer and less sophisticated links than those in high-resource contexts, and yet it is in the low-resource context that there is often the greatest need for links.

Where resources are severely limited, managers are confronted with hard choices. They must first decide which links are necessary, and then whittle this down to those few links which available resources can realistically sustain.

Linkage problems arising from resource constraints

In low-resource contexts, the problems facing managers trying to build effective links are particularly acute. These problems derive from constraints in both funding and staffing.

The availability of funds to support links tends not only to be inadequate but also to fluctuate. This causes several problems. First, it promotes competition rather than cooperation, as each institution seeks to capture as large a share of the limited resources as possible. Such competition undermines the potential to build successful links. The fluctuation of funds breeds uncertainty. Staff lose commitment if they cannot count on the availability of the basic resources needed to support linkage activities. Moreover, when cutbacks in expenditures have to be introduced, it is the operational funds for linkage activities, which are viewed as desirable but not essential, that are often the first to go. Finally, resource scarcity often makes institutions exert tighter control. This counteracts the decentralization and flexibility over resource use which are needed to build strong links at field level.

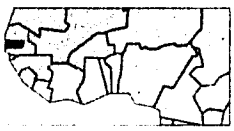
Limited resources have an impact on staffing as well. It is difficult to attract well-qualified personnel. In addtion, the pool of suitably qualified people from which to recruit staff is usually small. This tends to aggravate research-extension status differences and inhibit effective collaboration. Also, the common problems associated with locating professional staff in rural areas are even more extreme. Living conditions can be difficult and social or cultural amenities limited. Finally, in most low-resource contexts, there is staff instability and high turnover. This can seriously disrupt informal and formal links and limits the capacity to follow through on agreements.

Overcoming resource-related linkage problems

There are ways to overcome some of the problems mentioned above. Underlying all these measures is the need to ensure that decisions on linkage strategies are based on a realistic assessment of the resources available for research and technology transfer. Preliminary analysis indicates that where resources are low and/or unstable:

- linkage strategies should be limited in scope and fairly simple to implement;
- more networking should be undertaken, using farmers, paraprofessionals, rural development projects, and organizations such as NGOs to carry out technology testing and dissemination;
- it may be desirable to recruit ideologically motivated staff, willing to work in remote areas and accept lower salaries.

The analysis of various on-farm research approaches implemented in the 1980s in The Gambia —a small country with a small research system operating with limited staff resources — provides a good example of how one country has tried to overcome its resource-constraint problems by adopting some of these measures (Sompo-Ceesay and Gilbert, 1989) (*see* Box 2.4).



Box 2.4
The Gambia: Tailoring linkage strategies to suit resource capacity

The Gambia's agricultural research service is relatively young and concerned mainly with adapting imported technologies. It consists of only about 30 scientists, none of them holding a PhD. It is heavily dependent upon expatriate staff and external funding. In contrast, the extension service is fairly strong and well established. Staff are generally well qualified, the extension worker-farmer ratio is among the highest in Africa and, although the service relies to some extent on donor support, it receives a greater share of government funding than research. In addition, there is a strong involvement by nongovernmental organizations (NGOs) in technology transfer.

In the 1980s, to increase the relevance of research, several attempts were made to introduce on-farm client-oriented research into the system. These efforts met with limited success, primarily because they overlooked the need to match donor project objectives with the capacities of the research system. They overstretched the capacity of the research department to develop and monitor on-farm research, while they underutilized the capacity of the extension service and NGOs to play an active and substantial role in these projects.

The Farmer Innovation and Technology Testing program introduced in 1989, however, stands a greater chance of success because it taps current strengths, rather than making new demands on weaker elements of the system. It is based on using existing farmer groups, formed by extension workers, to conduct verification trials. Researchers provide information on available technologies; farmer groups, with the assistance of extension workers and NGOs, select those they wish to test; and researchers then assist in trial evaluation.

(Sompo-Ceesay and Gilbert, 1989)

In the workshop discussion on resource factors, research managers noted that in many low-resource contexts, NGOs and rural development projects are potential partners for research institutions, especially when extension services are in a serious state of decline. There are four main reasons for this. First, they tend to be staffed by ideologically committed people. Second, they are usually oriented towards serving resource-poor farmers. Third, they tend to be more localized and concerned with the need to adapt to local conditions. And last, they generally have sufficient funds for operating costs.

The potential benefit of linking with NGOs was the topic of a working group discussion on the strategy adopted by the Centro de Investigación Agrícola Tropical (CIAT) in the lowlands of Bolivia to develop new partnerships for technology transfer (*see* Box 2.5).

Box 2.5
Bolivia: Linking with NGOs for broader technology transfer

In 1983, in the face of severe resource constraints, the extension program of the Centro de Investigación Agrícola Tropical (CIAT) was discontinued and the institution sought to develop links with a number of other groups in Bolivia in order to transfer its technologies to farmers. These groups were termed 'intermediate users', and comprised:

- producers' associations representing both small- and large-scale farmers;
- nongovernmental organizations (NGOs) which generally worked with small farmers;
- government extension workers in the field;
- commercial companies.

With the support of the British Tropical Agricultural Mission, CIAT carried out a diagnosis of the activities of technical staff involved in research and technology transfer in these intermediate user groups. It then established various linkage mechanisms with the groups:

- representatives of intermediate users attend annual CIAT meetings to put forward what they consider should be research priorities;
- the groups collaborate in conducting joint on-farm trials, managed and evaluated by CIAT;
- CIAT offers short-term training courses, in the field or on-station, for farmers, NGOs, and others;
- a unit has been established within CIAT to maintain links with intermediate users, partly through the publication of a journal to which all groups contribute articles;
- an information center has been established to collate information from the intermediate users and distribute it.

This arrangement has succeeded in achieving greater coverage than that achieved by either the traditional extension services or the farming systems approach operating before 1983. It has also succeeded in offering a service in which there are now many more degree-level professionals engaged in technology transfer.

(Bojanic and Farrington, pers. comm.; Thiele et al., 1988)

41

Technical Factors

Those systems with the greatest need for effective links between researchers and technology users often face a number of problems which complicate their ability to develop such links. These include: a weak knowledge base about the environment and production systems; diverse agroecological conditions and production systems; inadequate communication, production, and distribution facilities; and dispersed farming populations.

The knowledge base

The knowledge base is defined by how much different actors — scientists, technology transfer workers, and farmers — know about the environment and relevant technologies. Scientists build up knowledge through research; farmers and technology transfer workers acquire knowledge through experience and from other farmers.

Where research has a solid knowledge base and an initial set of "on-the-shelf" technologies, it is easier to create down-stream links. Where the knowledge base is weak and there are few "on-the-shelf" technologies, links facilitating feedback are particularly important. By involving farmers directly, research conducted on farm offers a means of expanding the knowledge base and providing useful feedback. Similarly, close interaction between on-station and on-farm researchers and between researchers and technology transfer workers facilitates feedback and strengthens the knowledge base.

Agroecological and production system diversity

The complexity of tasks in agricultural research and technology transfer increases as the natural environment becomes more diverse. Most developing countries are characterized by diverse environments in which resource-poor farmers, using a variety of production systems, are striving to produce a wide range of agricultural commodities

Diversity makes it much more difficult to achieve a broad geographical coverage and develop relevant technologies for resource-poor farmers. Diverse environments require more location-specific diagnoses and more technology adaptation. The resources needed to cope with diversity are usually not available for working with resource-poor farmers. Diversity makes it more difficult to have one simple message. Commodity programs and centralized extension systems, such as the Training and Visit system, are less effective in these environments.

Communications and input distribution infrastructure

Many communication channels can be used to provide links between researchers and technology users, but the choice of which to use in a given situation will depend upon farmers' access to these channels and their ability to use them. Illiteracy among farmers, for example, is a severe

42

constraint facing researchers and technology transfer agents working in developing countries. Where production and distribution facilities are inadequate, this imposes constraints on the number and types of technologies researchers can develop and technology transfer workers can deliver effectively. It also tends to make technology transfer workers concentrate more on input delivery than on information dissemination, which inevitably weakens research-technology transfer links.

Dispersed farming populations

When working with dispersed farming populations living in areas that are difficult to reach, researchers and technology transfer workers have fewer opportunities for informal interaction. Technology transfer workers need to be close to the farmers they serve, whereas researchers, mainly because of cost, need to be concentrated in relatively few locations. This increases the need for formal linkage mechanisms to facilitate interaction. For these mechanisms to be effective, there must be some measure of decentralization. Without this, communication problems between central and field locations may paralyze operations.

Section 3

ORGANIZATIONAL CONSIDERATIONS

"Small national systems are not simply scaled-down versions of large systems. The limited resources, particularly manpower, of small systems necessitate hard choices about the scale and scope of research activities. An overriding issue facing small systems is how resources should be allocated between research on the one hand and links, both external and internal, on the other."

Sompo-Ceesay and Gilbert (1989)

"The organizational structure for links must ensure not only feedback on farmers' needs and problems for relevance, but also that these technology users have access to the information, inputs and services required to support the effective use of each technology."

Dr M. Lantin,
Assistant Secretary,
Department of Agriculture and Food, Philippines

"Merger depends on good directors, who may be more scarce than good researchers."

Dr M. Snyder,
Assistant Professor,
Florida State University, USA

Organizational Considerations

THE DEGREE TO WHICH A SYSTEM is integrated depends partly on how it is organized. Managers need to take the organizational structure into consideration, either as a variable they can manipulate or as something 'given' which they can work around. Senior managers can often exert some control over structures, and even managers at lower levels in the hierarchy can influence the organization of work within their own units.

In this section, we discuss the key organizational issues which managers need to consider when strengthening links: grouping research and technology transfer tasks; creating structural linkage mechanisms; the issue of size; and the limitations of reorganization.

Grouping Tasks

How tasks are grouped is a key factor affecting the kinds of linkage mechanisms needed between and within organizational units. Bourgeois (1989) outlines five principles for grouping tasks:

- the choice of an organizational structure should reflect the most important interdependencies between the system's various tasks;
- units should be set up according to the degree of interaction needed to meet a specific objective;
- grouping people whose work might otherwise overlap can increase efficiency by avoiding duplication of effort;
- there are limits to the size of a workable specialized unit or group (about six to eight people); beyond this, factions tend to develop;
- no grouping can, by itself, ensure that all necessary interactions take place.

The degree to which tasks are seen as interdependent also influences the way in which they are grouped in organizational units (Bourgeois, 1989). Until recently, technology transfer efforts were seen as sequentially linked to research; that is, technology transfer agencies received research outputs to incorporate into packages of technology, in what was largely a one-way flow of information. Thus, separating research and extension into different organizations was logical. Today, the interdependence between the two is more widely recognized; each depends on inputs from the other for its success. A team approach with a strong two-way flow of information, as in the case of Guatemala, is considered desirable (*see* Box 1.6). A similar change in attitude has also occurred with respect to the relationship between experiment station and on-farm research.

Missing tasks

Whatever approach is used for grouping tasks, at each critical stage of the technology development and delivery process there should be at least one unit or individual with the

responsibility and resources to move technologies efficiently through this stage (Kaimowitz et al., 1989). Common problems are that no group takes responsibility for translating research results into specifications for a new technology, 'packaging' that technology, and producing the necessary materials for its use. Adaptive research can also fall into a grey area on the fringes of the institutional mandates of both research and technology transfer.

Seed production is the task that most commonly falls victim to this kind of omission. Eponou (1990) documents a case in Côte d'Ivoire in which the unavailability of seed from the national seed production agency was identified as the main constraint limiting farmers' adoption of a new technology. To address this gap, research and development agencies worked together informally to produce and distribute seed to meet farmers' demands. Strong informal links between the two agencies and a commitment to a common goal led them to stretch their mandates to include tasks necessary to get the job done. In Guatemala, the seed production problem was overcome by organizing farmers, themselves, to produce seed for local distribution (Ortíz et al., 1989).

Merging research and technology transfer

To what extent should research and technology transfer be merged into one institution or program?

Two major advantages to merging are usually cited. First, organizational proximity can promote a shared goal and facilitate communication and collaboration between researchers and technology transfer workers. Second, merging is assumed to increase efficiency by, for example, sharing tasks among fewer people, facilitating the training of technology transfer workers, and shortening the time lag between the completion of research and the use of its results. Yet the evidence is that these advantages often fail to materialize. On the contrary, merging frequently raises unexpected problems (Bourgeois, 1989).

Merging two groups in one institution or unit is no guarantee that they will work well together. When research and extension shared the same government department in The Gambia, this did not translate into effective collaboration between the two (Trent, 1989). Even in the field, the mere physical proximity of two groups is not enough to ensure that they will communicate effectively. When combined research-extension teams were formed in Guatemala, initially they continued to work separately, just as before. Only when management repeatedly hammered home the message that a joint program had to be forged did the teams respond (Ortíz et al., 1989). Clearly, merging at the institutional or even the team level does not eliminate the need to manage links; rather, it can make the need still more acute.

A second problem with merging concerns the quality of the research carried out. Quality can be jeopardized if it becomes 'submerged' in the development process. This was observed in many cases where on-farm research was carried out by development projects or agencies (Ewell, 1989). Researchers find themselves unable to focus on long-term problems, as the short-term needs of the development program monopolize the agenda. Demonstration tends to take precedence over research objectives. Under pressure to lay out a large number of trials over a wide area, researchers find that research content suffers because of inadequate supervision and trial management.

46

The advantages of separation are that it encourages specialization and the development of expertise, and often permits closer supervision and leadership. Activities may also need to be separated because of differences in the nature of the tasks to be performed, in the management styles required, in size, and in each group's abilities, perspectives, and goals.

The different organizational requirements of research and extension are the key reasons why the two activities are often placed in separate units. National extension services, with their broad mandate to reach all farmers in all regions of a country, often serve as a tool for implementing government policies. As a result, they tend to be hierarchical, highly centralized in terms of decision making, and heavily regulated and standardized in terms of tasks, skills, and procedures. In contrast, national research, which is an open-ended process of scientific enquiry, is characterized by a 'flatter' structure, greater delegation of authority, and less standardization. Furthermore, extension activities are generally organized geographically by administrative regions. Research, when it is organized by regions, usually follows agroecological criteria (Bourgeois, 1989).

Conditions for successful merging

Kaimowitz (1989) concludes that, on balance, merging research and technology transfer to create stronger links between them should be considered only under certain conditions. Drawing on a comparative analysis of two institutions in Colombia, he identifies five basic requirements:

- research and technology transfer share a common, sharply focused area of concern, be it a specific commodity, region or problem;
- human, financial and managerial resources are available to support linkage activities;
- the size of the combined institution is not unmanageably large;
- managers have a strong commitment to making the two groups work together;
- the technology transfer process is not highly politicized.

Where these conditions do not hold, it is probably better to keep the two activities separate. It is not always necessary to merge organizations in order to achieve close collaboration between them. Kaimowitz's (1989) analysis of two contrasting experiences in Colombia shows that merging research and extension can have very different outcomes, depending on the institutional context (*see* Box 3.1 *overleaf*).

In the workshop discussion, managers agreed that merging was neither a necessary nor a sufficient condition for integration. They noted that it contributed more effectively to integration when groups shared a common goal, a clear focus or topic, and a common client group. They also felt that merging is often more effective at the team or program level, rather than at the department or institute level.

Integrating on-farm client-oriented research

Drawing on the findings of ISNAR's study on on-farm client-oriented research, Bourgeois (1989) examines the issue of merging with respect to on-farm and on-station research. He

Box 3.1
Colombia: Merging research and extension

The Instituto Colombiano Agropecuano (ICA) is the country's public-sector national research and extension body, with a mandate to improve performance in many types of crop and livestock production throughout the country. The Coffee Growers Federation is a quasi-private organization with a regional focus, dedicated mainly to the production and marketing of coffee. In ICA, research and extension were merged in 1968; in the coffee federation, the two activities have been together since the federation was founded.

Following the 1968 merger, ICA became a larger, more complex organization, with a broader range of clients, including resource-poor farmers. Management had difficulty in focusing on long-term goals or carrying out detailed analyses of specific problems. Conflict between ICA's research and extension groups grew, fueled by overlapping mandates, status differences, and competition for resources. In addition, research became politicized through its association with rural development. The failure to effectively integrate research and extension at ICA may well have led to the decline in institutional performance noted by several observers from the mid-1970s onwards.

In contrast, interaction between researchers and extension workers in the Coffee Growers Federation is more intensive and better coordinated. Unlike ICA, the federation concentrates on a single crop and clientele. Researchers and extension workers have been able to focus more sharply on a narrower range of common concerns. The federation has created a strong institutional culture in which status differences and the competition for resources have been minimized. Lastly, its private status has enabled it to avoid politicization. The overall result has been a high level of performance: coffee yields in Colombia have increased rapidly, and there has been an effective response to coffee rust and coffee bean borer, two major threats to the industry.

(Kaimowitz, 1989)

discusses the pros and cons of two common organizational approaches to integrating on-farm client-oriented research within national systems. The first is to have a separate multidisciplinary on-farm research team. The second is to 'fold' on-farm research into existing commodity programs. The analysis shows that the choice of organizational model should reflect the specific interdependencies or links managers wish to emphasize.

The team approach permits greater specialization and gives priority to the interaction among disciplines needed for strong systems research. The disadvantage is the distance created between on-station and on-farm research. Unless the regional teams take special pains to establish collaborative links, on-farm research may come to be seen as a separate activity, at odds with the research institute's other programs. This problem is often accentuated when large multidisciplinary field teams are launched with donor funding. Such large teams are rarely sustainable under national conditions (Merrill-Sands et al., 1990).

The second option, folding on-farm client-oriented research into commodity programs, favors the links between on-farm and on-station research. It tends, however, to hinder the application of a systems perspective in diagnosing problems and analyzing results. On-farm research may become narrowly associated with specific technologies and commodities, and the opportunity

to build a team of scientists with a broader view may be lost. Nevertheless, for some research systems, especially small ones, this model appears to be more feasible and sustainable. In The Gambia, senior management decided to fold on-farm research into the commodity programs after several unsuccessful attempts to build multidisciplinary field teams (Sompo-Ceesay and Gilbert, 1989). The country's small national system did not have the staff resources to sustain on-farm research as a separate specialized activity.

In many systems a mixed approach shows considerable promise. Commodity specialists can carry out a narrow range of on-farm trials near research stations. On-farm research specialists, while doing some station work, can be primarily responsible for a broader range of farm-level activities. Institutional barriers break down as each group gains appreciation for the other and understands the interdependence between their respective roles, while still retaining the benefits of specialization (Merrill-Sands et al., 1990).

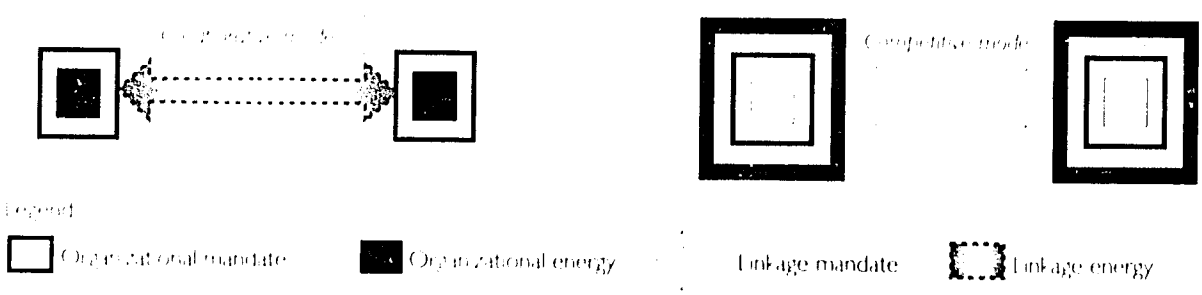
Whatever the model used, on-farm research is likely to be stronger if supported by a group of senior scientists who can provide additional disciplinary expertise and research guidance. A multidisciplinary central team of this kind can backstop several field teams, leading to a more efficient use of resources and smaller field teams.

Minimizing institutional barriers

If managers decide to separate out technology transfer or on-farm research into separate units, then it is very important that they do not let those units create impenetrable institutional walls. As Zuidema (1989) points out, the danger is that staff may put more energy into creating and maintaining barriers than into core activities and links (*see* Figure 3.1).

Figure 3.1
Types of linkage relationships between organizations

The figure shows two contrasting types of linkage relationships between organizations. In competitive relationships (right), staff spend considerable energy on protecting (or expanding) the organization's boundary and mandate. Thus little energy is available for implementing core mandates and forming links with others. In collaborative relationships (left), energy is available both for core activities and linking with other groups because less is spent on 'defense'.



Source: Zuidema (1989)

Structural Linkage Mechanisms

As indicated above, grouping tasks will not be enough to ensure that all the necessary interactions take place. Specific linkage mechanisms and active management are also needed. Creating structural linkage mechanisms is one option. Bourgeois (1989) analyzes the advantages and disadvantages of three kinds of structural linkage mechanisms: direct supervision; coordination positions or units; and permanent committees.

The appropriate choice, for managers, will depend on three key questions:

- What type of interdependence are managers trying to promote?
- At what institutional level would the mechanism be most effective?
- How much importance do managers want to give to the linkage mechanism?

Direct supervision

In direct supervision, two or more units in the same institution have a common supervisor who is responsible for integrating their work.

The chief advantage of direct supervision is the high degree of control exercised. Having a common supervisor can be a highly efficient way of ensuring that the activities of different units are coordinated, that priorities are followed and objectives met, and that programs respond quickly to changing circumstances. However, supervision can work as a linkage mechanism only if integration is explicitly defined as one of the manager's responsibilities.

Direct supervision also has its disadvantages. Senior managers may not be familiar with the technical issues handled by their staff. In addition, having to manage too many people or units can overload a manager. Direct supervision is thus less effective in ensuring integration in large, complex systems with many units (Martínez Nogueira, 1989). It also takes up a lot of management time, reducing the time available for other tasks.

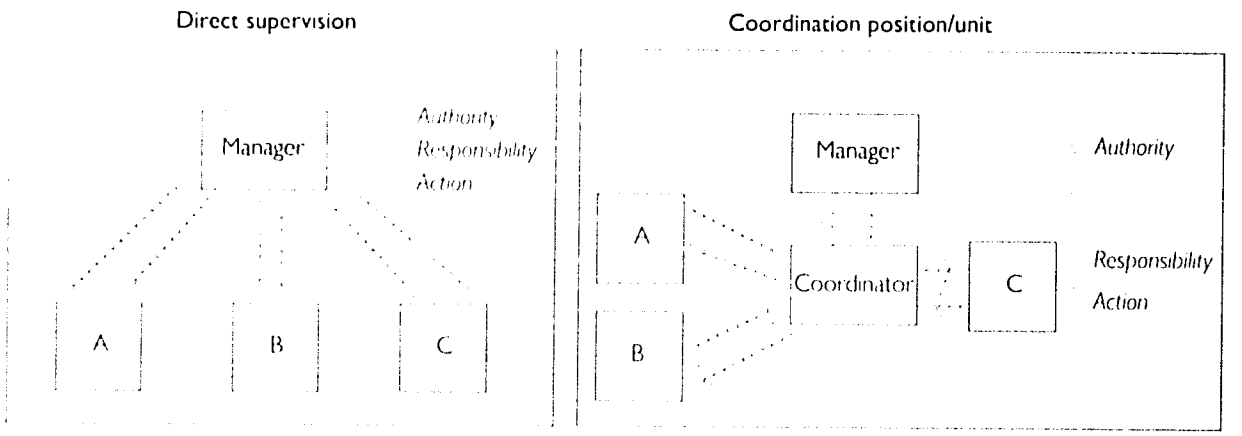
Direct supervision tends to work best at the middle-management level in organizations with a centralized structure. ISNAR's case studies of on-farm client-oriented research show that managers at this level (such as station managers and program directors) have more time for supervision, give more attention to links, and have a firmer grasp of technical issues (Merrill-Sands and McAllister, 1988).

Coordination positions or units

Coordination positions or units, such as subject-matter specialists, research-extension liaison officers, or pre-extension services, are an option frequently considered by managers trying to

strengthen links. As Bourgeois (1989) notes, what distinguishes this mechanism from direct supervision is that these positions or units have no formal authority over the units being coordinated (*see* Figure 3.2). Coordination positions or units may be part of one of the groups being linked or they may be independent.

Figure 3.2
Integration through direct supervision versus coordination



The advantages of coordination positions or units are that time and resources can be specifically allocated for integration, that expertise in coordination can develop, and that gaps can be more easily filled because there is someone responsible for organizing just this. Coordination positions can often handle technical interdependence better than direct supervision can.

Among the disadvantages are that integration may come to be seen as one person's or unit's job, rather than the responsibility of the whole team. Managers, in particular, may be tempted to shrug off their responsibility for integration in the belief that delegating this task to a specific person or unit has solved the problem. This can be dangerous, since the groups being coordinated will simply ignore liaison staff if they perceive that these staff have neither formal authority nor explicit support from senior management. Another disadvantage is that liaison staff can grow dissatisfied with simply linking and facilitating the work of other people. As the study conducted by Ekpere and Idowu (1990) illustrates, their reaction can be to try to take on some of the more concrete functions of the units they are supposed to be coordinating (*see* Box 3.2 *overleaf*).

Paradoxically, coordination positions or units can create fresh integration problems instead of solving existing ones. Rather than improving communication between units, they may impose an additional barrier to it. This can happen when liaison staff or units develop their own procedures, objectives, and language, adding to the complexity of coordination rather than simplifying it.

Box 3.2
Nigeria: Experience with an extension-research liaison service

When responsibility for research in the northern region of Nigeria was transferred from that region's Ministry of Agriculture to Ahmadu Bello University in 1963, the ministry set up a research liaison service to ensure that research continued to respond to the needs identified by the ministry. The service performed well in its early years. Extension specialists, based in research departments, concentrated their efforts on dissemination activities and developed effective research-extension links.

Between 1969 and 1975, when the ministry was decentralized into six separate state institutions, the liaison service, which was to serve all states, was incorporated into the university's Institute for Agricultural Research. It then became the Extension-Research Liaison Service. As part of the university's system, the service's staff became more professional and independent, and took on more responsibility for adaptive on-farm research. Direct collaboration with researchers diminished and relations became more conflictive, as extension staff began to challenge the relevance of on-station research.

In 1975 the university decided to separate the liaison service from the research institute for two reasons: the service had developed a solid subject-matter base of its own, and autonomy would allow it to criticize research without fear of reprisals.

Autonomy proved a mixed blessing, however. It provided the freedom to criticize research and stimulated the development of expertise in generating specialized extension communication materials and training events. But, at the same time, it led to reduced contact with the research institute and an expansion of the roles and activities the service was expected to perform. The service, now named the Agricultural Extension-Research Liaison Service, became an implementing, rather than a coordinating, agency.

Recognition of the service as a national institute came in 1987, placing additional demands on its limited resources by further expanding the number of client institutes whose needs it was expected to meet. The service is now overextended and underfunded.

The Nigerian experience shows that, for liaison units to be effective, managers must strike a delicate balance: they need to build a unit sufficiently competent in the skills of both research and extension to be an equal partner in collaborative activities, but at the same they need to restrict both the power and the scope of such a unit in order to prevent the duplication of activities and the dilution of impact. Maintaining this balance is more difficult in large countries with organizationally complex national systems.

(Ekpere and Idowu, 1990)

Managers often have trouble getting coordination positions or units to work effectively. Part of the problem is their ambiguous position within the administrative hierarchy (Ewell, 1989; Kean and Singogo, 1990). Coordination staff often have to work for two bosses, their career paths are unclear, and their job responsibilities are often poorly defined (*see* Box 3.3). Moreover, they are rarely trained in the skills needed for effective coordination, such as conflict management, negotiation, consensus building, communication, or managing and organizing groups and meetings.

Perhaps the most severe disadvantage of coordination positions or units is the shortage of competent people to fill them. Liaison staff need knowledge and experience of the work of the groups to be coordinated if they are to earn respect from these groups.

Box 3.3
Zambia: Experience with research-extension liaison positions

In the early 1980s, Zambia began to use research-extension liaison officers (RELOs) as one of several mechanisms aimed at bridging the gap between on-farm research and extension. Extension professionals are seconded to provincial multidisciplinary adaptive research teams. RELOs have proved very useful for such tasks as bringing researchers and extension workers together to revise crop recommendations, organizing on-farm verification trials of promising technology, coordinating provincial demonstration programs, and preparing extension materials and newsletters. They have also increased the feedback from extension to research and have begun to influence the direction of research. In so doing, they have helped raise the status of extension workers.

Despite these achievements, there have been several implementation problems. The most important is that RELOs, awkwardly straddled between two departments, have to report administratively to the Provincial Agricultural Officer in extension, but technically to the Chief Agricultural Research Officer. This has led to ambiguity as to who is responsible for recruitment and performance evaluation. Promotions have also been difficult to obtain since RELOs are integrated within a research team, yet it is their extension supervisors, with little direct knowledge of their performance, who must recommend them for advancement. Ambiguity in job descriptions is a second problem. It has frustrated the recruitment and retention of competent staff and has led to some duplication of tasks with subject-matter specialists.

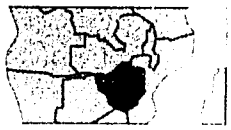
If these administrative problems can be solved, RELOs could prove to be a very effective link between on-farm research and extension. Familiar with the extension service from which they are seconded, yet committed to the technology developed by research, they are well placed to become product champions, enlisting the support of extension workers in broadening the impact of research. However, making a success of the RELO experiment will clearly require sustained commitment on the part of senior managers.

(Kean and Singogo, 1990)

Given the problems encountered in managing coordination positions and units, managers need to create a number of conditions if these mechanisms are to work. First, they must clearly define the responsibilities of such positions or units, acting promptly to curb any expansionist tendencies. At the same time, they should select competent liaison staff and give them their full backing, ensuring that fair staff review systems and career paths are put in place. Lastly, they must include liaison staff in decision making and provide them with access to all the information they need, both to secure their commitment and to ensure their technical competence.

Permanent committees

These committees help to promote horizontal and vertical integration. Committee members may be drawn from different units or institutions of the same level or different levels in the hierarchy.



Box 3.4
Zimbabwe: Building an influential liaison committee

Shortly after independence, Zimbabwe launched on-farm research in the country's peasant farming areas. The Department of Research and Specialist Services (DR & SS), responsible for research, had no formal links with AGRITEX, the extension service, to cover these areas. Individual stations and institutes within the decentralized research program of the DR & SS sought ad hoc links with extension. This approach soon led to duplication of activities, inefficient use of resources and overburdening of extension with research support activities. Staff dissatisfaction with this state of affairs triggered the search for better ways of linking research and extension.

The strong linkage mechanism that now exists — the Committee for On-Farm Research and Extension (COFRE) — evolved gradually. The planning meetings that preceded it were too large (40-50 people) and lacked sufficient authority and consensus to make and implement decisions. In contrast, COFRE is a smaller, more manageable group that includes representatives of the directorates and senior management of both DR & SS and AGRITEX. It is a decision-making body, not merely an advisory one. Committee members take their responsibilities seriously, and chairing the committee is considered a major responsibility, expected to take up to 40% of the time of the person responsible. Most importantly, funds have been provided to meet the committee's operating expenses.

COFRE has acted decisively in several key areas. It has increased the efficiency of on-farm research by implementing a system of clustering trials to reduce transport costs, decentralizing the acquisition of inputs by the extension services, and using simpler trial designs. It has played a crucial role in coordinating, planning, and priority setting in both departments. A major function of the committee is to screen on-farm research proposals, recommending projects for funding or termination. The clarity and relevance of these proposals is reported to be improving, as researchers become aware that committee support is crucial to the survival of their project. COFRE has now started to exert pressure on the system by requiring that the on-farm research results (not just proposals) be presented to the committee.

COFRE has succeeded in increasing the participation of AGRITEX in on-farm verification trials, in more rapidly translating research results into demonstration projects, and in synthesizing research results into tentative recommendations for several important crops and agroecological zones. It has fostered the growth of a farming systems perspective in AGRITEX, which now includes topics such as tillage systems and moisture conservation in its on-farm trials.

Reasons for COFRE's success

Why has COFRE succeeded when so many committees fail? It is a decision-making body, not just an advisory one. The committee is well represented at the operational level so that staff who have to implement its decisions identify with them and also have a means to influence them. It was initiated by research and extension staff and responds to their felt needs. It has maintained flexibility which facilitates the incorporation of new and innovative ideas.

(Shumba and Fenner, 1989)

The success of a committee depends more on the way in which it is organized and managed than on any intrinsic advantages or disadvantages. Bourgeois (1989) cites several conditions which determine success:

- the committee is considered necessary by all the parties represented on it;
- members have a stake in the work of the committee and can implement its decisions or recommendations;
- the committee is kept small enough to be manageable;
- it is decision- and action-oriented, not simply a forum for discussion;
- its scope or mandate is not too broad;
- it is strongly supported by senior management and staff;
- meetings are well planned and chaired, with procedures and agendas clearly defined and followed.

Many of these conditions are met by the Committee for On-Farm Research and Extension (COFRE) in Zimbabwe (Shumba and Fenner, 1989). COFRE is becoming a powerful mechanism linking researchers, farmers, and extension workers in the national system (*see* Box 3.4).

The Issue of Size

The size of the institutions involved in technology development and delivery has a major effect on the kinds of linkage problems that managers confront, as well as on the solutions that are appropriate. Larger institutions are more complex, tasks are divided among a greater number of specialist groups, and scientists tend to be more isolated from users. Typically, multiple linkage mechanisms of a more formal nature are required. Smaller institutions and systems tend to have a less specialized division of labor and to rely more on informal links. In many cases, however, small institutions and systems face serious resource constraints and can have difficulty sustaining even the most basic linkage activities.

Sompo-Ceesay and Gilbert (1989) discuss how being small affects the national agricultural system in The Gambia. They note the following points:

Research status and resources

The research component is more vulnerable in small systems than in large ones. Small countries tend to be designated technology users or adapters, implying that they should not carry out much research to generate new technology. Donors and governments may be disinclined to fund research, which may have a lower status than extension in such countries. Under these circumstances, hard choices over the scope and scale of research have to be made.

Emphasis on linkages

The emphasis in small systems is on borrowing and adapting technology. This means that the research system must give higher priority to the flow of information and technology than to research per se. Hence, in a small country links become particularly important.

Limits to specialization

Staffing constraints in small systems militate against specialization. Individuals have to assume responsibility for a broader range of tasks. Yet, this demands higher and more varied skill levels than are generally found in small systems. Small systems may find it particularly difficult, for example, to maintain on-farm client-oriented research as a separate program or unit. Often, they face extreme staff shortages. Under these circumstances an approach that emphasizes farmer participation and close links with NGOs may be a particularly appropriate way to mobilize additional resources. Similarly, small systems can rarely assign an individual full-time to liaison and coordination responsibilities; these tasks must become part of all staff's jobs.

Types of links

Small systems can make greater use of personal relationships than can larger systems. They employ fewer people, most of whom know each other personally. Relying on personal relationships rather than on more formal linkage mechanisms, if carefully managed, can save scarce resources.

System capacity

Externally funded projects can easily overburden small systems. Donors and governments should take this into account before launching new projects.

Reorganization

Reorganization is often the first intervention considered by managers, donors, or advisors when trying to improve links. It should be the last, if only because of its high cost in terms of disruption.

In a study of research-extension links related to maize in the Atlantic Coast region of Costa Rica, Palmieri (1989) reports a pattern of continuous structural change in the organization of research and extension over a period of 10 years, with no discernible improvement in research-extension coordination or agricultural performance. So frequent were the changes that no single arrangement was given enough time to have an impact (*see* Box 3.5)

In many institutions and systems, particularly those of Latin America, frequent reorganization provides an illusion of progress, disguising an underlying inertia. Structural change can become neurotic, substituting for the serious reassessment of objectives, policies, and procedures that is really needed. Merely changing the organigram does not bring about the operational changes required in the field. Some reorganization may be needed from time to time to accommodate changing circumstances, but major ones should be undertaken only with the greatest care. This is especially true when the initiative for structural reform comes from outside the institute.

The costs of reorganizations are felt in three ways. First, planning and implementing them can dilute senior staff's attention to managing research activities. Second, the bureaucratic infighting that often accompanies the uncertainties created by structural change can reduce research

Box 3.5
Costa Rica: Reorganizing research and extension

The Ministry of Agriculture and Livestock in Costa Rica is responsible for both research and extension. Between 1980 and 1989, the ministry went through numerous reorganizations designed, among other things, to improve the links between research and extension. These changes included: putting research and extension in the same department; revising the extension organigram several times; creating a research-extension planning unit; regionalizing research and extension; adopting the Training and Visit system of extension; reorganizing research into commodity programs instead of disciplines; and forming commodity programs involving research and extension.

With reference to maize technologies in the Atlantic Coast region, none of these changes had an important, identifiable impact on either research or extension or on the links between them at the field level. There were few changes in the number of research and extension activities, their topics, or their methodology which could be attributed to the reorganizations. Links between the two activities remained weak. Extension workers and farmers had no effective influence on research planning and there were few mechanisms for making research results available to extension. Adoption of maize technology has continued to be low.

The study concludes that the reorganizations were too frequent. Not enough was done to educate staff about the reasons for the changes or to persuade them of their necessity. There was insufficient attention to field-level links and methodologies. Resource limitations were at the root of many of the field-level problems, but these were not addressed by changing the boxes in the organigrams.

(Palmien, 1989)

productivity. Third, a prolonged process of internal reform breeds introspection, jeopardizing relations with other organizations, especially technology transfer agencies or other client groups.

The Senegal case (Faye and Bingen, 1989) discussed in Section 2 illustrates these common problems (see Box 2.3). There, a reorganization with the primary objective of strengthening links with farmers and development agencies through the formation of a Production Systems Department actually weakened links as the national research institute turned inward to cope with its organizational crisis. The new department charged with building links with technology users remained isolated from the mainstream of agricultural research in the institute. The opportunity to assign some of its researchers to extension liaison positions with regional development agencies was foregone in the interest of keeping these researchers in the department. And many research programs, unsure of themselves in the changing environment, held fast to their established priorities and activities, despite demands from extension for specific, shorter-term, applied research projects.

Section 4

MANAGING LINKAGE MECHANISMS

"It is important to remember that we are dealing with dynamic processes in the design and management of linkages. What works today will not necessarily work tomorrow. This means that managers' ability to effectively monitor and adapt to new circumstances is going to be continually needed. There is no one single decision, but a choice of initiatives that make an effective linkage mechanism."

Dr L. Trigo,
Director,
Technology Generation and Transfer Program, IICA,
Costa Rica

Managing Linkage Mechanisms

MANAGERS HAVE AT THEIR DISPOSAL different types of mechanisms for strengthening links with technology users. Some, such as joint priority-setting exercises, demand intensive management, staff involvement, and funds. Others can be much more informal and simply help in the exchange of information. To build effective links, managers usually have to combine various types of mechanisms and apply them at different levels of the institutional hierarchy. They also need to maintain flexibility and be alert to setting up new mechanisms as institutional conditions and technologies change. Most of all, managers have to give the leadership and active management required for developing effective links.

Which mechanisms are most appropriate and how they should be used or combined depends on a variety of factors:

- the institutional and political context;
- the technologies involved;
- the managers' objectives in building links;
- the resources available;
- the nature of the linkage problems faced.

For example, mechanisms needed simply to improve timely communication would be very different from those required to launch an integrated research and extension program. Similarly, the mechanisms needed to develop collaboration between two groups that resent losing their autonomy will differ markedly from those needed to link groups that recognize their interdependence but simply do not set aside enough time to work together and share information.

In this section, we review the basic types of linkage mechanisms; examine how different types of technologies often require different kinds of mechanisms; and conclude by drawing out the principles for managing links.

Types of Linkage Mechanisms

The ISNAR studies have identified four basic types of linkage mechanisms, in addition to the structural mechanisms described in Section 3 (Merrill-Sands and McAllister, 1988; Seegers and Kaimowitz, 1989). These mechanisms apply to links between on-station and on-farm research as well as between research and technology transfer agencies (*see* Box 4.1 *overleaf*). Many of these mechanisms can also be used to forge links directly with farmers.

In the following discussion of the specific mechanisms, we draw on the case study experiences to highlight each mechanism's particular utility for building links, its management requirements, and the kinds of institutional conditions under which it can be used most effectively.

Box 4.1
Linkage mechanisms

Planning and review processes	Joint problem diagnosis Joint priority-setting and planning exercises Joint programming and review meetings
Collaborative professional activities	Formal collaboration in trials, surveys, and dissemination activities Joint decision-making on release of recommendations Regular joint field visits, such as monitoring tours Informal sharing of tasks and responsibilities Informal consultations
Resource-allocation procedures	Formal guidelines for allocating time for collaborative procedures Specific allocation of funds for collaborative activities Staff rotation and secondment
Communication devices	Publications, audio-visual materials, and reports Joint training activities or seminars

(Merrill-Sands and McAllister, 1988; Seegers and Kaimowitz, 1989)

Planning and review processes

Joint planning and review mechanisms have been widely used to strengthen links and, in many cases, have proved effective (*see* Figure 4.1). When using these mechanisms, however, managers have to bear in mind that they require attentive management and adequate resources, in terms of both staff time and operating funds. These mechanisms also function best when managers set them up to be advisory, with professionals pooling their respective areas of expertise, rather than supervisory, with one group acting as a 'watchdog' over the other.

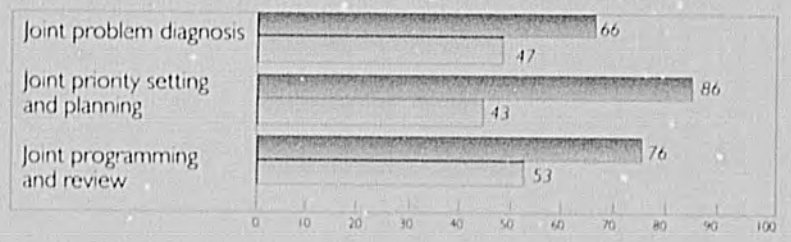
Joint problem diagnosis

These exercises are most effective when they take place in the field rather than in the conference room, and are conducted periodically rather than in a 'one-off' fashion. Bringing groups together to define priority problems provides a strong foundation for on-going cooperation. It forges shared objectives and a commitment to a common work agenda. The informal diagnostic field survey — involving on-station researchers, on-farm researchers, technology transfer workers, and farmers — has proved to be a particularly effective and feasible mechanism within national programs. It helps on-station researchers gain a deeper understanding of farmers' problems and a greater appreciation of the potential benefits of feedback from technology users for improving the relevance of research.

Figure 4.1
Linkage mechanisms: Frequency of use and assessment of impact on links between on-farm and on-station research

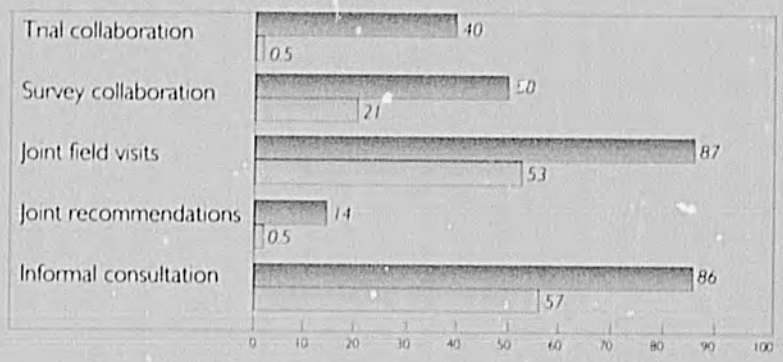
The graphs present the results of a comparative analysis of mechanisms used to link on-farm client-oriented research and on-station research (Merrill-Sands and McAllister, 1988). The analysis covers 17 institutional settings (for example, research institutes or projects) in nine countries. Each group shows (a) the percentage of cases in which the mechanism was used and (b) the percentage of cases in which national researchers cited the mechanism as important in strengthening links. The gap between the two, in many cases, reflects problems managers have faced in using the mechanisms effectively.

Percentage of cases using joint planning and review mechanisms



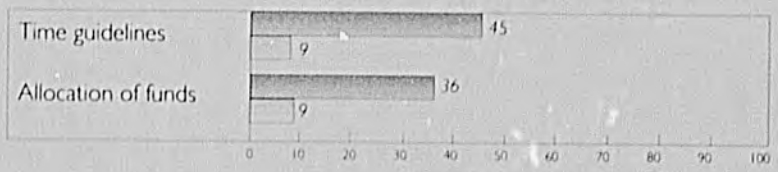
Joint planning and review mechanisms have been widely used, and have been moderately successful in strengthening links. Managers found it difficult to use joint priority-setting and planning exercises effectively.

Percentage of cases using collaborative activities



Two types of collaborative activities — joint field visits and informal consultation among scientists — were cited as key mechanisms for strengthening links in over half the cases. Collaboration in trials and surveys demand more resources and management attention. They have been used less frequently and their impact has been limited, often because of implementation problems.

Percentage of cases using resource-allocation procedures



Percentage of cases (n=17)

Legend:

Mechanism used Mechanism cited as strengthening integration

Source: Merrill-Sands and McAllister (1988)

Procedures for allocating staff time and/or funds specifically to linkage activities were used in less than half the cases. They were not seen to have had an important direct impact on links. However, in many of the cases reviewed, the absence of these resource-allocation procedures meant that other linkage mechanisms, such as joint field visits, could not be carried out.

61

Joint priority-setting and planning exercises

Although managers have often experimented with using joint priority-setting and planning exercises to strengthen links, in many cases they have found them difficult to implement. Such exercises almost inevitably raise issues of professional autonomy, power, and control over work agendas. This mechanism will fail if one group is perceived as dictating to the other, or becoming the 'new boss', as has often occurred with the introduction of major on-farm client-oriented research programs into national agricultural research systems.

The case experiences show that managers need to be alert to the potential for conflict and to manage these exercises carefully. Joint priority setting and planning exercises appear to be most effective as linkage mechanisms when senior managers, themselves, participate. This helps to foster commitment and ensure that staff follow through on agreements.

Joint priority setting and planning exercises conducted in the field in Nepal, called 'samuhik bhramans' or 'group treks', have been very effective in developing links between farmers and on station and on farm researchers (Kayastha et al., 1989; Mathema and Galt, 1987; Merrill-Sands and McAllister, 1988) (*see* Box 4.2). To date, however, opportunities for involving extension have not been fully exploited.

Box 4.2
Nepal: Joint planning in the field

The difficulties of travel and communications in the rugged terrain of Nepal hinder the coordination and collaboration of field work. To overcome these obstacles, researchers have developed the 'group trek'. Researchers from different programs, departments, and/or stations travel together at regular intervals to a target area where they meet for several days to plan and review their research activities. They diagnose problems and set priorities based on interviews with farmers and local officials and group discussions. Agreement is reached on the appropriate division of responsibilities and a plan for coordinated research is formed on the spot. Researchers organize follow-up meetings to monitor on-going activities and review research results.

The group trek has been easier to use in the two, externally funded, regional research centers in the highlands. Their small size and regionally focused mandate facilitate collaboration. The scientists live together at the station, see themselves as working in an integrated program, and report to a common director who actively promotes joint exercises. Moreover, target areas are within one day's walk and donor funding ensures adequate per diems.

In contrast, the Farming Systems Research and Development Division, which is a single department in a large national research system, has faced more daunting problems in conducting group treks. It is organizationally and logistically more difficult and costly to bring together scientists from different departments and dispersed research staitons and to support a nationwide network of target areas. Motivation is a second problem. Per diems in the national system do not even cover the actual costs of being in the field. Nevertheless, the group trek, although now conducted less often and for shorter periods, continues to serve as the primary mechanism for linking farming systems research with the station-based research of other divisions and commodity programs.

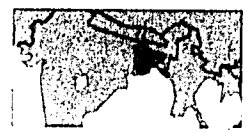
(Kayastha et al., 1989; Mathema and Galt , 1987; Merrill-Sands and McAllister, 1988)

Joint programming and review meetings

Joint programming and review meetings assist rapid communication of research results and provide an arena for direct and timely feedback from the field. The ISNAR studies show that these meetings are most effective when they are small, concentrate on a particular commodity and region, are attended by people with the power to take programming decisions and implement proposals, and involve field level staff who are closest to farmers.

Joint 'internal review workshops' proved to be a key linkage mechanism in the Extension and Research Project in Bangladesh. Based on the Training and Visit system, this project was launched in 1978 to strengthen research and extension in the northwest region of the country (Abedin and Chowdury, 1989) (see Box 4.3).

Box 4.3
Bangladesh: Institutionalizing joint 'internal review workshops'



After three seasons of on-farm research in the Extension and Research Project in northwest Bangladesh, researchers decided to hold a workshop to review the previous year's results, diagnose problems, and prepare plans for the following year. They also intended to discuss input and equipment needs and review interagency linkages. Researchers, unsure of their results, decided not to involve extension workers because they did not want to lose their confidence. Only an expatriate consultant to the Department of Agricultural Extension and a regional extension director were invited to attend.

The outcome was disappointing. Only a few researchers produced technical reports; most lacked experience in how to analyze data and write reports. What was intended to be a two-day meeting lasted only two hours!

Although initially frustrating, the problems encountered in the workshop led to the organization of training for researchers on data analysis and preparation of technical reports. This training yielded much better results at subsequent meetings. The workshops were also redesigned to strengthen their role as a mechanism for linking on-farm research, on-station research, and extension. Extension workers from the districts were invited to participate and were asked to report on their demonstration trials in order to give researchers feedback on how recommended technologies were performing in farmers' fields and how they might be modified. The meetings were also expanded to include representatives from other research institutes active in the region.

Institutionalized as Regional and District Technical Committees, the workshops became the central mechanism in the project for linking on-farm research, on-station research, and extension. They gave staff the opportunity to work together to discuss methods and results and to plan research and extension strategies. They also served as an important mechanism for improving the quality of on-farm research and interpretation of results.

The mechanism worked successfully for five years. It proved difficult to sustain and operate effectively, however, when the project expanded from six to 10 districts and the research component was transferred from a regional station to the national headquarters. Its effectiveness appears to have declined as many new people became involved who had little orientation to the project, on-farm research methods, or the workshops' objectives and functions. Moreover, at regional level, both the director of extension and the research team leader were personally responsible and accountable for strengthening links. When the project was moved to the national level, no one was assigned equivalent responsibilities for making the links work.

(Abedin and Chowdury, 1989)

A working group was set up during the conference to discuss joint planning and review mechanisms in relation to three questions.

In what contexts should these mechanisms be used?	Where researchers, technology transfer workers and farmers share common objectives, and institutions have the capacity and stability to carry the plans through.
What kinds of linkage problems can these mechanisms be used to resolve?	Duplication of tasks and activities, and other problems arising from poor definition of responsibilities; lack of joint planning.
What kinds of resources and management attention do these mechanisms require?	A clear institutional policy to make the necessary resources available; interaction between research and technology transfer agencies at various levels of the administrative hierarchy; mutually agreed upon strategy to carry out the joint activities.

Collaborative professional activities

Collaborative activities foster integration by providing an opportunity for participants to gain more insight into each others' problems, working methods, and objectives. This can promote the mutual respect on which successful linkage activities depend. Collaborative activities can also have the direct benefit of improving the quality of both groups' work.

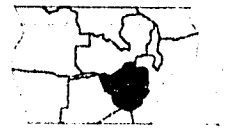
Formal collaboration in trials, surveys, and dissemination activities

Formal collaboration in professional activities, such as trials or surveys, can be a very effective linkage mechanism. Collaborative activities do not raise the power and control problems seen in joint planning and review mechanisms. However, they can raise a number of difficult issues related to status and the division of labor (*see* Section 5).

The benefits of collaborative activities as a linkage mechanism are illustrated by the Nariño Highlands case (Engel, 1990) (*see* Section 2). Collaborative research and extension task groups at the district level were cited as a key mechanism contributing to the impact of the development project. These groups brought researchers and extension workers together on a regular basis to perform specific activities, such as a multidisciplinary survey report, a multimedia extension campaign, or on-farm trials.

Formal arrangements are usually needed for effective collaboration between on-farm researchers and technology transfer workers at the field level (Ewell, 1989). As the Zimbabwe case demonstrates, informal arrangements alone are rarely satisfactory (Avila et al., 1989; Shumba and Fenner, 1989) (*see* Box 4.4). If technology transfer workers are to participate actively in running trials, they should be trained in trial management and their responsibilities must be clearly defined.

Box 4.4
Zimbabwe: Research-extension collaboration in field surveys and trials



In 1980, the Agronomy Institute of the Department of Research and Specialist Services (DR & SS) launched a major on-farm trial program with a view to adapting existing technologies to the particular conditions of the peasant farming areas. The trials were designed by research staff, covered a range of crops and were widely dispersed throughout the country. Because of the scale of the program, researchers delegated, on a rather informal basis, the routine management of the trials to local extension workers.

The results were disappointing. The researcher in charge of the program had to travel constantly to supervise the trials, leaving him little time to interact with extension workers and farmers. The extension workers had many other responsibilities and little training in managing on-farm trials. As a result, many trials were lost altogether, and few useful data were fed back into the research process.

The researchers subsequently reorganized the program, bringing it fully under their supervision and management. They greatly reduced the number of trials and clustered them in representative sites. Research technicians were then outposted to the sites to manage the trials. The research results have improved markedly with better management. The links with extension workers and farmers have weakened, however, with their significantly decreased involvement in the trials.

(Avila et al., 1989, Shumba and Fenner, 1989)

When using collaborative activities as a linkage mechanism, it is important to remember that they can be both management and resource intensive. The review of survey data on research-extension links shows that formal collaboration is used extensively in higher resource systems, such as Australia and Israel where one third of all researcher-extension worker contacts focus on collaborative trials. It appears to be much less widely used in low resource systems (Seegers and Kaimowitz, 1989).

Joint field visits

Joint field visits, such as annual monitoring tours or field days, are used widely and can have a high impact on strengthening links (*see* Figure 4.1). In Zambia, for example, many commodity research scientists were critical of the quality of the research being conducted in the on-farm research program in its early years (Kean and Simpogo, 1990). Joint field visits to on-farm trials improved collaboration significantly as specialists saw the actual performance of their varieties and recommended practices under farmers' conditions and gained more appreciation of the on-farm researchers' work.

Such efforts are often difficult to sustain on a regular basis, however, because of the lack of operating funds. Although joint field visits may be more expensive and difficult to arrange than joint meetings held at research stations, the case study experiences show that they definitely warrant the investment of time and money.

Joint decision-making on the release of recommendations

Disputes over who should be responsible for formulating recommendations — national commodity programs, on-farm research teams, or extension personnel — are a chronic problem jeopardizing links in many agricultural technology systems. In Zambia, the conflict was resolved only after much debate (Kean and Singogo, 1990) (*see* Box 4.5).

Box 4.5
Zambia: Joint responsibility for the release of recommendations

In the 1970s, researchers at the central research station near Lusaka drew up and released recommendations. These recommendations reflected only minimal extension worker involvement and did not take sufficient account of the particular agroecological conditions of each province. This strained research-extension relationships. Extension workers considered that much of the research conducted at the research stations was not relevant to resource-poor farming conditions. Researchers tended to blame extension workers for the failure of resource-poor farmers to adopt research recommendations.

In 1978 the Minister of Agriculture introduced several key linkage mechanisms aimed at improving the research-extension relationship. These included the establishment of Provincial Research and Extension Committees which, among other things, were intended to give research and extension staff the opportunity to suggest changes in research recommendations. In several provinces, the research-extension liaison officers (RELOs), who are members of on-farm research teams deployed in the provinces, have taken a leading role in bringing researchers and extensionists together to revise recommendations to make them more appropriate for provincial conditions (*see* Box 3.3). They have brought them together to resolve contentious issues, and incorporated information from researchers, farmers, and extension workers into provincial crop recommendations, using a farming systems perspective.

(Kean and Singogo, 1990)

Managers need to develop flexible mechanisms for involving the relevant agencies and professionals in joint decision-making on recommendations. This can not only improve the quality and relevance of the recommendations, but also ensure that farmers are receiving similar messages from the various agencies operating at field level. Contradictory information can only confuse farmers, undermine the credibility of the institutions, and aggravate linkage problems.

The working group set up during the conference to discuss the use of collaborative activities as linkage mechanisms came up with the following conclusions.

In what contexts should these mechanisms be used?

Where there is strong policy support, backed up by the necessary organizational and financial resources; where on-farm and on-station research, or research and technology transfer, serve a common group of clients; where agroecological environments are diverse and close collaboration is needed to produce technologies relevant to specific local conditions.

What kinds of linkage problems can these mechanisms be used to resolve?	Groups' different perceptions of farmers' problems and priorities; lack of articulated common goals; communication problems; lack of coordination on similar tasks, leading to duplication and overlap of activities; incompatible programs or work plans.
What kinds of resources and management attention do these mechanisms require?	Adequate operating budgets and staff time allocation by both parties; active management involvement in coordinating policies, strategies, and operations.

Informal consultation and task sharing

Managers should not overlook the potential benefits of informal collaboration as a low-cost and expedient way of building links. The ISNAR studies show that informal consultations can contribute significantly to strengthening links between on-farm and on station research (*see* Figure 4.1). Concerning research extension links, the survey data show that in countries with stronger extension systems there are substantially more direct personal contacts between researchers and extension workers (Seegers and Kaniowitz, 1989).

Managers need to find ways of stimulating informal collaboration among staff as a way to supplement and give vitality to the more formal mechanisms. Nevertheless, as the Zimbabwean example cited earlier shows, managers should not rely on informal links alone, even in very collegial situations.

The analysis of a development project in Côte d'Ivoire shows clearly the potential benefits of informal relations in strengthening links (Eponou, 1990). In the three periods examined in this study, formal links did not change, and yet significant results were achieved only in the period during which these links were reinforced by strong informal links (*see* Box 4.6 *overleaf*).

Eponou (1990) argues that managers can use informal collaboration and consultation to forge links only when:

- both the institutions and the people involved share a common goal;
- staff are willing, and encouraged, to take on any additional responsibilities or tasks required to achieve the goal;
- operations are decentralized;
- institutions are flexible;
- stability in staffing permits the development of collegial relations.

The working group set up to discuss informal links focused on factors which facilitate informal collaboration.

What factors facilitate the development of informal links?	Personnel factors, such as common background, convergence of interests and mutual trust; organizational factors, such as physical proximity and good communication facilities.

Box 4.6
Côte d'Ivoire: Using informal links to complement formal links

In the 1978-89 period, the main entities involved in food crop technologies in central-west Cote d'Ivoire were:

- a regional development body;
- a regional research institute;
- an integrated regional development project.

In the first period, a memorandum of agreement between the development body and the research institute provided the basis for formal collaboration, but there were no informal links. The research institute assumed responsibility for conducting on-farm trials and developing improved cultural practices, particularly intercropping. *Few new technologies were developed during this period.*

In the second period, the integrated development project was launched. The project's research and development (R & D) unit conducted on-farm trials and demonstrations. At the same time, the research institute was intensifying its on-farm activities. There were close personal ties between the leaders of the R & D unit and the on-farm research program. A memorandum of agreement laid the foundation for formal collaboration between the project and the institute in on-farm activities, and the project funded some of the institute's operational costs. *Several new varieties were developed and widely adopted.*

During the third period, the leader of the R & D unit left. His successor did not have the same personal ties with the on-farm research program leader. Formal links between the project and the research institute remained, and the project continued to fund the institute's on-farm activities. *Some new varieties were developed but none was successfully transferred.*

Stability, adequate resources and formal links were features of all three periods. What made the difference in the second period? strong informal links, developed largely from the friendship between the two leaders and from their strong commitment to collaboration and achieving impact. The recognition of interdependence which emerged as a result of informal collaboration converted 'passive' links into 'active' links. In the third period, when informal links broke down, the relationship between the two entities reverted to passive collaboration.

(Eponou, 1990)

What kinds of linkage problems can these mechanisms be used to resolve?	Occasional, 'one-off' problems; problems which can be solved by simple decisions, avoiding complex administrative procedures.
What kinds of resources and management attention do these mechanisms require?	Flexible management in terms of allocation of time and use of resources; managers should resist the temptation to formalize successful informal links but draw on elements of these links when creating formal links.

Resource-allocation procedures

Managers can indicate the importance they attach to links by using procedures which formally allocate staff time, funds, and other resources to support linkage activities. The case studies indicate that formal allocation of funds and staff time to linkage activities should be exploited more fully (see Figure 4.1). Many of the other linkage mechanisms, such as joint planning exercises or collaborative activities, failed simply because no resources had been specifically allocated to support them.

Formal guidelines for allocating time to linkage activities

Staff rarely allocate sufficient time to linkage activities on their own initiative. They often see these activities as competing with the 'core' professional activities for which they are held directly accountable. Managers need to provide clear and realistic time allocation guidelines. These help to ensure that staff participate sufficiently in linkage activities, but at the same time do not jeopardize their other professional duties.

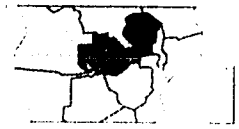
In Indonesia, for example, technical specialists based at headquarters, who have responsibility for backstopping regional on-farm research teams, have clear guidelines on the time they should spend on field visits and joint meetings with on-farm researchers. Similarly, on-farm researchers have time specifically set aside for returning periodically to their home institutes for annual planning and review meetings and discussions with senior scientists. These procedures have been very important for ensuring effective collaboration (Budianto, 1989; Merrill-Sands and McAllister, 1988).

Specific allocation of funds for linkage activities

Lack of money to meet operating costs such as transport and fuel thwarts many collaborative activities, particularly joint field visits. The cases show that managers can take several measures to ensure that adequate funds are made available for linkage activities. These include: making collaborative activities a line item in program budgets; placing funds for collaborative activities under the control of those individuals responsible for carrying out these activities; and, where the activities are based on a partnership between two units or institutions, obtaining a specific allocation of funds from each partner to support linkage activities.

Staff rotation and secondment

The rotation or secondment of staff is an effective way to pool experience and get collaborative activities moving. However, it sometimes proves difficult to administer, particularly when seconded staff become so isolated from their parent institutions that their career prospects are damaged. It is important to set a clear time frame for the secondment.



Box 4.7
Zambia: Seconding field staff from extension to research

In setting up the Adaptive Research Planning Team (ARPT) program, no provision was made initially for the secondment of extension workers to field research programs. However, when the program organizers began to plan the trials for the first season, they decided that instead of recruiting technicians and posting them to research sites to supervise the day-to-day on-farm research operations, it would be more effective to draw on full-time extension workers already living in the regions. The Extension Branch was willing to second some of its best local agents because extension had been actively involved in planning the ARPT and saw it as a mechanism for generating technology relevant to local conditions.

Known as Trials Assistants, these personnel are responsible for the day-to-day management of on-farm trials, for maintaining contact with farmers, and for organizing field days. They have been effective not only because they received adequate training but also because they are from the areas in which they work, speak the local languages, and understand local farming practices and food preferences.

Trials Assistants are paid by the Extension Branch but supervised by the Research Branch. This has led to some conflicts but, with good communication at the provincial level, such conflicts are usually resolved before they become serious problems.

(Kean and Singogo, 1990)

Formal staff secondment has not been widely used as a linkage mechanism. In Zambia, however, it has been crucial to the success of the Adaptive Research Planning Team (ARPT) program (Ewell, 1989; Kean and Singogo, 1990). Here, the technicians responsible for on-farm trials are formally seconded from extension (*see* Box 4.7).

Communication devices

Communication devices such as publications, audio-visual materials, radio programs, training courses and seminars can be used to strengthen links in a wide variety of situations. Like other linkage mechanisms, however, they require careful planning, adequate funding, and strong commitment; in many cases they also require specific skills and creative talents.

Publications

The Seegers and Kaimowitz (1989) review of survey data on research-extension links provides useful insights into using publications as a means for strengthening links:

- extension workers are more interested in short, easy-to-digest publications, such as bulletins, brochures, and leaflets, preferably written in the local language, than in scientific research journals or research reports;

- annual reports, scientific journals, and research progress reports play only a minor role in disseminating research results to technology transfer workers; they are more important for communicating within the research community;
- researchers in highly effective technology systems have put more effort into producing extension materials than have those in systems which have had less impact on agricultural performance;
- research materials take a long time to get published and extension workers often have difficulty obtaining them.

The Nariño Highlands case from Colombia (Engel, 1990), discussed in Section 1, shows the importance of targeting communications at specific clients and involving both technical and communication specialists in the development of materials (*see* Box 4.8).

Box 4.8
Colombia: Implementing Communication Plans for Technology Transfer

In 1981, the communication department of Colombia's national research and extension institute developed a new approach to improve technology transfer to small farmers. The methodology focused on the planning, preparation, and implementation of multimedia extension programs and provided the means to clearly define the objectives, target groups, and content of these programs. A key element was the systematic planning of extension events with groups of farmers in a village.

The Communication Plans were designed and implemented jointly by extension field supervisors, subject-matter specialists, and researchers. The involvement of specialists meant that the plans were backed up by a continuous production of high-quality extension materials, including slide shows, booklets, brochures, a newsletter, and, later on, a daily radio program providing news on meetings, demonstrations, and research recommendations. These materials were designed to ensure easy access by peasant producers, women, and children. For example, written materials used peasant vocabulary for technical words.

The Communication Plans significantly increased the number of small farmers reached by the research-extension institute.

(Engel, 1990)

Training and seminars

Joint training programs and seminars have been used very effectively to strengthen links, especially in cases where groups do not understand each other's work well. Managers can use these events to foster common objectives and approaches essential for effective collaboration.

The initial hostility of commodity and disciplinary specialists towards an on-farm research program in Senegal was diffused significantly after the on-farm researchers organized a series of seminars explaining their approach and methods and showing how their research complemented that of the specialists (Faye and Bingen, 1989). In Guatemala, training extension workers in the

on-farm research approach was a critical mechanism for building strong on-farm research and extension teams (*see* Box 1.6).

Different Links for Different Types of Technology

A key conclusion emerging from the study on research-technology transfer links is that one set of mechanisms is rarely sufficient for dealing with a range of different types of technologies (Kaimowitz et al., 1989). Several examples illustrate this point. Links used for the development and delivery of physical inputs, such as improved crop varieties, are quite different from those needed for more complex technologies, such as integrated pest management practices. The latter entail the transfer of information, the development of educational materials, and the organization of cooperative actions among farmers. Similarly, links which work perfectly well in promoting input sales may, on the other hand, be totally inadequate for promoting the more cost-effective use of those inputs. Strong coordination between institutions on one type of technology does not necessarily imply similar coordination in other areas, as the case from Colombia illustrates with respect to varietal and fertilizer technologies (*see* Box 4.9).

When managers seek to improve links, they should identify specific linkage mechanisms, or sets of mechanisms, which will be appropriate for particular technologies. Information about certain technologies, such as varieties, can often be disseminated through informal channels. Many other types of technologies, however, require more formal links, such as training technology transfer workers and producing information materials. Moreover, as new technical issues emerge, managers must adapt linkage mechanisms accordingly.

The study by Agudelo and Kaimowitz (1989) of rice research and technology transfer in Colombia shows how a variety of links — involving different mechanisms and different actors — were needed for four basic types of rice technologies (*see* Box 4.9).

Box 4.9
Colombia: Using different links for different technologies

The main agencies concerned with rice technology in the region known as Llanos Orientales in Colombia are the national agricultural institute, a growers' organization, an international research center (Centro Internacional de Agricultura Tropical — CIAT), agrochemical and seed production companies, and private agronomists. Although all these agencies were involved in the development and transfer of four different types of rice technologies — imported varieties, nationally developed varieties, fertilizer recommendations, and cost-reduction techniques — the links between them differed with each type of technology.

Imported varieties

The first major technological improvements were based on imported varieties. The growers' organization was closely involved in importing, multiplying and distributing improved varieties. One variety, Bluebonnet-50, was eventually planted in over 90% of the rice area. This success rested entirely on simple trial and error, carried out

-12

(Box 4.9 contd.)

on a purely commercial basis without any elaborate research efforts. There was minimal coordination between the growers' organization and other agencies.

Nationally developed varieties

Despite its success, Bluebonnet was susceptible to local diseases and had rather low yield potential. Thus, in 1957, a research program was created to develop varieties adapted to local conditions. Through a formal agreement, the agricultural institute assumed responsibility for breeding and the growers' organization took on the responsibilities for extension, seed multiplication, and seed distribution. The two agencies shared responsibility for regional variety trials and for determining the agronomic recommendations to accompany new varieties. After the first locally bred variety was released in 1963, coordination grew even stronger through staff secondment, training programs, and regular joint planning and priority-setting meetings.

With the creation of CIAT in 1967, a triangular relationship developed between CIAT, the research institute, and the growers' organization; CIAT provided support in the early breeding stages and in variety evaluation. Around the same time, the growers' organization exchanged its direct technical assistance role for a coordinating role as growers' needs became more sophisticated and the number of private agronomists increased as a result of government credit programs. In addition, the growing number of private seed multipliers and distributors provided informal but effective communication links between researchers, private agronomists, and farmers. The clear division of responsibilities and strong links (many of them informal) which developed between these agencies were a major factor in the more than twofold increase in rice yields between 1961 and 1984.

Fertilizer recommendations

The increase in new varieties has been accompanied by a need for fertilizers. Most soil research is conducted by the agricultural institute. However, there is little coordination between this institute, the growers' organization, and the private sector in this respect, or even within the institute's own soil and rice units. The institute relies mainly on publications and seminars to disseminate results, but faces strong competition from private companies, who have far greater resources to promote their products. The lack of coordination has meant that, although fertilizer use has increased, the specific fertilizers used and their methods of application often differ from those recommended by researchers.

Cost-reduction techniques

Yields from the locally developed varieties have remained high, but production costs have soared. In an effort to deal with this, CIAT, the agricultural institute, and the growers' organization have produced a cost-reduction plan. Among other things, the plan recommends that pesticides should be applied only when critical economic threshold levels have been reached. The three agencies have collaborated closely on disseminating information on reduced pesticide usage, mainly through demonstrations and publications. However, acceptance from growers has been low because there has been little practical support for the plan from the private sector or from private agronomists. The growers' organization is now considering working directly with farmers. Although it stopped providing technical assistance in the 1970s, it has recognized that the institutional arrangements that worked well for transferring new varieties are not adequate for transferring information on pest management.

(Agudelo and Kaimowitz, 1989)

The issue of different types of technologies requiring different linkage mechanisms provoked considerable discussion during the workshop. Managers were particularly concerned about the implications for agricultural technology systems that have limited resources and yet have to deal with many types of technologies. It was observed that while a stable set of organizational arrangements and actors may be involved in the research and technology transfer system, the specific linkage mechanisms and leverage points used within the system are likely to differ according to major types of technologies. Managers agreed that it was important to determine the likely bottlenecks in transferring a particular technology, and then to choose mechanisms suitable for overcoming them.

Principles for Using Linkage Mechanisms

From the review of case study experiences, the ISNAR studies have been able to draw out some basic principles for using linkage mechanisms.

- **There is no formula or recipe for strengthening links.**

The effectiveness of a specific linkage mechanism varies according to the institutional and political context in which it is used. What works well in one context will not necessarily work in another. The clear lesson from the studies is that linkage mechanisms cannot be directly transferred from one context to another, but must be adapted to suit specific contexts.

- **Linkage mechanisms supplement, or compensate for, structural arrangements.**

Structural changes or innovations, such as merging departments or institutions, can be used to handle important interdependencies. However, linkage mechanisms must be developed to handle the remaining interdependencies or, where structural arrangements are weak, to compensate for these weaknesses.

- **Linkage mechanisms should be developed at multiple levels of the administrative hierarchy.**

The case experiences show that links are most successful and sustainable when mechanisms are active at several administrative levels — in the field, at the regional level, at the senior management level, and at the policy-making level. Such mechanisms reinforce each other. Good field-level cooperation is impossible to sustain unless managers provide regular opportunities for staff to meet and work together. At the same time, joint goals agreed upon by senior managers or policy-makers cannot be achieved unless specific operational procedures for collaboration are worked out at the regional and field levels.

- **Because linkage mechanisms cost time and money, they should be used selectively.**

Managers should choose mechanisms carefully, manage them actively and flexibly, and re-evaluate them periodically. The basic rule is to limit the choice of mechanisms to the minimum

required to achieve a given objective. Few technology systems in low-income countries can afford the ideal configuration of linkage mechanisms; managers have to diagnose their environment and the nature of the linkage problems, set priorities, and make tough choices as to which mechanisms will yield the highest payoff.

- **Managers should not overuse, or abuse, linkage mechanisms.**

Individuals or institutions may see the creation of links as a threat to their autonomy. Participation in joint activities may entail some loss of control over resources and programs, and may divert professionals from carrying out their principal activities. In addition, if too many individuals or institutions are involved, conflicts are likely to arise which will erode the effectiveness of the links.

- **Managers should allocate resources explicitly to support linkage mechanisms.**

If the priority managers give to linkage mechanisms is ever to be anything more than rhetoric, they must demonstrate their commitment by allocating the necessary staff time and operational funds to support communication, coordination, and collaborative activities. This is a chronic weak spot in the management of links.

- **Managers should anticipate the need for links.**

Too often, managers focus on links only when problems arise. Yet, the costs of linkage problems are high. Managers should start forging strong links at the beginning of the technology and delivery process, not at the end of it.

- **Different technologies require different types or sets of linkage mechanisms.**

Managers have to maintain flexibility and be ready to exploit a range of diverse mechanisms depending on the major categories of technologies being developed and transferred.

- **Managers should stimulate informal links as well as formal ones.**

This is the 'people side' of the linkage issue. Managers should provide opportunities for informal collaboration as a way of motivating staff to work together and coordinate their efforts.

Section 5

HUMAN RESOURCE ISSUES

"In the end, links are between people and nothing can replace a good environment in which researchers and extension workers can communicate freely, constructively, and informally."

Dr G. Montes Llamas,
Director General,
ICA, Colombia

"The most important and beneficial result of three years' experience in developing an integrated research-extension program is the belief each group now has in the ability of the other group to get the job done."

Ortiz et al. (1989)

Human Resource Issues

DEVELOPING EFFECTIVE LINKS means motivating people. Managers have to persuade staff with differing responsibilities, skills, and aspirations to talk together, work together, support one another, and recognize each other's contributions. All the linkage mechanisms in the world will not succeed in integrating the efforts of researchers, technology transfer agents, and farmers if these people do not believe it is worth their while to work together.

Both the ISNAR studies focus on how to integrate efforts through improved staff management. The workshop presentations and discussions dealt only with selected issues. With respect to research-technology transfer links, emphasis was placed on tackling the status differences which so often obstruct relationships between these groups (Zandema, 1989). With respect to on-farm client-oriented research, status issues were also considered, but within the broader context of managing three relationships that are critical for effective teamwork, namely: those between senior and junior scientific staff; those between national and foreign scientists; and those among professionals of different disciplines (Bingen and Poats, 1990). The following discussion on staff management issues draws primarily on these two presentations.

Status Differences

Integration is more difficult between groups of different status. In many agricultural research institutions, commodity and disciplinary specialists working on stations have higher status than on-farm researchers. Researchers in general have higher status than technology transfer workers. The low status of resource poor farmers themselves is often a major factor contributing to institutional status problems. This tends to be greater in developing countries, where there is often a large gap in income, education, and culture between farmers and professionals. Many technology transfer workers and on-farm researchers prefer not to work in the difficult environments where resource poor farmers live.

Lower status is associated with less education and experience. This can obstruct researchers from accepting input and feedback from lower-status groups, such as technology transfer workers or on-farm researchers. Yet it is these groups who are often in closer contact with real farming conditions and who recognize the inadequacies of the technologies research stations produce. When status differences are not surmounted and feedback channels established, it is difficult for this knowledge to be used to define relevant problems and produce appropriate technologies.

Perceived status differences also hinder the use of collaboration as a mechanism for strengthening links. For example, in trial work, scientists often limit the responsibilities of extension workers, or even on-farm researchers, to simple implementation tasks. They ask these groups to find farmer collaborators, lay out the trials, and do the manual labor, but exclude them from planning the research and from analyzing or interpreting the results. Field staff resent, and will often resist,

this type of 'collaboration' when they are asked to take on additional responsibilities without receiving any professional benefits (Ewell, 1989). In the Caqueza project in Colombia, this type of unequal partnership led to severe conflicts which disrupted several research projects (Zandstra et al., 1979) (*see* Box 5.1).

Box 5.1
Colombia: Conflicts arising from status differences

In Colombia, researchers from the agricultural research institute wanted to use staff from the Caqueza development project to help them collect data, but felt that analyzing this information or using it to produce recommendations was purely a research responsibility. Project staff, on the other hand, felt that both groups should participate equally in implementation and analysis, with equal recognition. They resented always being regarded as junior partners. This led to several clashes between the two groups.

These conflicts, in addition to their dissatisfaction with the technology researchers were offering, led project staff to undertake their own adaptive research efforts. Researchers, on the other hand, were sceptical about project staff's ability to carry out research-related tasks since they had limited formal training in agronomic research. The researchers complained that the development project's research activities duplicated previous work, suffered from faulty experimental design, and confused demonstration activities with experiments.

(Zandstra et al., 1979)

Status differences shape the attitudes researchers and technology transfer workers hold towards one another. The review of survey data from 18 countries on research-extension links shows that researchers frequently view extension workers as ineffective (Seegers and Kaimowitz, 1989). They blame the problem on inadequate education and training, poor incentives, and high staff turnover. Extension workers, on the other hand, do not question the technical competence of researchers, but often question the relevance of their research as well as their commitment to communicating its results to users — both extension workers and farmers.

The status problem also afflicts on-farm research. On-station researchers' low esteem for on-farm research was the key factor hindering its effective integration in at least half of the national research systems studied by ISNAR (Merrill-Sands and McAllister, 1988). In particular, status problems undermined on-farm researchers' ability to effectively feed back information on farmers's problems and priority needs to experiment station researchers.

The status problem has no simple solutions. Lack of respect for one's partner poses a powerful barrier to developing links (*see* Section 1). Managers have three options for coping with status differences and their impact on links (Zuidema, 1989):

- reduce the differences;
- manage the differences;
- avoid the differences.

Reducing status differences

Managers can reduce the status differences between research and technology transfer by creating training opportunities for technology transfer workers and encouraging their sense of professionalism. Training can prepare them to take on higher status tasks such as consolidating research results and packaging information, making recommendations, testing technologies, and providing systematic feedback from farmers. The joint training of researchers and technology transfer workers is particularly effective because it allows the development of a common approach based on a shared philosophy (*see* Box 1.6). Professionalism can be encouraged by providing various incentives, such as opportunities for joint publication with researchers and for attending conferences. The best encouragement of all is provided when managers and researchers formally acknowledge technology transfer workers' achievements.

Strengthening technology transfer in these ways has obvious advantages and can be highly effective in building a more integrated national system. Nevertheless, narrowing the gap between researchers and technology transfer workers by increasing the status of the latter risks widening the gap between technology transfer workers and farmers. Technology transfer workers who have gained more professional credentials may become less willing or able to interact effectively with resource-poor farmers.

A second option open to managers seeking to reduce status differences is to improve the employment conditions of technology transfer workers. The most direct way of doing this is to raise salaries in line with increased responsibilities, offering better grades to those who become involved in more professional tasks, especially research. One problem with this approach is that, while reducing status differences in one direction, it simultaneously increases them in the other. Rewarding technology transfer workers for conducting adaptive research might set them apart from colleagues who do not have such responsibilities. Another, more acute problem is that actions of this kind often have financial and structural implications that make them impossible to institute in a developing country civil service.

In the workshop discussions, managers noted several other, less direct measures which could help reduce status differences. These include changes in benefits (such as housing or other allowances), in the quality of offices and administrative support, and in the availability and condition of vehicles. Small improvements in these areas can often bring about a marked rise in both morale and performance. For example, the efficiency as well as the status of technology transfer workers can be improved substantially by ensuring that enough vehicles are available and in good working order to enable them to do their work.

Another approach is to help the group with the lowest status — resource-poor farmers — organize themselves to apply pressure for higher quality (and hence higher-status) services (Roling, 1989). This is one of the aims of the collegiate approach to farmer participation in research (*see* Section 1). Individual managers do not have much opportunity to organize farmers on a national scale, but they can help to persuade senior policy-makers of the effectiveness of this approach. If high-level political support is obtained, paraprofessionals can be recruited on a sufficiently large scale to disseminate technology widely and promote dialogue between rural families and public-sector services.

Box 5.2
Guatemala: Using rural leaders to reduce status differences

Over 4,000 rural leaders have been hired by Guatemala's Ministry of Agriculture, which pays them a small salary. They work closely with extension agents and groups of farmers in transferring new technology. They also act as a channel for feedback to guide the research program, and have helped establish a seed distribution system.

Rural leaders are influential and respected members of the community, but the difference is that they are elected by that community with an explicit mandate to act as a link between the government agencies and the people. Care is taken not to remove them from the rural environment, not to change them into trainers or bureaucrats. They divide their time equally between working with their group of farmers and working on their own farm.

(Ortiz et al., 1989)

As the Guatemala case illustrates, the advantage of using paraprofessionals is that, while becoming aware of how the public services operate and what they can offer, they retain close contact with the local community (Ortiz et al., 1989) (*see* Box 5.2). Paraprofessionals are often highly motivated, since being selected for this role is usually a mark of status within the local community. Nevertheless, experience has shown that these positions can become highly politicized and result in yet another level of status problems.

The drawback to this approach is that farmers' organizations rarely maintain technology as their primary focus. Issues such as land tenure, social services, and pricing policy soon dominate the agenda. A further problem with farmers' organizations is that progressive farmers still tend to get more than their fair share of attention.

Managing status differences

A second, and often complementary approach, is to accept status differences but manage them so as to minimize their negative impact. Differences in status need not lead inevitably to poor collaboration. Options for managers include developing a shared goal for collaborating partners, applying pressure to achieve that goal, clearly defining the roles of each partner, and changing personnel policies so that these encourage collaboration.

Developing a shared goal is vital for successful collaboration (*see* Section 6). In integrated systems where there are shared goals, status differences may persist but are less pronounced. The difference is that the system works in spite of them. It does so because all participants recognize that their real interest lies in working together to make the system as a whole more successful.

Managers can also stimulate collaboration by adding pressure to achieve impact. The extent of status problems is closely related to the success or failure of the joint program itself. Success

helps to minimize conflict and status differences. Failure, on the other hand, often leads to the identification of scapegoats — the allocation of blame based on status (Zuidema, 1989). ISNAR's on-farm research case studies show the importance, to the status of the on-farm research team, of achieving success early in the program. Success in generating technologies that farmers have adopted makes commodity researchers much more interested in collaborating with the on-farm team (Merrill-Sands and McAllister, 1988).

Defining roles clearly is another way to manage status differences. Status problems are frequently aggravated when one party feels the other is not doing its job. This is often a result of false expectations. Researchers and managers often overlook the fact that many extension workers have other duties besides transferring technology. They should make sure that these personnel have the time to actually perform the tasks researchers request of them. The case studies indicate that collaboration has the greatest chances of success when a group of extension workers' jobs are redefined to concentrate exclusively on technology transfer tasks; this forms a cadre of specialists.

Establishing routine procedures and standardized tasks, as in the Training and Visit system of extension, minimizes the negative aspect of status differences. Staff have clear expectations of their jobs and how they are supposed to relate to one another. However, systems that adopt routine procedures are usually more effective at pushing information downstream than at eliciting feedback from users. This approach also operates more effectively in stable and homogeneous, rather than diverse, environments.

Changes in personnel policies can be effected in such areas as job descriptions, performance appraisals, and the qualifications required for staff assigned linkage responsibilities. Job descriptions should specify the requirements for collaboration in detail; they represent a good opportunity for orienting staff towards meeting these requirements. Similarly, performance appraisals should reflect the value placed on collaboration by allowing performance in this area to be evaluated and rewarded. In The Gambia, linkage responsibilities are now being written into the job descriptions of all researchers, and guidelines are being issued on the percentage of their time to be devoted to specific linkage activities (Sompo-Ceesay and Gilbert, 1989). Staff will be evaluated not only on the quality of their research but also on its effective transfer to clients. Incentives such as recognition awards, consultancy fees, or improved conditions of service are also under consideration. Participation in workshops and study tours may be made conditional on a demonstrated interest in linkage activities.

Changes in personnel policy may look insignificant by themselves, but used in combination with incentives that enhance a sense of professionalism, they constitute a powerful means of defusing the status issue and promoting collaboration.

Avoiding status differences

When status differences or conflict constitute an insuperable barrier to effective links, or there is no possibility of strengthening a chronically weak partner, managers may try to avoid these

problems altogether by seeking alternative partners for technology transfer. There is no real substitute for the wide geographical coverage and impartial advice an effective national extension service can offer. However, during the workshop, managers made the point that they should not be limited to building links only with extension organizations, especially where these are in severe decline. By diversifying partners, managers can ensure that at least some technologies are transferred.

Options open to research managers include hiring technology transfer workers, linking directly with technicians in the private sector, and linking with nongovernmental organizations (NGOs). In Chile, for example, the national research institute set up its own extension unit to ensure that technologies were delivered effectively to farmers (Altmann Moran, 1989). In Tanzania, the secondment of extension staff from the ministry to a specialized extension component in the National Coconut Development Programme has proved to be very effective in avoiding status differences (*see* Box 5.3).

Box 5.3
Tanzania: Avoiding status differences between research and extension

The National Coconut Development Programme (NCDP), a parastatal, established its own extension component with staff seconded from the ministry. These staff provide technical knowledge and services to local extension workers and directly to farmers.

Status differences have been avoided because the NCDP extension staff, who are specialized in coconut production, have been able to develop technical expertise to complement their knowledge of producers' conditions and problems. This has facilitated successful links with researchers. On the other side, links with local extension workers are strong because the two groups have similar backgrounds and experiences and can work together well in the field. The NCDP staff can translate research results into language the field staff can easily understand.

(Lupanga, 1989)

Hiring technology transfer workers helps to offset status differences because a single set of personnel policies and procedures applies both to these workers and to researchers. With both groups controlled by a single manager, a common set of values can be cultivated. This option is a special case of merging research and technology transfer, and is appropriate only under certain circumstances (*see* Section 2).

The advantages of links with private-sector technicians are that these staff are often better educated and more highly motivated than those of the public sector, with the result that status differences are reduced. For example, in the Philippines, a multinational company, Ciba-Geigy, provided a university research department with funds to develop a fungicide to control corn downy mildew, and then took over the extension service's role of transferring the technology to farmers (Bernardo, 1989). However, there are also disadvantages to this solution. The coverage of farmers will be reduced, since only those who can afford purchased inputs and services will

be involved. A further concern is that farmers may not get the benefit of impartial advice. Lastly, private companies are not interested in technologies that are not saleable or profitable.

Some of the advantages of working with NGOs are discussed in Section 2. The disadvantages are the limited coverage and resources of NGOs, which often address only specific groups or areas.

In his summing up on how to tackle status differences, Zuidema (1989) suggests that the problem can be minimized if both parties:

- work within their mandates and areas of competence;
- clearly understand their roles and responsibilities within the system;
- have well-defined linkage and support mechanisms at field level;
- place a high value on collaboration;
- accept task interdependency as a basis for success.

Managing On-Farm Research Staff

Good staff management is critical to the successful integration of on-farm client-oriented research within the national system.

There are four main areas which the ISNAR study has identified as requiring managers' particular attention (Bingen and Poats, 1990). These are:

- guiding the work of junior on-farm researchers;
- getting the best out of foreign scientists;
- promoting interdisciplinary teamwork;
- providing strong leadership.

These are all areas over which managers can exercise some control. The discussion here looks at the first three issues; leadership is dealt with in Section 6.

Guiding junior scientists

Many on-farm research programs are staffed predominantly by junior scientists, who need guidance in their work. In five of the nine national programs studied, more than half of the on-farm research scientists had only BSc degrees (Bingen and Poats, 1990). It is widely recognized that on-farm research requires the input of experienced senior scientists, but that they are difficult to attract to on-farm research if this means spending long periods in the field in remote locations. Managers must therefore often rely on more junior staff. These staff have to be given the necessary support and guidance if the credibility of the on-farm research program is not to suffer.

The essential ingredient is good scientific leadership, whether this comes from an individual or from a group. At least one senior scientist must be made explicitly responsible for building a strong on-farm research effort and ensuring that the junior researchers receive technical support in areas such as experimental design, data analysis, and interpretation of results.

Managers in the case study countries had found various ways of meeting the need for scientific leadership. Long-term commitments by senior scientists to making short-term advisory visits to field programs are a promising solution. These scientists can be assigned mentoring duties explicitly. Because their involvement is ongoing, their 'outsider' status in the eyes of the on-farm team is gradually lost with each successive visit. Their growing familiarity with the on-farm research program makes them increasingly useful as advisors and enables them to act as a 'friend at court', representing the efforts and achievements of the on-farm research team to other scientists at headquarters and experiment stations. Incentives such as generous per diems can be used to encourage senior scientists to make regular visits.

Involving junior staff in research planning and review is a second important means of building their confidence. Managers can ensure their active participation by keeping the atmosphere informal, even when visitors are present. This kind of environment is often easier to create in the field than in the conference room. A key to success in providing support to junior scientists is to keep the relationship collegiate, avoiding an overbearing supervisory relationship.

Using foreign scientists

In most of the case studies, foreign scientists had made important contributions to on-farm research, but they had also posed management problems. In some instances they had pursued their own research interests, which had not been consistent with national priorities. In nearly all countries, the large differences in salaries and benefits between foreign and national scientists had created resentment. Often, national managers did not have enough say in the recruitment or job descriptions of foreign scientists.

Operating problems included the 'revolving door' syndrome — the replacement of an outgoing foreign scientist by a newly trained national scientist, without an adequate period of overlap between the two. The lack of an overlap period denied the incoming national scientist an important mentoring relationship to follow up his or her training.

Where permanent positions are created under long-term technical assistance arrangements, screening foreign candidates through initial short-term consultancies is an excellent means of ensuring that suitable candidates are selected. Clear job descriptions should be developed for foreign scientists, specifying their in-service training and mentoring responsibilities. At the end of their assignment, ensuring an overlap period with their successor provides a useful further in-service training opportunity and ensures the continuity of research.

Periodic short-term visits by a foreign scientist provide an attractive alternative to long-term assignments. This arrangement still provides continuity, while allowing the national program greater control and flexibility. It allows an incremental approach to the building of skills in the

national team, with events such as program reviews, courses, and workshops scheduled to coincide with each visit. Short-term visits are management-intensive to plan and organize, but if this is properly done they can be very productive. The international agricultural research centers have often used this approach when helping national institutes develop an on-farm client-oriented research capacity.

Promoting interdisciplinary research

Many of the case studies revealed difficulties in developing interdisciplinary teamwork (Merrill-Sands et al., 1990). The weight of scientific tradition, with its strong emphasis on disciplinary recognition, still exerts a considerable, negative influence. Scientists often had 'disciplinary career' objectives, such as publishing in a scholarly journal, rather than the 'social' objective of developing and transferring a new technology.

One of the prerequisites for interdisciplinary teamwork is that each scientist must know enough about the others' disciplines to ensure effective interaction. Cross-disciplinary training is an important but under-used means of achieving this. Strong emphasis on team building is another prerequisite.

Bringing researchers together in the field to discuss farmers' problems is a useful way of breaking down disciplinary barriers, particularly if the exercise is carried out regularly. This approach, basic to on-farm research, lays the foundations for interdisciplinary teamwork in the subsequent stages of the research process. This was evident in Nepal, where the group trek was used not only to identify constraints but also to prioritize them and to plan research, all three steps being carried out in the field (Ewell, 1989) (*see* Box 4.2).

Section 6

THE MANAGEMENT CHALLENGE

"If linkages are to be effective, a high-level manager must be given personal responsibility for forming and maintaining links. Nobody's job is ever finished by 'somebody' or 'anybody'."

Abedin and Chowdury (1989)

"Remember: an on-farm research leader must inspire staff, create esteem for the program, and champion the cause of on-farm research."

Bingen and Poats (1990)

The Management Challenge

No organizational structure or set of coordination mechanisms, however good, can substitute for active management in forging strong links.

Managers make the difference between strong and weak links. They have to diagnose their environment and develop the specific strategy for strengthening links. They have to choose the types of mechanisms which are most appropriate for their own institutions and objectives. They have to create the institutional conditions which promote links and motivate staff to work together. And they have to be responsive to changes in the environment, adjusting mechanisms and approaches to fit the changing conditions and linkage requirements. This means that they should be alert, flexible in their thinking, and firmly committed to building links with technology users.

The following discussion, while highlighting many of the key points made in earlier sections, focuses on the central role managers must play in developing links and creating the institutional conditions for successful collaboration.

The Need for Active Management

To ensure the cooperation of all actors, managers need to create an environment which promotes what Bourgeois (1989) calls 'the will to integrate'. They need to inspire their staff to be committed to making links work. To do this, they must initiate and maintain dynamic linkages through effective support, incentives, guidelines, and resource allocation. In essence, active management implies:

- leadership;
- flexibility and a 'hands-on' approach;
- the ability to manage conflict.

Leadership

Effective leadership is essential in any linkage situation. The ISNAR study shows that strong scientific leadership is needed to integrate on-farm client-oriented research and uphold its status and credibility within the national agricultural research system. Bingen and Poats (1990) draw on the case studies to describe the qualities of a strong on-farm research leader. Many of the conclusions arising from their analysis are equally valid for leadership in the broader context of managing links in the agricultural technology system (*see* Box 6.1 *overleaf*).

Box 6.1
Leadership in the on-farm research context

On-farm research leaders' responsibilities include developing and guiding strong scientific programs, building effective field teams, managing arrangements with donor agencies, disseminating research results, and developing appropriate links with other scientists, with farmers, and with technology transfer workers.

Successful on-farm research leaders and managers have:

- on-farm experience;
- administrative and managerial experience;
- a good working knowledge of all the disciplines involved in the program;
- personal commitment and the ability to inspire commitment in others;
- the ability to resolve conflicts and foster collegial relationships;
- a forward-looking approach.

Among the most important of these is the ability to inspire commitment in others, both within the program itself and in the national system as a whole. A strong leader is needed to defend the scientific credibility of on-farm research and champion its cause. "A consensus in favour of on-farm research among the leader's senior colleagues in the national system is a vital ingredient in the mix of conditions necessary if on-farm research is to prove institutionally sustainable. It is the leader's responsibility to build this consensus and commitment."

To inspire commitment, a leader must earn the respect of all parties involved. Administrative and scientific competence are therefore essential qualities, and must be backed up by an ability to forecast long-term needs and make adequate preparations to meet these needs — for example, putting in place effective measures to address potential changes in funds, staffing patterns and availability, or program objectives.

(Bingen and Poats, 1990)

Flexibility and a 'hands-on' approach

The development, transfer, and use of technology is a dynamic process, and the links set up in this process must reflect this. Links which work successfully in one institutional context do not necessarily work well in another. Nor does any set of circumstances remain static; changes occur in national and institutional policies, funding levels, the availability of qualified personnel, the types of technologies being developed, and the needs of clients. Links have to change as circumstances change.

Managers need to monitor and evaluate links to assess their effectiveness in the light of changing circumstances, and to introduce measures or adjustments which accommodate the changes. This requires considerable time and energy, as well as flexibility and creativity in the design and management of linkage mechanisms.

Managing conflict

Managers have to learn how to manage conflict. This has emerged as a key issue in both the ISNAR studies. It also emerged as an important issue in Sonder's (1980) study, which identified conflict as the most severe constraint to effective collaboration (*see* Section 1). However, managers must also bear in mind that a certain amount of creative tension can be productive. Complete accord can lead to complacency, which also reduces performance. The challenge is to turn potential for conflict into constructive debate.

Persuading staff from different but interdependent units or institutions to work together requires careful handling. This is especially true where there is considerable variation in staff background, experience, status, and objectives. With such differences, the potential for conflict is high, and this conflict can too often degenerate into unproductive institutional infighting or, simply, studied avoidance (*see* Box 6.2).

Box 6.2
Turning conflict into constructive debate

Many of the on-farm research case studies revealed serious and often debilitating conflicts between on-station and on-farm researchers. These conflicts arose not only from fundamental differences in objectives and priorities but also from differences in research methods, design, types of data collected, and how these data were analyzed and interpreted.

The challenge facing on-farm research managers is to find ways of turning this conflict into constructive debate. These measures should aim at:

- ensuring that on-farm research is seen as a complementary approach to on-station research and not as a way of correcting past failures of on-station research to transfer relevant technologies to farmers;
- avoiding ambiguity by working with all participants to develop a clear and realistic policy on the role, responsibilities, and products of the two sets of research activities;
- ensuring that on-farm research is perceived as a research activity, not simply as a technology transfer activity;
- promoting respect and understanding between the two groups, and a willingness to cooperate.

(Merrill-Sands and McAllister, 1988)

Creating Institutional Conditions for Effective Links

Managers should strive to create institutional conditions which promote effective links. Managers committed to strengthening links should view these conditions as their strategic objectives, while recognizing that not all can be attained in the short term. They can also use them as a checklist for diagnosing the quality of existing links and determining areas which require their intervention.

The ISNAR studies have identified seven key institutional conditions which facilitate links (Kaimowitz et al., 1989; Merrill-Sands and McAllister, 1988) (*see* Box 6.3).

It is important to emphasize, however, that managers should invest energy in creating these conditions only if the groups involved have a basic level of competence and are willing to cooperate. If not, it is best to look for another partner, 'go it alone', or invest in the longer-term strategy of strengthening the other partner.

Box 6.3
Institutional conditions which promote effective links between groups

Links are likely to be effective where members of groups:

- share a common overarching goal and sense of mission;
- feel that they depend on each other to successfully accomplish their tasks;
- agree upon the tasks each should perform to get the job done and on their relative importance;
- view each other as professionally credible, with the capacity to follow through on agreements;
- view each other as partners, not as competitors;
- have adequate opportunities for formal and informal interaction;
- consider that the personal benefits of collaboration outweigh the costs.

(Kaimowitz et al., 1989; Merrill-Sands and McAllister, 1988)

Developing a shared goal

Developing a shared goal and sense of mission among groups which depend upon one another for their success is the most important condition a manager can put in place for building strong links. The case experiences show that fundamental differences among groups in terms of objectives, priorities, clients, or strategies lead to severe and costly linkage problems. The findings emerging from the Souder (1980) study on private-sector research and marketing links confirm this.

Managers should recognize, however, that this condition is difficult to attain. It usually requires bringing about fundamental changes in institutional culture — changes in staff's professional goals, attitudes, and values. For example, shifting researchers from focusing on disciplinary objectives (advancing scientific knowledge and publishing in international journals) to focus on development objectives (generating relevant technologies for farmers) can be a slow and painful process. Yet the change is critical if managers are to succeed in developing effective links with technology users.

The cases show that it is easier for managers to forge a shared goal and sense of mission when the following conditions exist: the groups have a common set of clients and topics of concern; there is external pressure to improve institutional performance; the institution is small and has a clear and limited focus; the groups are responsible to a common supervisor; and there is continuity in leadership.

What managers need to do:

- support words with action by providing a consistent internal policy which supports the declared goal and places emphasis on links;
- provide leadership by taking part in linkage activities and giving them high visibility and priority;
- provide incentives and rewards to encourage commitment to linkage activities;
- use mechanisms such as joint problem diagnosis, joint training, and joint priority-setting and planning to set a clear goal and complementary objectives.

Promoting understanding of interdependence

For links to work, the groups themselves — and not just their managers — must feel that the success of each depends upon the other. If on-station researchers, on-farm researchers, and technology transfer workers do not recognize that they depend on one another to get relevant technology to farmers, there is little motivation to link.

A common problem found by the study on links between research and technology transfer was that extension workers often did not recognize the interdependence between research and extension as much as researchers did. Researchers recognized that they depended on extension workers to disseminate results, but the latter saw technology transfer as only one of their many responsibilities.

The on-farm research study found that linkage problems arose not because on-farm and on-station researchers did not recognize their interdependence, but because they differed in how they viewed the nature and scope of that interdependence. This emerged with respect to feeding back information on farmers' priority problems and needs. Many on-station researchers did not feel that they needed to rely on on-farm researchers to understand what farmers needed; in contrast, on-farm researchers saw feedback as one of their primary responsibilities. These differences in perceptions caused tensions which jeopardized links in half the cases.

The cases show that managers find it easier to get groups to understand that they depend upon one another for success when they are focusing on a common client (such as the peasant farming sector in Zimbabwe), when they are working on the same commodity (such as coconuts in Tanzania), or when they are concerned with the same agroecological zone (such as the Nariño Highlands in Colombia).

What managers need to do:

- create demand in each group for the other group's services and products by promoting collaborative professional activities and improving communication facilities;
- create opportunities for staff to become familiar with each other's work and approaches by using mechanisms such as seminars, joint field visits, joint review meetings, and collaboration in professional activities;
- encourage groups to work together to diagnose problems and set priorities;
- exert pressure for impact, to force groups to recognize their interdependence;
- reward achievements based on collaboration, not simply on separate activities.

Seeking agreement on assigned tasks

Ambiguity about groups' respective roles and responsibilities can have high costs. It can cause 'turf' problems where one group feels that the other is taking away some of its power, duplicating its work, or reducing its scope of activity.

Ambiguity can also create false expectations. Conflict erupts when a group does not deliver expected services or products simply because it did not see this as its responsibility. As was seen in the Zimbabwe case in Section 4, a common example of false expectations is researchers' frustration when extension agents do not manage on-farm trials properly because it is only one of their many duties (Ewell, 1989).

The problem of 'missing tasks', discussed in Section 3, is another likely result of ambiguity. Critical tasks remain undone because they were never clearly assigned to either group. Conflicts break out as each group blames the other for the breakdown in the process.

It is easier for managers to clearly define roles and responsibilities when the groups are in the same institution and have the same supervisor, when there is continuity in management and staff, and when there is strong commitment to the collaborative effort from all levels of the hierarchy.

What managers need to do:

- develop a clear policy on groups' respective roles and responsibilities;
- build this policy on consensus among participants, rather than by decree;
- ensure groups consider the roles assigned to them are legitimate, feasible, and important;
- provide incentives for staff to perform assigned tasks and fulfill obligations;
- make effective use of joint planning and review mechanisms so that groups feel accountable to one another;
- encourage collaborative activities to help groups define how they can best work together.

92

Cultivating mutual respect

Collaboration must be built on a foundation of mutual respect, where each group regards the other as professionally competent and reliable. Problems arise when one group views the other as unable or unwilling to perform tasks, when one group does not agree with the other group's approach or methods, and where there are considerable status differences between the groups.

Both ISNAR studies show that these problems frequently jeopardize links. The Souder (1980) study, too, shows that problems stemming from 'lack of appreciation' between groups markedly reduced performance in product development. In the on-farm research study, fostering mutual respect has emerged as probably the most important objective for managers. In five of the nine case studies, on-station researchers' low esteem for on-farm research was found to be at the root of linkage problems. Managers should be vigilant on this issue.

What managers need to do:

- set realistic objectives for collaboration that are in line with the capacities and resources of both groups;
- ensure that groups are staffed with competent professionals, or that junior staff are supported by senior staff;
- provide strong scientific or professional leadership to ensure quality of work;
- provide specialized training in required skills, and joint training so that staff adopt similar approaches;
- use linkage mechanisms which foster mutual respect, such as joint field visits and joint problem diagnosis;
- second staff from one group to another, or rotate staff between groups, so that they develop an appreciation of each other's aims, methods, and constraints.

Minimizing competition

Unless managers promote an environment in which groups view each other as partners, there is likely to be competition for resources, power, and control over the research agenda. Professional jealousies and open hostility undermine links and can cause technology development and delivery to fail.

Competition occurs more frequently when groups are part of the same institution and compete for the same resources. In a third of the on-farm research case studies, it was found that serious linkage problems arose because on-farm research programs were capturing donor resources at the expense of commodity and disciplinary programs. This problem is also more likely to surface when research and extension are merged into the same institute.

Power struggles over control of the research agenda were identified in two thirds of the on-farm research cases studies. Problems were accentuated when commodity and disciplinary scientists

felt that on-farm research had been introduced as a strategy to correct their past failures in generating technologies for resource-poor farmers. Problems also arose when on-farm programs had been built up rapidly and independently, when one group had been allowed to assume a supervisory role, or when managers had given more status to one group than another.

What managers need to do:

- ensure a balanced build-up in both sets of activities;
- avoid giving any particular activity or group special status;
- experiment with resource-sharing between the groups, particularly in terms of personnel and equipment;
- formally allocate staff time and operating funds to linkage activities in order to minimize competition or disputes over the funding of these activities;
- assign coordination responsibilities to a neutral person or unit;
- allow some competition between groups to stimulate creativity, but manage it carefully.

Creating opportunities for interaction

The need to give groups opportunities for formal and informal interaction is common sense but it is often overlooked. In the on-farm research case studies, the opportunities for interaction between on-farm and on-station researchers were insufficient in over half the cases. Interaction is necessary for exchanging information, launching joint activities, and building collegial relationships. Managers need to be creative in developing opportunities for informal interaction.

What managers need to do:

- bring groups together in the same organizational unit;
- post members from different groups to the same station, office, or region;
- improve communication facilities;
- sponsor social events which bring groups together informally;
- cluster on-farm activities to permit more frequent contacts in the field;
- actively encourage members of groups to consult each other and meet together informally.

Ensuring that staff benefit from collaboration

Successful links depend upon committed people. It is essential that managers encourage their staff to see that the potential benefits of participating in linkage activities outweigh the costs. They must be sensitive to staff's personal ambitions, motivations, and values. The challenge for

managers is to get staff's personal ambitions and interests to coincide with their objectives in developing links. The basic lesson emerging from the studies is that managers cannot impose links or make them mandatory; rather, it is up to them to motivate staff to make links work. This requires creating values within the institution which support linkage objectives.

To increase staff motivation, managers have to make sure that linkage activities do not jeopardize staff's professional standing by detracting too much time from activities for which they are directly accountable or which bring them professional recognition. They also have to ensure that linkage activities do not create personal costs. Inadequate per diems, for example, quickly dampen scientists' interests in traveling to the field to work with on-farm researchers or technology transfer workers. Staff should be compensated for hardships incurred by traveling under difficult conditions, long separations from home, or isolated regional postings.

What managers need to do:

- take part in linkage activities to demonstrate their importance;
- build linkage responsibilities into job descriptions;
- provide guidelines for staff on how much time to allocate to linkage activities;
- reward participation in linkage activities;
- provide funds explicitly for linkage activities;
- minimize, or compensate for, hardships involved in linkage activities.

Effective collaboration rarely occurs spontaneously. Someone has to be responsible for making links work. This is the job of managers. They must create the conditions that promote staff's commitment to links from the field level to the top of the administrative hierarchy.

A Research Manager's Concluding Remarks

Gabriel Montes Llamas, Director General of the Instituto Colombiano Agropecuario, Colombia, was invited to give his reaction to the ideas presented during the workshop.

THE GOAL OF EVERY RESEARCH and extension institution in the world is to produce relevant technology, transfer it to farmers in an efficient manner, and thus have a sizable impact on agricultural production and farmers' welfare. To reach this goal obviously requires links — between the institution and the outside world (national and international agencies and policy-makers); within the institution, among researchers and between researchers and technology transfer workers; and between the institution and its clients, the farmers. But these links do not develop spontaneously. They are costly to operate and take time and creativity to manage.

Relevance

According to some analyses, the easiest way to solve the problem of relevance is to increase farmers' participation in the process of research and technology transfer. However, one has to be careful that the cost of ensuring relevance is not too high. There are alternative methodologies that will achieve the same goal, and these can be combined with some kind of efficient farm participation. In the first place, you have to define your diagnostic tools on the basis of detailed knowledge of the agroecological and socioeconomic conditions in which different types of farmers live, as well as the importance of these farmers now and in the future. Then you should set your priorities in terms of regions and products and clearly identify target groups according to national development policies. After this, you can design ways in which your findings for a particular region and type of farmer could be extended to other regions and farmers.

Another important issue is to establish in what way, at what level, and at what stage farmer participation would be most effective. Clearly, some degree of farmer participation is necessary and we must devise ways of promoting it. You can have it at the farm level, with farmers working alongside researchers and technology transfer workers; or you can promote it at higher levels, with farmer representation on research station advisory councils or on regional or national boards; or you can have a combination of these. So, as in other fields, you have here an optimal path and an optimal point. It would be unreasonable to expect to be able to completely solve the problem of the relevance of technology if you are dealing with a heterogeneous environment and a complex research and technology transfer system.

Context

With reference to relationships with the outside world, it is clear that the work of research and extension institutions must be responsive to political realities. This can be perceived as an

96

'external pressure', but the recognition of these realities should be reflected in the institutional frameworks if institutions want to attract public support. They also have to take account of their socioeconomic context if they want technology to respond effectively to society's real problems; they have to establish channels through which technology users' demands can be expressed and recognized.

It is also important to approach the linkage issue from a dynamic point of view. Changes in the socioeconomic context require changes in the organization of institutions and in the relationship between research and extension. At the same time, organizational changes must fit the specific context if they are to be successful; they should be backed up by resources and training, as well as by the recognition that it will take time for them to begin operating effectively, as the Costa Rican case showed.

It is interesting and useful to look at the issue of external pressure. Do institutions perform effectively only when they are subjected to external pressure, when farmers are organized and can articulate demands, or when there is a donor involved, asking questions and monitoring and evaluating progress? I think that this is rather a simplistic view of the dynamic and complex relationship between institutions and their environment. In fact, sometimes institutions deliberately seek external pressures from governments, donors, or farmers. These pressures are usually accompanied by resources and other kinds of support. On the other hand, the presence of a donor sometimes weakens links, particularly when some people try to identify themselves with a specific program that has attracted considerable funding. This was the case in Colombia, where people called themselves ICA-DIA, ICA-USDA, or ICA-Holland, instead of simply ICA.

Among the other interesting issues analyzed in the workshop was the finding that different technologies require different kinds of links. This merits some thought because of the modifications in terms of management and resources that it implies. Technologies differ in applicability, complexity of the types of users, and so on, and institutions should have enough flexibility to manage this in an effective and economic way.

Institutional organization

A key issue raised at the workshop concerned the location of research and extension. Is it better to have them in the same institution or in different institutions? The conclusion — correct in my view — is that merging does not necessarily lead to success or failure. There are a lot of additional factors that come into the picture: the context in which institutions work, the amount of resources they have, and the capacity of managers to carry out and support the necessary activities. In my own experience in Colombia, we decided not to divide research and extension but, rather, to rationalize the system. Initially, we delegated to municipality extension workers the task of providing direct technical assistance to farmers; we also decentralized much of our adaptive research so that it would be carried out in specific regions in collaboration with extension workers, using farmers' plots.

I also find interesting the analogy between extension and marketing. It is obvious that research results are not a homogeneous commodity, but when we use this analogy, much of the linkage problem becomes very clear to me. For example, in the case of a company producing cars, its

marketing personnel would not advertise bicycles; similarly, although companies sometimes hire advertising agencies or decentralize publicity to dealers, they do not place the whole marketing effort in a different company.

Small systems, such as Guatemala, which are involved mainly in adaptive research, devote most of their resources to on-farm research, which minimizes communication problems between researchers, extension workers, and farmers. However, although this has been successful in the short term, it could lead to stagnation in the long term. In my opinion, the workshop did not analyze sufficiently the alternatives open to small country systems.

Research and technology transfer links

As important as these structural matters are, and given that an institution has clear goals that are compatible with national policies and defined channels through which users can make their demands known, it is still important to recognize that the tasks of producing and transferring relevant technology are carried out by two groups of people -- researchers and technology transfer workers -- and that these groups differ in attitudes, interests, and training.

There are a series of tools and mechanisms which management can use to promote links among researchers and between researchers and technology transfer workers. Among these we have committees, coordinating units, and direct supervision. In my view, committees, liaison persons, and coordinating units often have a difficult time creating effective links, unless they have power and authority or control a budget. Researchers and extension workers are difficult to manage through voluntary mechanisms; in general, formal mechanisms such as incentives and rules tend to work better. It is not surprising that the studies show that mechanisms such as joint review meetings, joint diagnosis, and joint programming and priority-setting are among the most effective in promoting links. To be even more effective, these joint planning and review mechanisms should lead in the medium term to an integrated project that would include research and extension components. However, this could be too costly to implement and supervise, and we should stick to what is feasible.

It should be recognized that these concrete mechanisms will work only if the general philosophy and working environment of the institution foster collaborative work. That is why we must be very careful in designing research and extension systems, and we must reorganize the systems only when things are not working properly. In the end, links are between people and nothing can replace a good environment in which researchers and extension workers can communicate freely, constructively, and informally.

Conclusion

It is clear from the analyses carried out and the cases presented at the workshop that links are important for performance. It is also clear that the context and nature of institutions is so different that we cannot have general recipes to establish links. In addition, we should bear in mind that links are costly in terms of resources which have to be diverted from research and extension. We have to be very precise about what kind of links are needed, at what level they should be

established, and what goals we hope to achieve. When we need so many linkage mechanisms that an organization becomes excessively complex, we have to start thinking about reorganization rather than creating more positions or units in the organization.

Finally, the goal of developing links to build bridges between researchers and extension workers should not make us forget that specialization and division of labor have contributed to growth throughout history. Sometimes a bit of competition between different actors will lead to improved performance by each of them, as long as the social and institutional goals are clear for everyone.

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Most conference papers have been or will be published under one of the ISNAR studies' publication series (*see* Appendix 4). Single copies are available upon request by writing to ISNAR, P.O. Box 93375, 2509 AJ The Hague, The Netherlands. They are free of charge to institutions and individuals working in agricultural research and technology transfer.

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Appendix 2

Conference Agenda

Session I Introduction

Chairperson: Dr Howard Elliott, ISNAR

Opening	Dr H. Elliott (Acting Director General, ISNAR)
Introduction to the Workshop and to the Study on the Organization and Management of On-Farm Client-Oriented Research	Dr D. Merrill-Sands (Workshop Coordinator Study Leader, ISNAR)
Introduction to the Study on Research-Technology Transfer Linkages	Dr D. Kaimowitz (Study Leader, ISNAR)

Session II Making the Link with Technology Users: Ensuring Relevance

Chairperson: Dr Michael Collinson, CGIAR

	Presenters
Why Farmers Matter: The Role of User Participation in Technology Development and Delivery	Dr N. Röling (Wageningen Agricultural University, The Netherlands)
Farmer Participation in Research: A Review of Experiences	Dr J. Ashby (CIAT, Colombia)

Session III Making the Link with Technology Users: Ensuring Effective Transfer

Chairperson: Dr N'Guetta Bosso, ISNAR

	Presenters
Linkages between On-Farm Research and Extension in Nine Countries	Dr P. Ewell (CIP, Kenya)
Closing the Gap between Research and Limited-Resource Farmers: A New Model for Technology Transfer in Guatemala	Dr S. Ruano (Guatemala)
Institutional Linkages for Different Types of Agricultural Technologies: Rice in the Eastern Plains of Colombia	Dr L. Agudelo (ICA, Colombia)

Session IV Strategic Issues in Making the Link

Chairperson: Mr Huntington Hobbs, ISNAR

	Conveners
Working Group Discussions	
Themes:	
Complementary Roles of On-Farm Client-Oriented Research and Research-Technology Transfer Linkages	Dr G. Semuguruka (Tanzania)

Resolving the Tension between the Need for Intensive Participatory Methods and the Need for Broad Geographical Coverage	Dr A. Bojanic (CIAT, Bolivia)
Different Linkage Requirements for Different Types of Technology	Dr E. Trigo (IICA, Costa Rica)
Alternative Ways of Organizing User Participation in Research and Technology Transfer	Mr L. Gahamanyi (ISAR, Rwanda)

Reports of Working Groups and Plenary Discussion

Session V Putting the Links into Context

Chairperson: Dr Eduardo Trigo, IICA

	Presenters
Contextual Factors Affecting Linkages: An Overview	Dr D. Kaimowitz (ISNAR)
The Effect of Changes in State Policy and Organization on Agricultural Research and Extension Links: A Latin American Perspective	Dr R. Martínez Nogueira (Argentina)
The Influence of International Agencies on the Links between Technology Development and Delivery Institutions in the Philippines	Dr E. Bernardo (University of the Philippines)
The Impact of Improved Institutional Coordination on Agricultural Performance: The Case of the Nariño Highlands in Colombia	Mr P. Engel (Wageningen Agricultural University, The Netherlands)
Optional Session	
Building Linkages for Lateral Learning among Farmers, Scientists and Extension Workers	Dr A. Gupta (Indian Institute of Management, Ahmedabad, India)

Session VI Organizational Considerations (Part I)

Chairperson: Dr Anil Gupta (Indian Institute of Management, Ahmedabad)

	Presenters
Promouvoir l'Integration par des Liens Structurels	Dr R. Bourgeois (ISNAR)
Placing Agricultural Research and Technology Transfer in One Organization: Two Experiences from Colombia	Dr D. Kaimowitz (ISNAR)
Efectos de los Cambios Estructurales en el Ministerio de Agricultura y Ganadería de Costa Rica sobre la Relación entre Investigación y Transferencia de Tecnología en Maíz	Dr V. Palmieri (Costa Rica)
La Méthodologie de la Recherche sur les Systèmes de Production comme Instrument de Réorganisation et Réorientation de la Recherche Agricole Sénégalaise	Dr J. Faye (SAFGRAD, Burkina Faso)
Special Issues for Small Countries in Making the Link between Agricultural Research and Technology Users: The Case of The Gambia	Mr M. Sompo-Ceesay (GARD, The Gambia)

Session VI Organizational Considerations (Part II)

Chairperson: Dr Anil Gupta (Indian Institute of Management, Ahmedabad)

Plenary Discussion of Organizational and Structural Factors Affecting Linkages with Technology Users

Optional Session	*Conveners*
Strengthening Links between Agricultural Research and Nongovernmental Organizations	Dr A. Bojanic (CIAT, Bolivia) Dr J. Farrington (ODI, UK)

Session VII Coordination and Linkage Mechanisms (Part I)

Chairperson: Dr T. Ajibola Taylor, ISNAR

	Presenters
Linkage Mechanisms: An Overview	Dr D. Merrill-Sands (ISNAR)
Relations between Agricultural Researchers and Extension Workers: The Survey Evidence	Mr S. Seegers (Wageningen Agricultural University, The Netherlands)
Managing Research-Technology Transfer Linkages: The Case of Agricultural Extension-Research Liaison Services in Nigeria	Dr J. Ekpere (University of Ibadan, Nigeria)
Bridging the Gap between Research and Extension in Zambia: The Incorporation of Research-Extension Liaison Officers into the Adaptive Research Planning Team	Mr L. Singogo (Zambia) Mr S. Kean (University of East Anglia, UK)

Session VII Coordination and Linkage Mechanisms (Part II)

Chairperson: Dr Robert Tripp, CIMMYT

	Presenters
Linking Research and Extension through On-Farm Research and Demonstrations: The Zimbabwe Experience	Mr R. Fenner (DR & SS, Zimbabwe)
Mécanismes Informels et Transfert de Technologie: Le Cas du Projet PACO dans Côte d'Ivoire	Dr T. Eponou (CIRES, Côte d'Ivoire)

Working Group Discussions

Themes:

Joint Planning, Informal Links, Liaison Units, Liaison Positions, Collaborative Activities

Session VIII Human Resource Management Issues Affecting Linkages

Chairperson: Dr Sergio Ruano (Guatemala)

	Presenters
Improving Collaboration between Research and Extension Workers	Dr L. Zuidema (Cornell University, USA)

Staff Management Issues in On-Farm Client-Oriented Research: Lessons for Research Managers	Dr R. J. Bingen (Michigan State University, USA)
Plenary Discussion and Working Groups	*Facilitators* Dr S. Poats (CIAT, Ecuador) Dr L. Zuidema (Cornell University, USA)

Session IX Summary and Conclusions

Chairperson: Dr Howard Elliott, ISNAR

	Presenters
Creating Institutional Conditions which Promote Strong Linkages: Key Lessons from the Case Studies	Dr D. Merrill-Sands (ISNAR)
Summary Observations	Dr G. Montes Llamas (ICA, Colombia) Dr B. Ouayogode (Ministry of Scientific Research, Côte d'Ivoire) Dr. M. Lantin (Department of Agriculture and Food, Philippines)
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Closing of Workshop	Dr H. Elliott (ISNAR)

Appendix 3

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Appendix 4

Publications from the ISNAR Studies

Study on the Organization and Management of On-Farm Client-Oriented Research

OFCOR Country Case Studies

No. 1 Zambia: Organization and Management of the Adaptive Research Planning Team (ARPT), Research Branch, Ministry of Agriculture and Water Development. *Stuart A. Kean and Lingston P. Singogo.*

No. 2 Guatemala: Organización y Manejo de la Investigación en Finca en el Instituto de Cienca y Tecnologiá Agricolas (ICTA). *Sergio Ruano and Astolfo Fumagalli.*

No. 3 Bangladesh: The Evolution and Significance of On-Farm and Farming Systems Research in the Bangladesh Research Institute. *M.A. Jabbar and M. Zainul Abedin.*

No. 4 Nepal: Organization and Management of On-Farm Research in the National Agricultural Research System. *B.N. Kayastha, S.B. Mathema, and P. Rood.*

No. 5 Zimbabwe: Organization and Management of On-Farm Research in the Department of Research and Specialist Services, Ministry of Lands, Agriculture and Rural Resettlement. *Marcelino Avila, Ephrem E. Whingwiri, and Bright G. Mombeshora.*

No. 6 Sénégal: Organisation et Gestion de la Recherche sur les Systèmes de Production. *Jacques Faye and R. James Bingen*

No. 7 Ecuador: Organización y Manejo de la Investigación en Finca en el Instituto Nacional de Investigaciones Agropecuarias (INIAP). *Rómulo Soliz V., Patricio Espinosa, and Victor H. Cardoso.*

No. 8 Panamá: Organización y Manejo de Programas de Investigación en Finca en el Instituto de Investigación Agropecuaria de Panamá (IDIAP). *Miguel Cuéllar M.*

OFCOR Comparative Study Papers

No. 1 Strengthening the Integration of On-Farm Client-Oriented Research and Experiment Station Research in National Agricultural Research System (NARS): Management Lessons from Nine Country Case Studies. *Deborah Merrill-Sands and Jean McAllister.*

No. 2 Organization and Management of Field Activities in On-Farm Research: A Review of Experiences in Nine Countries. *Peter T. Ewell.*

No. 3 Resource-Poor Farmer Participation in Research: A Synthesis of Experiences from Nine National Agricultural Research Systems. *Stephen D. Biggs.*

No. 4 Linkages between On-Farm Research and Extension in Nine Countries. *Peter T. Ewell.*

No. 5 Staff Management Issues in On-Farm Client-Oriented Research: Lessons for Managers. *R. James Bingen and Susan V. Poats*

OFCOR Discussion Papers

No. 1 Bridging the Gap between Research and Extension in Zambia: The Incorporation of Research-Extension Liaison Officers into the Adaptive Research Planning Team. *Stuart Kean and Lingston P. Singogo.*

External Publications

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Merrill-Sands, D. 1989. Assessing the Institutional Impact of On-Farm Client-Oriented Research Programs: Lessons from a Nine-Country Study. In *Contributions of FSR/E towards Sustainable Agricultural Systems: Proceedings of Farming Systems Research Extension Symposium.* Arkansas: University of Arkansas.

Merrill-Sands, D., Ewell, P., Biggs, S., and McAllister, J. 1989. Issues in Institutionalizing On-Farm Client-Oriented Research: A Review of Experiences from Nine National Agricultural Research Systems. *Quarterly Journal of International Agriculture* 28 (3/4): 279-300.

Von der Osten, A., Ewell, P., and Merrill-Sands, D. 1989. Organization and Management of Research for Resource-Poor Farmers. In *Technology Systems for Small Farmers: Issues and Options.* Boulder, Colorado: Westview Press.

In preparation

OFCOR Country Case Studies

No. 9 Indonesia: Organization and Management of On-Farm Research in the Agency for Agricultural Research and Development. *Joko Budianto, Inu G. Ismail, Sridodo, P. Sitorus, Doah Dekok Tarigans, Agus Mulyadi, and Suprat.*

OFCOR Comparative Studies

No. 6 Financial Resources and Management for On-Farm Research: A Review of Experiences in Nine Countries. *Elon H. Gilbert.*

No. 7 Alternative Arrangements for Organizing On-Farm Client-Oriented Research in National Agricultural Research Systems. *Deborah Merrill-Sands and Jean McAllister.*

OFCOR Synthesis Papers

Management of Key Institutional Linkages on On-Farm Client-Oriented Research: Lessons from Nine National Agricultural Research Systems. *Deborah Merrill-Sands, Peter Ewell, Stephen Biggs, Jean McAllister, R. James Bingen, and Susan Poats.* (scheduled for publication September 1990)

Guidelines for Research Managers: Lessons from a Comparative Study of On-Farm Client-Oriented Research in Nine Countries. *Deborah Merrill-Sands, R. James Bingen, Stephen Biggs, Peter Ewell, Jean McAllister, and Susan Poats.* (scheduled for publication 1990)

Study on Research-Technology Transfer Linkages

Linkages Theme Papers

No. 1 A Conceptual Framework for Studying the Links between Agricultural Research and Technology Transfer in Developing Countries. *David Kaimowitz, Monteze Snyder, and Paul Engel.*

No. 2 Intergroup Relations in Institutional Agricultural Technology Systems. *Paul Bennell.*

No. 3 Private Sector Agricultural Research and Technology Transfer Links in Developing Countries. *Carl Pray and Ruben Echeverría.*

No. 4 The Political Economy of the Development and Transfer of Agricultural Technologies. *Holly Sims and David Leonard.*

No. 5 The Effect of Changes in State Policy and Organization on Agricultural Research and Extension Links: A Latin American Perspective. *Roberto Martínez Nogueira.*

No. 6 The Agricultural Research-Technology Transfer Interface: A Knowledge Systems Perspective. *Niels Röling.*

Linkages Discussion Papers

No. 1 Institutional Linkages for Different Types of Agricultural Technologies: Rice in the Eastern Plains of Colombia. *Luis Alfonso Agudelo and David K. Kaimowitz.*

No. 2 Relations between Agricultural Researchers and Extension Workers: The Survey Evidence. *Stephan Seegers and David K. Kaimowitz.*

No. 3 Placing Agricultural Research and Technology Transfer in One Organization: Two Experiences from Colombia. *David K. Kaimowitz.*

No. 4 The Impact of Improved Institutional Coordination on Agricultural Performance: The Case of the Nariño Highlands in Colombia. *Paul Engel.*

No. 5e Informal Linkage Mechanisms and Technology Transfer: The PACO Project in Côte d'Ivoire. *Thomas Eponou.*

No. 5f Mécanismes Informels et Transfert de Technologie: Le Cas du Projet PACO dans Côte d'Ivoire. *Thomas Eponou.*

No. 6 Managing the Links between Research and Technology Transfer: The Case of the Agricultural Extension-Research Liaison Service in Nigeria. *Johnson Ekpere and Isiaka Idowu.*

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Agudelo, L.A., and Kaimowitz, D.K. 1989. Interacción Interinstitucional y Tecnología Agropecuaria: El Arroz en los Llanos Orientales. *Coyuntura Agropecuaria* (Colombia) 5: 143-156.

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Linkages Discussion Papers

Efectos de los Cambios Estructurales en el Ministerio de Agricultura y Ganadería de Costa Rica sobre la Relación entre Investigación y Transferencia de Tecnología en Maíz. *Viviana Palmieri.*

The Influence of International Agencies on the Links between Technology Development and Delivery Institutions in the Philippines. *Emiliana Bernardo.*

Training and Visit System and the Links between Rice Research and Extension in Matara District, Sri Lanka. *Stephan Seegers.*

Eficacité de Mécanismes du Liaisons et Type de Technologie: Le Cas del Zones Savanicoles de la Côte d'Ivoire. *Thomas Eponou.*

Single copies of the ISNAR publications are available upon request by writing to ISNAR, P.O. Box 93375, 2509 AJ The Hague, The Netherlands. They are free of charge to individuals and institutions working in agricultural research and technology transfer.

Appendix 5

Acronyms

AGRITEX	Department of Agricultural, Technical and Extension Services (Zimbabwe)
ARETP	Agricultural Research, Extension and Training Project (Sudan)
ARPT	Adaptive Research Planning Team (Zambia)
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture, Colombia)
CIAT	Centro de Investigación Agrícola Tropical (Center for Tropical Agricultural Research, Bolivia)
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo (International Center for Maize and Wheat Improvement)
CIP	Centro Internacional de la Papa (International Potato Center)
CIRES	Centre Ivorien de Recherches Economiques et Sociales (Center for Economic and Social Research, Côte d'Ivoire)
COFRE	Committee for On-Farm Research and Extension (Zimbabwe)
DEPA	Departamento de Pesquisa Agrícola, Ministerio de Desenvolvimento Rural e Pescas (Department of Agricultural Research, Ministry of Development and Fisheries, Guinea Bissau)
DR & SS	Department of Research and Specialist Services (Zimbabwe)
DRI	Integrated Rural Development Programme (Colombia)
GARD	Gambian Agricultural Research and Diversification Project
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
IARC	international agricultural research center
ICA	Instituto Colombiano Agropecuario (Colombian Agricultural Institute)
ICTA	Instituto de Ciencia y Tecnología Agrícolas (Institute of Agricultural Science and Technology, Guatemala)
IICA	Instituto Interamericano de Cooperación para la Agricultura (Inter-American Institute for Agricultural Cooperation)
INIA	Instituto Nacional de Investigación Agropecuaria y Agroindustrial (National Institute of Agricultural and Agroindustrial Research, Chile)
ISAR	Institut des Sciences Agronomiques du Rwanda (Rwandan Institute of Agricultural Science)
ISNAR	International Service for National Agricultural Research
ISRA	Institut Sénégalais de Recherches Agricoles (Senegalese Institute for Agricultural Research)
LAC	Lumle Agricultural Centre (Nepal)
NCDP	National Coconut Development Programme (Tanzania)
NGO	nongovernmental organization
OFCOR	on-farm client-oriented research
PACO	Projet Agricole du Centre-Ouest (Agricultural Project for the Central-West Region, Côte d'Ivoire)
R & D	research and development
RELO	research-extension liaison officer
SAFGRAD	Semi-Arid Food Grain Research and Development
USAID	United States Agency for International Development