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# FARMING SYSTEMS RESEARCH:

# ISSUES FOR PROJECT EVALUATION

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## ACRONYMS

| | |
|---|---|
| AID | U.S. Agency for International Development |
| ASM | Agricultural Sector Modeling |
| BIFAD | Board for International Food and Agriculture Development |
| CGIAR | Consultative Group for International Agricultural Research |
| CSR | Cropping Systems Research |
| FSR | Farming Systems Research |
| IARC | International Agricultural Research Centers |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics (India) |
| ICTA | Agricultural Science and Technology Institute (Guatemala) |
| IITA | International Institute for Tropical Agriculture (Nigeria) |
| ILRAD | International Laboratory for Research on Animal Diseases (Kenya) |
| IRRI | International Rice Research Institute (Philippines) |
| ISNAR | International Service for National Agricultural Research |
| R&E | Research and Extension |
| TAC | Technical Assistance Committee (of CGIAR) |
| T&V | Training and Visit System (of Extension) |

## PREFACE

Since the late 1970s, the U.S. Agency for International Development (AID) has allocated substantial development assistance resources in support of Farming Systems Research (FSR) projects in developing countries, in addition to its substantial core support for international agricultural research centers conducting a variety of FSR programs. As of FY84, AID's portfolio included over 40 FSR projects in Africa, Latin America and the Caribbean, and the Near East. The majority of these are now midstream in implementation terms and are or will be due for evaluation.

PPC/CDIE summarizes, synthesizes and disseminates lessons learned from development experience for the purpose of assisting improved design and management of projects. In this effort, PPC/CDIE focuses on activities that represent major current and probable future areas of program concentration and develops guidance for evaluation that will help pertinent and useful lessons to surface.

In September 1984, Associates in Rural Development, Inc. (ARD), was asked to address the problem of a comprehensive approach to evaluating Farming Systems Research projects. To obtain the most useful information from upcoming FSR project evaluations, CDIE requested ARD to develop an initial analytical framework which is comprehensive enough to support the following requirements:

- that the evaluations of these projects are appropriately comprehensive in addressing the range of issues pertinent to the holistic nature of the research itself;
- that some basic or "core" questions are asked in all evaluations, so that PPC is better able to summarize and synthesize evaluation findings in ways which are most helpful to design and implementation; and
- that evaluations address the issue of macro-implications and use of information derived from micro-level research.

In order to assist CDIE in this effort, ARD was asked to provide a classification or typology of FSR projects, according to their characteristics, purposes and operations, with an initial identification of core issues for evaluation, and a refinement of both through their application to a selected sample of AID-supported FSR projects.

The activities undertaken by ARD in pursuit of these objectives centered on:

- a review of relevant literature written by agricultural development professionals who are or have been

substantively involved with FSR at the field level;

- unstructured personal interviews with these same field-level practitioners, as available to ARD in the United States;

- structured personal interviews with agricultural development professionals working for AID and other U.S. government agencies directly involved in design, implementation, management and evaluation of FSR projects in developing nations; and

- structured review of AID Africa Bureau Project Papers and project implementation evaluations, as available to ARD.

This report is organized around the task objectives--not activities--as set forth above. Section 1 provides a Summary. Section 2 develops the conceptual framework and background for thinking about FSR in the larger scheme of agricultural research, technology development and dissemination. This section proposes a classification scheme for FSR projects and programs, developed according to objectives, characteristics and activities used by each "class" of project/program. Section 3 identifies potential issues for evaluation, which both "cut across" the FSR portfolio and are appropriate at the project-specific level. Section 4 presents the results of an application of the classification scheme to FSR projects in the AID Africa portfolio, as well as an identification of issues of potential relevance to those projects.

## 1.0 EXECUTIVE SUMMARY

There has been much confusion surrounding Farming Systems Research (FSR), primarily because it is a new research strategy which does not have a well-established lexicon or set of procedures and methodologies. This paper is written in response to a need to summarize what is known about FSR, to develop a useful conceptual framework and to apply this framework to AID Africa FSR project designs with a view toward surfacing questions which may be relevant to future project design and implementation evaluation.

Farming Systems Research is a research "process" or "approach" which takes the objective of conducting on-farm research for the purpose of testing, adapting, integrating and disseminating new technologies for adoption by farmers. All FSR must embody certain characteristics and activities in order to meet the functional requirements and organizational objectives which it is intended to address. The core characteristics are:

- farmer participation in the research process;
- multidisciplinary research planning, design, conduct and evaluation;
- holistic approach to research problem identification/ prioritization and technology evaluation;
- problem-solving research orientation; and
- reduction of natural heterogeneity of farming systems to homogeneous groups of farming systems for both research and extension purposes.

The conceptual framework is applied to the AID Africa FSR project design documents. Using the criteria implied by the conceptual framework, we found only 11 of over 30 projects meet these criteria. The extent to which the "newness" of FSR--and the resulting confusion as to the role of FSR in relation to existing national agricultural research and extension, the FSR objective, characteristics and activities--has affected project design is apparent on reading these project papers. There is clearly an increasing level of "sophistication" and clarity in the project papers as one moves from 1978 to 1984 documents. This suggests the existence of a learning curve as AID experience with FSR increases and this experience suggests alternative strategies for project design. Given this evolution in FSR, implementation evaluation can be very useful in moving AID along this learning curve. The following questions could be applied to implementation evaluations of all FSR projects:

#1 Has there been an effective integration of FSR activities backward into applied, on-station research and forward into technology dissemination?

#2 To what extent has the FSR cycle (at each stage) incorporated the requirements of extension?

#3 To what extent has the FSR program developed effective linkages to external agriculture sector support institutions and service organizations?

#4 Are there any functional or organizational gaps remaining in the national-level technology innovation process which inhibit the efficacy of FSR?

#5 What are the organizational or institutional requirements for thorough institutionalization of FSR as an integral working part of the national agricultural research and extension system which are or should be addressed through implementation of this project?

#6 During the diagnostic stage of the FSR cycle did the research team comprehensively examine the whole farm system? To what extent does the information obtained in the diagnostic stage guide the prioritization of the FSR research agenda and continue to be fully utilized in the subsequent activities of the FSR process?

#7 How and when have farmers been involved in the diagnostic and technology evaluation stages of FSR? Has their participation been effective?

#8 To what extent have technical research program management decisions demonstrated concern for increased efficiency in the research process?

#9 What evidence exists which indicates project progress at the goal and purpose levels? Have improved technologies been developed, extended and adopted by farmers as a result of the FSR process?

Background research activities which enabled the development of the FSR conceptual framework included an extensive literature review, and discussions with field practitioners and AID personnel with FSR management responsibilities. Based on these activities we have found that several issues are still unresolved:

1. Should FSR be institutionalized into existing agricultural research and extension services in developing countries?

2. What is the role of the International Agricultural Research Centers (IARCs) in FSR development at the country level?

3. What is the role of FSR in the national technology extension process in developing countries?

4. What is the role of FSR in providing linkages between in-country research and extension organizations and other in-country agricultural planning, development and service organizations?

5. Should FSR take more than a field crop orientation in setting the research agenda?

6. How should AID consider the question of FSR cost in relation to such concepts as benefits, effectiveness and efficiency?

7. In the design of FSR projects are time frames and objectives properly aligned?

8. Are there circumstances when FSR should not be considered as an AID-supported program option in implementing agricultural development strategies in developing countries?

While these issues remain unresolved, to the extent that project evaluators can gather information to inform these issues then Agency understanding of the role and requirements for effective Farming Systems Research can be advanced significantly.

## 2.0 CONCEPTUAL FRAMEWORK OF FARMING SYSTEMS RESEARCH

### 2.1 The Role of FSR in National Agricultural Technology Innovation

Farming Systems Research (FSR) is a research "process" or "approach" which, in the main, takes the objective of conducting on-farm research for the purpose of testing, adapting, integrating and disseminating new technologies for adoption by farmers. FSR, in combination with strong commodity research and extension programs, offers an increased potential for improving the productivity of the whole farm system and, thereby, improving the welfare of the adopting farm family and, ultimately, the larger national economy, as measured primarily by production and income indices. As a research approach, FSR emerged in response to an increasing recognition that the existing national agricultural research and extension systems have been functioning ineffectively, in terms of appropriate technology development and dissemination. This ineffectiveness has been attributed to an observable lack of understanding of farm production systems in which new technologies are intended--and expected--to perform and, thus, to a failure to evaluate the new technologies' performance by the criteria of those systems and the farmer decision-maker.

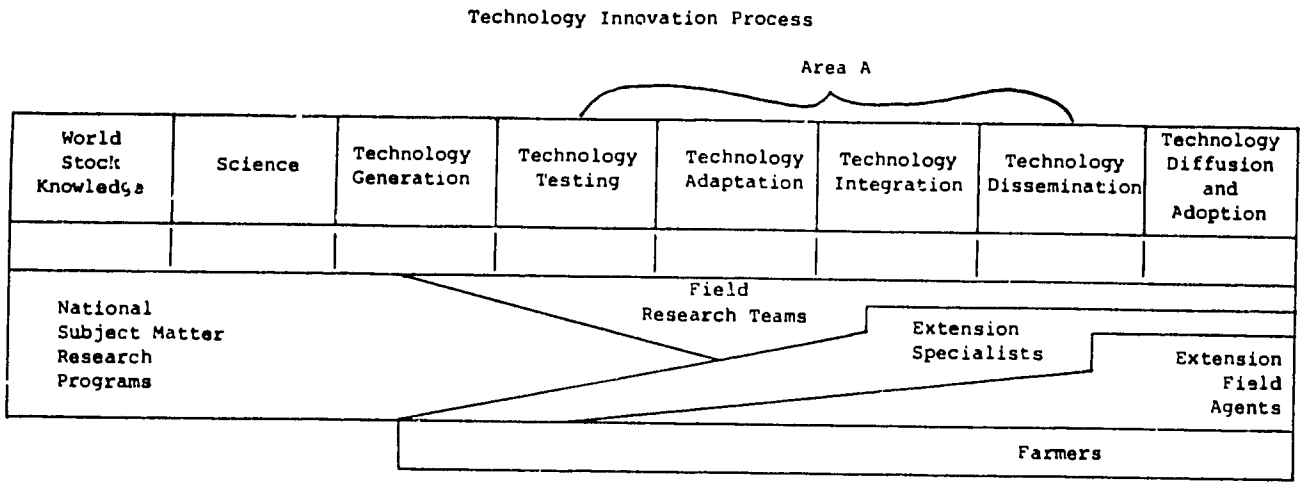
In this section, we discuss the reason for and the nature of the functional and organizational gaps, which exist in most developing-country agricultural research and extension systems, and the role of FSR in bridging these gaps. Figures 1 and 2 present a visualization of the functions and organizational requirements of effective national research and extension systems. In both figures, Area A represents the existing gap in national systems and, at the same time, defines Farming Systems Research.

As suggested by Figure 1, Farming Systems Research is (or should be) regarded as an integral part of the larger research, development and diffusion process. It is appropriate, therefore, to briefly examine the entire process, for which we will rely heavily on concepts and definitions elaborated by McDermott.

Figure 1 presents what McDermott conceptualizes as the technology innovation process in agriculture. He notes that the visualization greatly oversimplifies a rather complex process in that it shows the process as a simple chronology with one discrete function following completion of the previous one. In reality, these functions flow together and become so thoroughly fused that, in practice, they cannot easily be distinguished (#5, 1984). The subsequent explanatory notes will be useful to the reader to ensure a common lexicon.

Figure 1.

**The Technology Innovation Process in Agriculture**




Adapted from J. K. McDermott, "Farming Systems Support Project, VITA-CAR Team Notes," 10/19/84.

Research is commonly associated with science in the search for new knowledge. In this sense, research is an abstract analytical process which seeks to control all independent variables so that new knowledge can be gained regarding the dependent variable.

Technology Generation is a creative function wherein something new is conceptualized, designed and put together. Technology is usually generated on an experiment station. The reductionist approach (the "scientific method") is used and, thus, performance can be hypothesized. It is important to note that not all technology generation occurs within any given national system. There is heavy borrowing from other national and international research systems, e.g., the world stock of knowledge.

Technology Testing is the testing of a proposed, promising technology for performance. Often the first test (screen) will be on the experiment station. If we keep in mind that a

technology will be of value or use only in relation to a production system, such initial experiment station screening is not enough. The new technology must be tested in the system in which it is expected to perform and against the performance criteria of that system. If the public system does not perform the second-phase testing, then either the process stops or some other entity will pick it up.

Technology Adaptation is the function of adapting a technology, which has been tested (and works) in one specific production system, often with minor modifications, so that it performs to standard in other relatively similar systems. This is a very important function from an economic point of view in that to bring costs and benefits in line with management expectations and criteria, it is necessary to enlarge the range of sites in which a technology will serve. The need to adjust technology to a range of sites requires extension specialists to be active participants in the technology development process.

Technology Integration is a function with multiple aspects. Technology itself is an integration of performance characteristics with other technologies into a single new technology, which must then be integrated with other technologies in the production system. Sometimes a technology is embodied in a commodity which can only be adopted into the production system if larger systems which serve the production system change accordingly, e.g., market distribution systems, etc. It is important to realize that even in the "earlier" stages of technology generation, integration problems can be anticipated, will be important in designing and generating the new technology, and will provide some of the criteria for testing and adaptation. New technologies must be integrated into both the bio-physical production environment and the "agri-milieu" of markets, consumer acceptance, storage capacity, etc.

Technology Dissemination is an extension function which requires a conscious, active promotion campaign for the new technology. Although "dissemination" is often used interchangeably with "diffusion," there is a major distinction to be made. One of the most common dissemination techniques is the extension demonstration. Extension field agents and, in some cases (where existing and functioning), other state, parastatal and private-sector agribusiness entities do most of the actual dissemination. It is necessary, therefore, that these dissemination agents be familiar with the new technology. When a national extension service is doing the dissemination, there must be extension personnel, who have participated in the technology testing, adaptation and integration phases, working with the field agents and supervising the farmer-agent demonstrations.

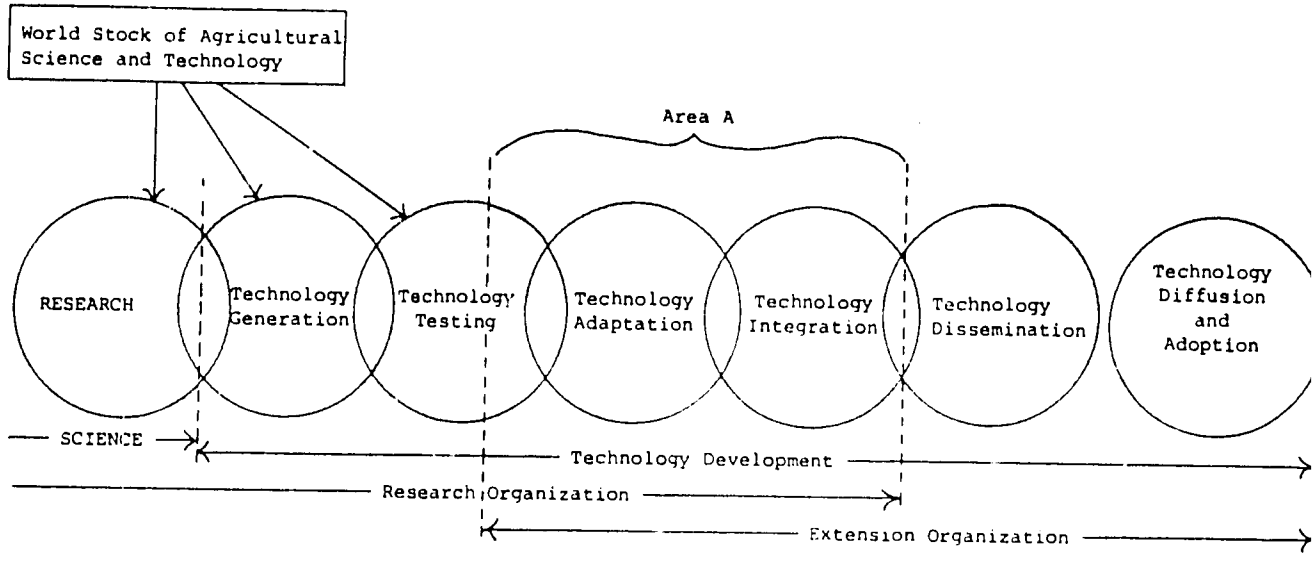
Technology Diffusion is a dynamic social process which occurs in every community through farmer membership in various social systems: family, neighborhood, church, civic

organizations and cliques. It is a natural process, the dynamism of which emphasizes the importance of working with farmers throughout the technology innovation process.

With the foregoing, we have conceptualized the functions of the technology innovation process in agriculture. As one further step in this conceptualization, we must make the system operational by overlaying the national research and extension organizational structure(s). By doing so, we are able to relate the functions of the technology innovation process to organizational requirements. Figure 2 presents this overlay. We have added farmer participation to this visualization to indicate which functions are most appropriate for their involvement.

Figure 2.

Division of Functions Between Research and Extension Within the Technology Innovation Process




Adapted from J. K. McDermott, "Technology of Technology Innovation," ed. George Beal et al, East-West Center, Honolulu, from Knowledge Generation Exchange and Utilization, forthcoming.

The reader should not interpret the equal area allocated to each of the functions in the technology innovation process as implying an equal allocation of effort.

All four sub-entities of the national research and extension organization(s) can be involved toward the beginning of the adaptation function and the end of the testing function without violating the mandate of any of the units.

Finally, in order to understand the emergence of Farming Systems Research and its role relative to the various functions of the technology innovation process, we briefly examine the efforts of the United States' bilateral aid and scientific communities to strengthen the indigenous capacity for technology innovation in developing countries. Since the 1950s, the United States has been involved in national institution-building for agricultural research and extension. Institution-building in this context involved human resource development, the provision of physical facilities and equipment, administrative and management development, and the provision of U.S. scientific counterpart personnel to work in cooperation with host-country researchers (USAID, #1, 1982, p. 22).

Our successful domestic experience with the U.S. Land Grant research, extension and education system formed the basis for our institution-building efforts in developing countries. However, according to McDermott, we made a few errors in conceptualizing the land grant model and its role in the national technology innovation process for its transfer to developing nations. The essence of the problem is that we did not explicitly recognize that our own research and extension administrative organizations did not perform all of the agricultural technology innovation functions. Thus, we transferred administrative organizations, which did not have the mandate to perform all the necessary functions of technology innovation and dissemination within the U.S. context, and certainly would not in the developing-country context. This error was compounded by a failure to realize the integrative functions which mediating entities (e.g., the so-called agribusiness complex in the United States) have come to fulfill in the technology innovation process (Winkleman & Moscardi, 1979). And finally, as has been pointed out by many participants in this institution-building process in developing countries, we did not properly appreciate the experimental nature of farmers and the extent to which innovation and experimentation occur within the dynamic social systems of farming communities in developing countries as well as in the United States.

We can now see the results of these "conceptual shortcomings" in the operation of the national research and extension organization(s) which developing-country governments built with foreign assistance. There are national agricultural research capacities in most developing countries which have varying capabilities (determined by many factors outside the scope of this paper) to conduct applied research using the scientific method of inquiry, with a conspicuous absence of a farmer-client orientation. Similarly, there are national agricultural extension capacities in most developing countries which have varying capabilities for introducing innovation to their farmer clientele--determined in part by the limited applicability of most experiment-station recommendations available for extension, and by the absence of extension personnel in the technology development process. The resulting ineffectiveness of

developing-country agricultural research and extension organizations is of critical importance because research, technology development and extension derive purpose and meaning from their service to the nation in the achievement of national development goals (Dillon, 1976).

In summary, then, it has been widely recognized that there are conceptual and operational gaps in the agricultural technology innovation process in most developing countries. In functional terms, these gaps represent the present inability to develop technologies for the production systems in which they are intended to perform and to evaluate the performance of those technologies against the criteria of those systems.

We now turn to a discussion of the concept of what Farming Systems Research is and the functions and organizational requirements needed to bridge the existing gap in the developing-country agricultural technology innovation process. Referencing both Figures 1 and 2, FSR can be conceptualized as an approach, a strategy and a philosophy to be applied across the entire technological support system, giving special attention to the area (A) of function and organizational operation. Generally stated, FSR is comprised of the technology innovation functions of technology testing, adaptation, integration and dissemination (to a varying extent). In operational terms, FSR requires the participation of disciplinary and commodity research teams (in Figure 2, national subject-matter research programs), multidisciplinary field research teams, extension specialists, extension field agents and farmers, working in cooperation toward common objectives. The only relevant measure of objective achievement is the adoption of new, improved technologies by target farmers, which increase the productivity of the whole farm system, and consequently improve the welfare of the adopting farm family, and the strength of the overall economy, as measured by production and income indices.

## 2.2 FSR Objective, Characteristics and Activities

With the foregoing, we have presented a functional and organizational explanation of Farming Systems Research and the rationale for its emergence as an integral part of an agricultural research, technology development and dissemination process for developing countries. We now discuss Farming Systems Research "in the main" by identifying the objective, a set of core characteristics and activities which set FSR apart from more conventional agricultural research.

From this common base, we will then identify three major "types" of FSR projects and programs currently under implementation in developing countries. This "classification" or "typology" of FSR projects and programs is based mainly on the

differences in project and program purposes, activities and major characteristics, which are clearly distinguishable, and which tend to group themselves into distinctive types of FSR.

FSR: Objective

All Farming Systems Research projects and programs share a common objective, which is to raise the efficiency of the whole farm system (Norman, 1980). There is a distinction to be made between the objective of FSR and more conventional discipline- or commodity-oriented research. The FSR task is to identify potential technologies which will not only increase the productivity of a particular commodity/enterprise or even subsystem, but will also not lower (and, it is hoped, will raise) the productivity of all other subsystems within the whole farm system. Conventional research is not typically concerned with the performance of enterprises or subsystems other than the subsystem under study. The whole farm system orientation places greater demands for information on the research team than one of lesser scope, with implications for the types of activities which must be undertaken and the disciplines which need to be involved.

FSR: Core Characteristics

Farming Systems Research, regardless of the particular approach followed, must have certain characteristics embodied in the research organization and process for FSR to be distinguished from the so-called conventional on-station disciplinary- or commodity-oriented research. Reference to this common set of characteristics can be found throughout the literature on FSR (TAC, 1978; Shaner et al, 1982; Norman, 1980; Collinson, 1982; Gilbert et al, 1980; Harrington, 1980; Kampen, 1979). The characteristics are:

- farmer participation in the research process;
- multidisciplinary research planning, design, conduct and evaluation;
- holistic approach to research problem identification/ prioritization and technology evaluation;
- problem-solving research orientation; and
- reduction of natural heterogeneity of farming systems to homogeneous groups of farming systems for both research and extension purposes.

Probably one of the most important characteristics of FSR is the insistence that farmers, for whom research is being conducted, must be involved in the research process. Many events and ideas have contributed to this reorientation in research procedures. For many years, it was widely assumed that small

farmers were a homogeneous group of inefficient producers, bound in ignorance by the forces of tradition. However, over the past 15 years, research results from all areas of the developing world have shown that:

- small farmers are economically rational in their decision-making regarding resource allocation (USAID, #2, 1976);
- their objective is not necessarily profit maximization (Labadan et al, 1980; Collinson, 1982);
- risk and uncertainty are dominant forces in their decision-making (Shultz, 1953);
- the nature of these forces are primarily determined by the economic and natural (bio-physical) circumstances of the individual farmer (Winkleman & Moscardi, 1979); and
- the economic and natural circumstances which dictate the type of farming system are widely diverse, even within relatively small geographic areas (Hildebrand, 1979).

Research scientists have come to recognize that if they are to be successful in developing technologies for adoption by small farmers, they must first come to understand those farming systems, and then evaluate the performance of new technologies against the criteria of those systems. According to Collinson, "relevance in research demands that local farmers provide their own perspectives (to researchers) in planning experiments and their own decision criteria in evaluating results" (1982, p. 3). Specifically, the farmer must be involved in the <u>problem-identification</u> phase to the extent that he gives the researchers a sufficient undertanding of the whole farm system, the problems he has in increasing the production and productivity of any particular subsystem(s), and an indication of the priorities for problem solving.

Similarly, the farmer must be involved in <u>evaluation</u> of new technologies designed by researchers to solve farm production problems. Such involvement provides the researchers with information regarding the appropriateness of the technology and its acceptability to the farmer. Also, in cases where problems arise concerning appropriateness and/or acceptability, the farmer provides essential <u>feedback.</u> This feedback can be important in not only improving the "fit" of a particular technology to a particular system, but also in guiding future experimentation and dissemination efforts.

If we accept the need for improved understanding of small-farmer decision-making, in terms of their perceptions of risk and uncertainty as conditioned by economic and natural

(bio-physical) circumstances in which decisions are made, then multidisciplinary research is critical to FSR. At an absolute minimum, multidisciplinary research in the FSR context demands the collaboration of a research agronomist and an agricultural economist in all of the activities of the FSR cycle (e.g., site selection, diagnosis, design, experimentation and testing). Norman has characterized the underlying determinants of any farming system as technical and human, with the human element including both exogenous and endogenous factors. He claims that the technical and exogenous human factors are beyond the control of the individual farmer. Therefore, the farmer will make decisions regarding resource allocation within his farm system according to his perceptions of the constraints which those technical and exogenous human factors impose on him (1980). Whereas it is the task of a physical or biological scientist to modify the technical environment to provide the potential for improvement of the production system operating in that environment, FSR practitioners claim that the technical perspective is not enough. Collinson states that the most important contribution of the agricultural economist is in providing an understanding of how and why, in managing his farm, the farmer will compromise on the optimal technical management of any one enterprise to raise the productivity of the whole system (1982). Thus, a collaborative, multidisciplinary research effort can provide the combination of perspectives and abilities to understand both the technical and the human determinants of any given farming system, and thereby provide the possibility of modifying constraints, resulting in the improvement of the whole farm system.

FSR recognizes the importance of the underlying technical and human determinants of any particular farm system as constraints to increased efficiency of that system. Therefore, FSR focuses on the interrelationships and interdependencies between the technical and human elements and, as such, is more holistic than conventional agricultural research (TAC, 1978; Norman, 1980). Upon this much, we find general agreement in the literature. However, some confusion and disagreement remain as to the interpretation of the word "holistic" to infer a guiding principle and general perspective (Byerlee et al, 1982; Simmonds, 1983) or to infer the application of whole farm analysis and similar-systems analysis concepts (Labaden et al, 1980). In general, the majority of FSR practitioners use the term "holistic" to mean bringing a broad understanding (obtained from both primary and secondary data) and appreciation of technical and human elements which constrain the various on- and off-farm production enterprises to the problem identification, research prioritization and technology evaluation activities of the FSR process.

FSR must have a problem-solving orientation. As we pointed out earlier in this section, FSR is not "scientific" or "basic" research. Rather, FSR involves technology testing, adaptation

and integration (with a varying role in dissemination). The important point here is that FSR is not undertaken in order to generate knowledge for the sake of knowledge. Knowledge which is generated through FSR is applied to production problems of a specific farming system to raise the overall efficiency of that system, as perceived by the farm family, according to their goals.

Once we assume that the economic and natural (bio-physical) environments in which a farmer must operate are the most influential forces in his decision-making regarding technologies to be used in production, it is also important to recognize that there is considerable heterogeneity in small farm agriculture. Technologies must be tested, adapted and integrated into production systems of small farmers who may produce the same commodities but have different preferences and operate in different market situations (Bremer, 1983). One of the first FSR activities is, therefore, to reduce the "universe" of heterogeneous farming systems to a set of relatively homogeneous subgroups. The disaggregation is done first in terms of agro-ecological systems or differences in the technical element, then if further disaggregation is necessary, in terms of differences in the human element (Norman, 1980, p. 8). The research process can then proceed with each group in turn, or simultaneously, depending on development priorities of the national decision-makers and the research resources available.

Each relatively homogeneous group of farming systems is referred to as a "recommendation domain" (Hildebrand, 1976; Winkleman and Moscardi, 1979) or a "domain of adaptation" (Zandstra et al, 1981). The terminology implies that there is a clearly bounded area, not necessarily physically contiguous on a map, but which is defined according to economic and natural characteristics, and for which new technologies with a proven "fit" may be applied by all farmers in that area.

## FSR: Research Activities and Methodologies

Given the relatively recent emergence of FSR, the literature abounds in methodological discussion. Much of what has been published is in the vein of documenting the development of activities and methodologies within the context of specific country or IARC projects and/or programs (Norman et al, 1982; Collinson, 1982; Hildebrand, 1979). Other authors have gone a step further in attempting to publish guides to FSR activities and methodologies, based on a particular country or IARC experience or collection of experiences (Zandstra et al, 1981). To date, only one group has attempted to present general, standardized guidelines for the conduct of FSR (Shaner et al, 1982).

Norman states that "there are four successive research stages: descriptive (diagnostic), design, testing and extension" (1980, p. 6). Hildebrand's experience in Guatemala and the work

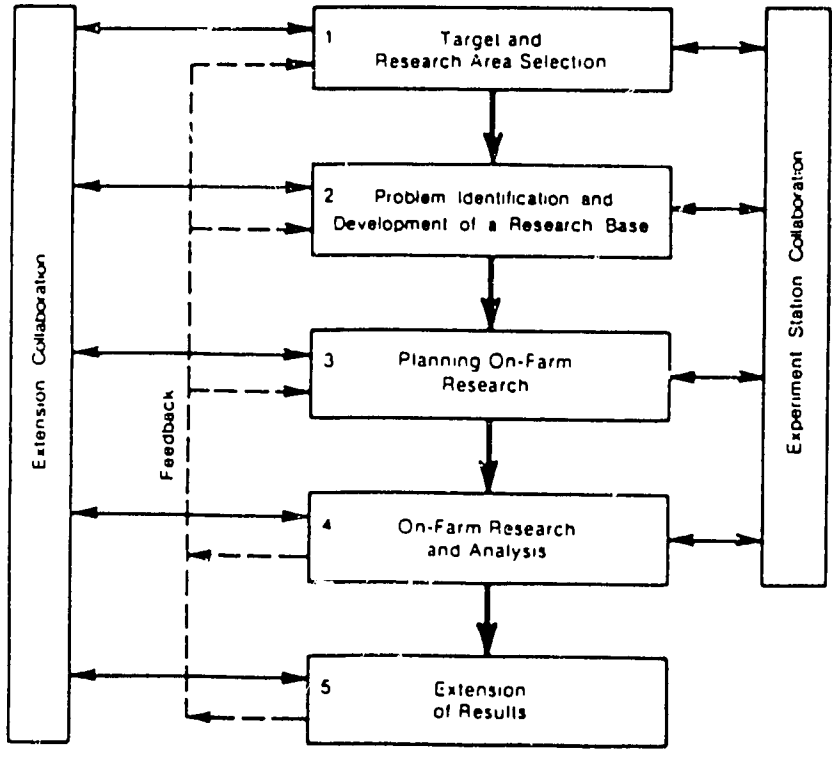
of CIMMYT and IRRI suggest a fifth stage, which actually comes first, involving site selection or identification of recommendation domain (Hildebrand, 1979; Winkleman & Moscardi, 1979; Zandstra et al, 1981).

Figure 3 presents an illustration of the sequence of the five stages of the FSR cycle (Shaner et al, 1982). Several aspects of the cycle should be noted. Experiment station and extension collaboration, which interact with the first four stages and the fifth stage, respectively, are set off to the sides to emphasize their supporting roles. It is also important to note the iterative nature of the activities. In Figure 3, they are shown to be sequential and discrete. In practice, certain activities may overlap and be repeated or skipped altogether. Information feedback is an important element of FSR. Finally, farmer involvement is not shown on the diagram. Although there is some disagreement about the degree of farmer involvement required in each of the stages, it is generally recognized that farmers will need to be involved in diagnosis, testing and extension.

Each of these research stages is composed of a specific set of activities and each activity can be conducted by a range of methodologies, which are not agreed upon and which some claim are situation specific. Table 1 summarizes the common activities in each stage.

Figure 3.

The Five Basic Activities of On-Farm Research in FSR&D.




From Shaner et al, Farming Systems Research and Development, 1982.

Table 1.

## Stages and Activities of the FSR Cycle

| FSR Stage | Activities |
|---|---|
| 1. Target and Research Area Selection (Site Selection) | Secondary data collection<br>Primary data collection<br>Data analysis<br>Decision |
| 2. Problem Identification and Development of Research Base (Diagnosis) | First preliminary analysis<br>Secondary data collection<br>Second preliminary analysis<br>Primary data collection (formal and informal methods)<br>Analysis of data<br>Problem identification<br>Prioritization of well-defined problems<br>Feedback of ill-defined problems for additional data collection and analysis |
| 3. Planning On-Farm Research (Design) | Appraisal of organizational capabilities and resources<br>Appraisal of relevant shelf-technology (local, regional, national, international sources)<br>Setting assumptions<br>Setting research priorities<br>Developing hypotheses for testing<br>Establishing research collaboration<br>Ex ante analyses of proposed experiments<br>Considering alternative research activities<br>Setting final plan for experiments |
| 4. On-Farm Research and Analysis (Testing) | On-Farm Research<br>--Researcher manager trials<br>--Superimposed trials<br>--Farmer manager trials<br><br>Results analysis<br>--Biological performance<br>--Net benefit projection<br>--Economic feasibility<br>--Financial feasibility<br>--Sociocultural feasibility<br>--Acceptability<br>--Long-term versus short-term |
| 5. Extension of Results (Extension) | Field demonstration plots<br>Multi-locational testing<br>Pilot production programs |

Two things should be noted regarding this table:

1. Activities are those used primarily in conduct of crop and cropping systems on-farm research; livestock, perennials and off-farm enterprises will require additional or different activities and perhaps a different sequence.

2. No specific references are made to on-station work which will occur in Stage 4, if necessary.

## 2.3 Classification Scheme for FSR

Although we were unable to trace the exact origin of Farming Systems Research, we do know that FSR was incorporated into the charter mandates of most of the International Agricultural Research Centers when they were formed in the early 1970s by the Consultative Group for International Agricultural Research (CGIAR). Also at that time, some development organizations and donors were supporting the development of FSR in specific country programs; for example, in Guatemala (ICTA), Mexico (Puebla Project) and Colombia (Caqueza Project). No literature documents in detail the development of the FSR "movement." What we do know is that what emerged in the thinking of many international agricultural research organizations and development donors as the need to incorporate agricultural economics, ex ante, into the process of planning and evaluating agronomic research through on-farm experimentation has blossomed and undergone a process of mutation since those early days.

There appear to be three major "types" or classes of FSR projects and programs being implemented in developing countries. Norman Simmonds, in his 1983 report to the World Bank, provides labels for these three types. The general literature suggests an alternative FSR classification; i.e., upstream, downstream (Norman, 1980; Gilbert et al, 1980; Harrington, 1981; TAC, 1976). However, building on McDermott's model, we believe that "upstream" applied research and "downstream" FSR are complementary functional parts of the same process and, thus, not separate classes of FSR. Therefore, we will rely on Simmonds' classification of FSR and encourage the reader to examine that report for more details. The three types are:

- Farming Systems Research/Sensu Stricto,
- On-Farm Research/Farming Systems Perspective, and
- New Farming Systems Development.

Farming Systems Research/Sensu Stricto is academic research on farming systems as they exist; their description, analysis, classification and understanding. In practice, there can be varying degrees of depth, but typically such research goes deeply into the agriculture, economics and social context of the system under study. This type of research is useful for academic purposes, but much less so for the purposes of agricultural technology development and dissemination. Furthermore, it cannot meet the functional and organizational requirements we posited as necessary to bridge the hypothesized gap in the technology innovation process. With regard to increasing whole farm system productivity, FSR Sensu Stricto can only meet a portion of the requirements for objective achievement. In terms of the core characteristics of FSR, if does not embrace a problem-solving orientation, although it could display the others. Finally, in

terms of activities, FSR Sensu Stricto will probably never get much beyond the diagnostic phase. For these reasons, this FSR approach falls short of meeting developing-country research and extension needs.

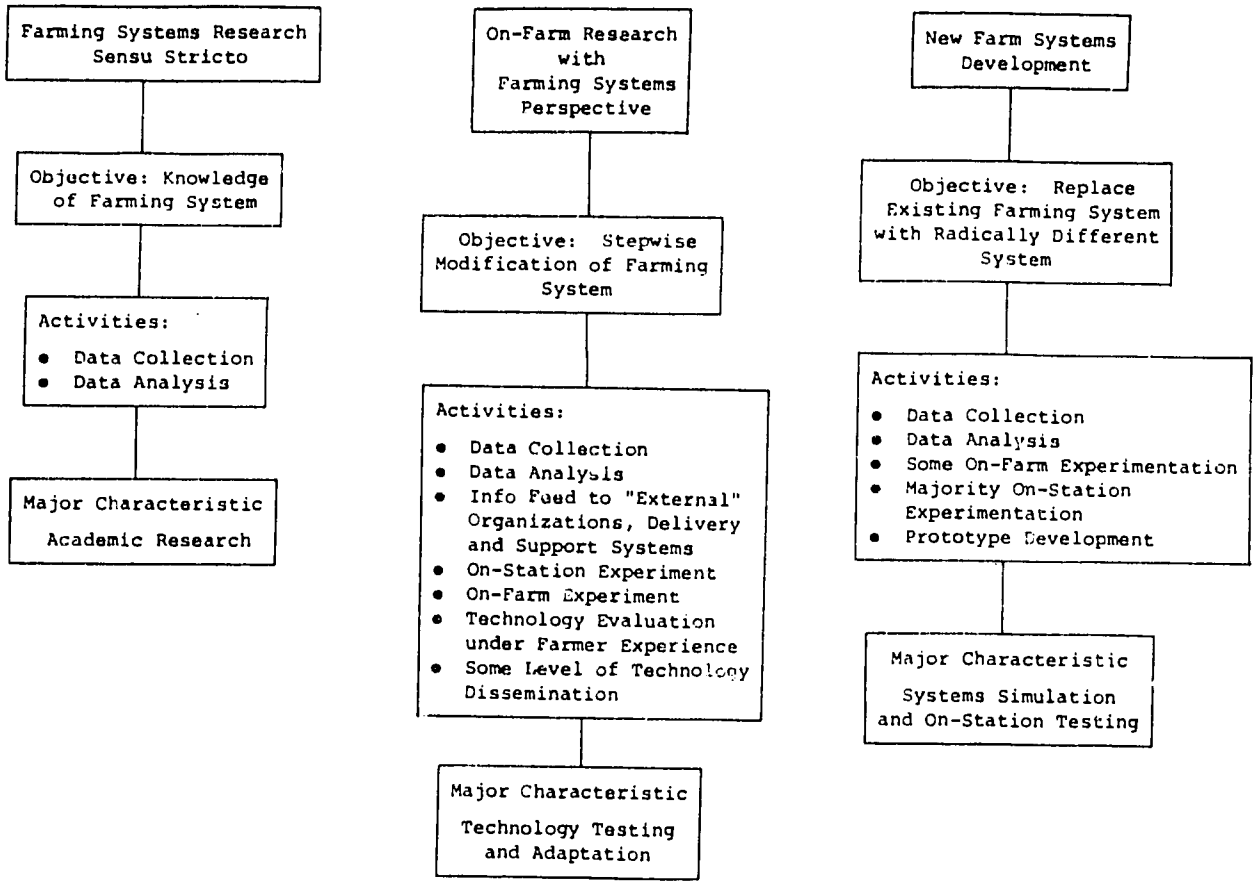
On-Farm Research with a Farming Systems Perspective (OFR/FSP) begins with collecting just enough information (in the FSR Sensu Stricto mode) on the farming system to define the research necessary for step-by-step modification and improvement of that farming system. Most of the research conducted in this style will be on-farm, recognizing that technologies intended to change the performance of a particular system need to be adapted to the circumstances of their farmer users, and that experiment station results by no means always predict the experience with a technology at the farm level. In practice, OFR/FSP meets all of the requirements of FSR, but is perhaps less holistic than some would like.

New Farming Systems Development (NFSD) begins with some degree of information on a particular farming system, will use some degree of on-farm research and is oriented toward the complete replacement of the existing system with radically new systems. NFSD shares the general FSR objective and can display all the core characteristics. The activities may also be similar to OFR/FSP but will vary as to relative emphasis and methodology. Systems simulation and on-station research are typically the most important activities. In promoting fairly radical change (as perhaps dictated by reasons of environmental degradation, population pressure, etc.), New Farming Systems Development will likely require large investments and total political commitment in order to succeed. For these reasons, work in NFSD will probably be highly site dependent and will not be undertaken as a rural development option too often. Finally, NFSD does not adequately address the functional and organizational gaps between research and extension posited at the beginning of this section.

Figure 4 presents these three types of FSR, their objectives, major activities and characteristics. No horizontal connecting lines appear because these three types of research have nothing in common apart from a focus on farming systems as the subject of the research and data collection/analysis activities; and in the latter case, there is a significant difference in degree and purpose.

Figure 4.

Farming Systems Research Classification




Regarding the terminology chosen to identify the second type of FSR, there are almost as many labels as there are practitioners and/or authors on the subject. For example, Byerlee prefers "On-Farm Research with a Farming Systems Perspective;" Collinson prefers "On-Farm Adaptive Research;" Hildebrand prefers "Farming Systems Research and Extension." The chosen terminology is that of Byerlee et al, because it stresses the importance of on-farm research relative to other research activities conducted in the FSR cycle while maintaining the whole farm research orientation. Each of these labels has its own emphasis. However, at this level of classification the differences implied by these various labels are not significant. While they may differ slightly, they all share the same objectives, activities and characteristics and are clearly distinguishable from the other two types.

## 3.0 AID AFRICA FSR

In the preceding section we discussed the role of FSR in the national technology innovation process and developed a useful conceptual framework for thinking about Farming Systems Research. In this section we present the results of our review of AID Africa Bureau Farming Systems Research project papers. The purposes of this review were to:

- apply the FSR conceptual framework developed in section 2, to delineate FSR projects from non-FSR projects; and
- examine the design of these FSR projects to surface specific questions which project evaluators may wish to examine during implementation evaluation.

### 3.1 FSR Projects in the Africa Region

Distinguishing FSR projects from other types of agricultural research and institution-building projects is important because of the confusion which surrounds this subject (Simmonds, 1983; Harrington, 1981; Bremer, 1983), and because of the need to establish the most relevant criteria for project evaluation and review. It would be unfair and dangerous to the continued development of FSR as well as to more conventional research and institution-building efforts of the Agency if evaluations of the latter type projects were to be framed in terms of performance measurements for FSR and vice versa (James Oxley, personal communication, 1984).

In late 1983, a BIFAD task force issued a list of projects which it considered FSR projects, in whole or in part. For the Africa Region alone this list included 30 projects, in addition to core support provided to two Africa-based IARCs conducting FSR programs. This listing was our universe of FSR projects for review. Using our review process we discarded from further analysis those projects in which the FSR "component" was a minor element in relation to project objective, activities and expenditure. We also excluded from analysis the programs of the relevant IARCs. Six new projects had not completed the design and approval process, and final documents were not available (Gambia, Guinea, Kenya, Mali, Senegal, Somalia).

Through application of the criteria of the conceptual framework, developed in section 2, we found 11 projects which can be considered FSR. Table 2 shows a listing of these projects. Among those "rejected" we found predominantly two types of projects: 1) integrated rural development and 2) conventional agricultural research and extension institution-building.

Table 2.

Listing and Classification of AID Africa FSR Projects*

| Country | Sensu Stricto | OFR/ FSP | NFSD | Project Title |
|---|---|---|---|---|
| Botswana 633-0221 | | X | | Agricultural Technology Improvement |
| Burundi 695-0106 | | X | | Small-Farming Systems Research |
| Cape Verde 655-0011 | X | | | Food Crop Research |
| Gambia 635-0203 | | X | | Mixed Farming and Resource Management |
| Lesotho 632-0065 | | X | | Farming Systems Research |
| Malawi 612-0202 | | X | | Agricultural Research |
| Rwanda 696-0110 | | X | | Farming Systems Improvement |
| Sudan 650-0444 | | X | | South Regional Agricultural Development I |
| Sudan 650-0020 | | X | | West Sudan Agricultural Research |
| Tanzania 621-0156 | | X | | Farming Systems Research |
| Zambia 611-0201 | | X | | Agricultural Development Research and Extension |

* Upper Volta (686-0255), Agricultural Development Support, (Component III-A), was deleted following a coup d'etat.

* Africa Regional (698-0444), CIMMYT-Farming Systems Research, is a support project similar in operational style to Central Bureau support projects, for FSR activities in East and Southern Africa.

The extent to which the "newness" of FSR--and the resulting confusion as to the role of FSR in relation to existing national agricultural research and extension, and the FSR objective, characteristics and activities--has affected project design is apparent on reading these project papers. There is clearly an increasing level of "sophistication" and clarity in project design as one moves from 1978 to 1984 documents, suggesting both a learning curve and the desirability of mid-course re-design or modification of those projects designed in earlier years.

## 3.2 Key FSR Evaluation Questions

Based on our conceptualization of Farming Systems Research, several central and key questions regarding implementation of FSR projects can be considered during the evaluation of every FSR project because they address both the "institution-building" role of FSR projects, as well as central technical and management performance aspects. These key FSR evaluation questions are:

#1 Has there been an effective integration of FSR activities backward into applied, on-station research and forward into technology dissemination?

#2 To what extent has the FSR cycle (at each stage) incorporated the requirements of extension?

#3 To what extent has the FSR program developed effective linkages to external agriculture sector support institutions and service organizations?

#4 Are there any functional or organizational gaps remaining in the national-level technology innovation process which inhibit the efficacy of FSR?

#5 What are the organizational or institutional requirements for thorough institutionalization of FSR as an integral working part of the national agricultural research and extension system which are or should be addressed through implementation of this project?

#6 During the diagnostic stage of the FSR cycle did the research team comprehensively examine the whole farm system? To what extent does the information obtained in the diagnostic stage guide the prioritization of the FSR research agenda and continue to be fully utilized in the subsequent activities of the FSR process?

#7 How and when have farmers been involved in the diagnostic and technology evaluation stages of FSR? Has their participation been effective?

#8 To what extent have technical research program management decisions demonstrated concern for increased efficiency in the research process?

#9 What evidence exists which indicates project progress at the goal and purpose levels? Have improved technologies been developed, extended and adopted by farmers as a result of the FSR process?

### 3.3 AID Africa FSR Project Design

Before describing our specific findings, we point out that they are derived from a view of these projects as set forth in project papers. Project papers do not always predict accurately what actually happens during implementation. Documented and undocumented modifications to implementation plans occur frequently, but we do not have access to this information. Nevertheless, our review of the 11 AID Africa FSR projects surfaced items of potential interest to evaluators in relation to the elements of the conceptual framework.

The most important finding from our review is that there is an explicit recognition of a gap in national agricultural research and extension, and enthusiastic endorsement of FSR as a means to bridge that gap. The most lucid discussions of the functional role proposed for FSR in the national R&E process are contained in the Rwanda (696-0110) Farming Systems Improvement and Burundi (695-0106) Small Farming Systems Research project papers. Given the state of the art in FSR, these documents can be considered as models of FSR project design. In the case of Rwanda, the project was designed to be directly responsive to the major recommendations of a 1983 ISNAR institutional assessment of the national R&E system. An unusual aspect of the Rwanda design was that FSR was not assumed to be valid or appropriate to the institution-building requirements in Rwanda. The project paper acknowledges this, and states that FSR will be tested as an approach to achieving increased effectiveness of the overall system. Other project papers made a priori assumptions about the validity of FSR and its appropriateness for the respective countries.

At the goal and purpose levels all FSR projects were ultimately aimed at promoting improved welfare of smallholder farmers through increased productivity of their farming systems, leading to increased aggregate national production and welfare. Hence, all projects appear to embrace the stated objective of FSR. Purpose statements, however, were divided fairly evenly between increasing the effectiveness of the research and extension system through institution-building with an FSR

orientation, and raising the productivity of existing farming systems through farmer adoption of improved technology. End-of-project status and performance indicators reflected the purpose in terms of either institutional/organizational change or quantifiable adoption targets/indicators, respectively. This difference in expectations for project performance hits at the center of the controversy surrounding FSR. What is it that we expect of FSR at this stage of development? Do we expect to introduce a completely new concept for organizing, managing and conducting research and extension into an established system, and within a relatively short time (in terms of behavioral change) to find the new system functioning effectively, developing new technologies, extending them to farmers, and farmers' production and incomes actually being increased? Expectations are not in line with the short-term performance potential of FSR.

In terms of FSR core characteristics, we found that all of the FSR project papers embrace the concepts of reduction of natural heterogeneity of farming systems in order to apply a multidisciplinary and holistic approach to problem identification, research prioritization and technology evaluation which involves the farmer in the process of solving farm production problems. However, there is wide variation in the interpretation of these characteristics into action strategies.

We acknowledge the differences in methodologies employed by different practitioners and the need for flexibility in FSR implementation. However, there is a point beyond which the interpretation of how these core characteristics come together to form a research strategy become so seriously confused that it can no longer be considered as FSR. For example, one project planned to begin the FSR process with the collection of farm management data on farms in the target area. This information would then be turned over to station researchers and would form the basis for on-station <u>replication</u> of those farming systems. Innovations would then be tested on-station in these replicated farming systems, and the results would serve as the basis for recommending new technology packages for extension. The project paper specifically states that there would be no attempt to introduce more advanced packages to farmers until reliable marketing systems were established. However, FSR disclaimed responsibility in this area. Another project paper envisioned the introduction of one expatriate farm management economist into a "basic and applied" research program attempting to develop prototype technologies for semi-arid subsistence farming. In the project design, the work of the economist was not integrated into the technical research process and there was little attempt to involve farmers. At least in their design, these projects completely misunderstand the rudimentary elements and procedures of FSR. There is, then, a risk that implementation of these projects will continue to reinforce these misinterpretations.

Some project papers reveal a variation in conceptual application which does not serve to destroy the viability of the FSR approach but which might handicap implementation, accuracy of research results and/or movement toward increased R&E system effectiveness. These variations should be considered for continuous management monitoring and evaluation. Probably the most potentially critical variation is in the extent and nature of the proposed linkages between the research and extension departments.

All project papers acknowledge the existence of a very weak or non-functional extension organization and the relatively ineffective transfer of research results/recommendations to extension personnel. All project papers recognize the creation or strengthening of effective linkages between research and extension as critical for FSR success. The approaches to creating effective linkages are very diverse. In one country, two mechanisms are employed to create this linkage; a research-extension liaison officer who acts as an information conduit, and the involvement of extension workers in the work of adaptive research teams. While in another country, research liaison officers (extension specialists) are responsible for adaptation of technology packages developed by research and translation of technical language into material suitable for extension field agents. In other countries, local extension field agents work with FSR teams, or the mechanisms for dissemination were not well established and the project appears to take a developmental or discovery approach to extension. Careful monitoring will be required to ensure that the implementing agency is continuously modifying approaches to creating this critical linkage.

A related issue concerns "locating" FSR in research organizations which have no mandated responsibility for extension, in countries where there are, historically, no linkages between the two organizations. In one project, the principal implementing agency is the Ministry of Agriculture and Natural Resources, which has no extension responsibility. In another country, the FSR project will be implemented by a research institute which is separate from the Ministry of Agriculture, and which does have extension responsibilities. These locational decisions may be necessary given existing organizational structures and their relative capacities. Nevertheless, the more new linkages which must be created, the more management time must be devoted to this task, probably slowing the pace of project accomplishments. In these situations frequent management evaluation is desirable.

Finally, evaluators should remember that integration of the <u>functions</u> of research and extension is required for effectiveness in technology innovation, not necessarily the integration of <u>administrative organizations.</u> One project plans to create this functional integration by adding the technology dissemination function to the mandate of a semi-autonomous

research organization for the purpose of carrying out FSR, in addition to an already existing extension organization within the Ministry of Agriculture.

Another area for possible review during implementation evaluation is the degree of variation in project design in the extent to which exogenous environmental determinants of farming systems are given. Many project papers specifically exclude certain determinants from consideration in advance of project implementation, in effect limiting the range of opportunities for the FSR team and likely limiting the effectiveness of the project in terms of objective achievement. A corollary to this is the extent to which the project envisions the development of linkages with external institutions/organizations. One project design document constrains implementation by predetermining that exogenous environmental constraints to technical production opportunities will not be considered for intervention by the FSR team. The project paper states that "eventually FSR institutionalization will allow the exertion of influence on support services to provide farm requisites and marketing opportunities in a form useful to small farmers." The design strictly limits the responsibilities of the FSR team throughout the life-of-project period to research and extension. Conversely, other projects anticipate effective linkages will be developed with service and support entities as well as planning agencies. While in other projects, the problems created by ineffective/non-existent service infrastructure and an inappropriate policy environment are to be avoided by having the FSR team work in areas supported and artificially enhanced by the presence of large-scale, donor-funded projects. Many other project papers are silent on this point.

Evaluators can also examine constraints placed on the range of options open to FSR. Given the developmental stage of FSR, and consequently our tenuous ability to foresee the future direction of FSR, how much specification should be required of project design? Our review shows an overall tendency to specify too much. Project design typically specifies which crops and cultural practices will be subjected to experimentation; which locations; how many farmers, researchers, extension field agents will be involved; what linkages will be established and how; what commodities and equipment will be procured; how much time will be required for certain activities; and how much (and by which methods) data will be collected.

The practice of pre-specifying details of the implementation of a research strategy which is not well established or understood may lead to situations which are contrary to the spirit of and expectations for FSR. Certainly, experienced FSR practitioners call for greater flexibility in design and management. For example, in one country, it was determined (through bilateral discussion) that maize and oilseeds were the crops which promised the greatest potential for meeting

government production/consumption objectives. It was therefore agreed that the FSR project would focus on those commodities. In situations like this we can hardly expect FSR to be "holistic" in farmer problem identification and development of research priorities. On the other hand, allowing the FSR process to be diagnostic and discovery oriented may meet too much resistance within the existing research system and/or too much diagnosis and not enough technology development and dissemination.

Our review of FSR project papers shows that the benefit/cost and time-objective alignment issues were, in effect, dismissed. Nearly all project papers rejected the utility of making assumptions regarding benefit impact within a research institution-building context, and admitted that within the time frame of project implementation not much in the way of benefit impact at the goal level could (should) be expected. A common time frame suggested for impact at the purpose level was 10 to 15 years.

Project effectiveness was discussed in most papers in terms of the potential contribution of FSR to increasing the effectiveness of existing research and extension. Cost-effectiveness was not considered relevant because of the non-existence of alternatives to project design, with one exception. One project paper suggested that the only alternative to FSR institution-building was to hire long-term expatriates to perform the research and extension functions, but this was dismissed as not cost-effective in comparison to the project approach as proposed. The questions regarding efficiency were not seriously or widely addressed. Finally, few project papers explicitly provided for collection of baseline data and continuous monitoring in order to allow for measurements of impact at a later date. Two projects do provide for this activity, but the project papers leave unclear who would be responsible for this activity. Issues of cost-benefit, effectiveness and efficiency are thus wide open for further methodological treatment; in the meantime evaluators should anticipate a lack of readily available data to support such analyses.

The majority of project designs explicitly acknowledged the need for linkages with IARCs, although these were mostly unspecified with the exception of country institutions having an ongoing relationship with a specific IARC (e.g., Zambia, Tanzania). Among those projects which discussed a specific role for the IARCs, both CIMMYT and IITA were identified as sources of support for assistance in short-term training and research methodology/strategy development. Our reading of FSR project designs indicates that the relevant IARCs are a wholly underutilized resource. Evaluators may evaluate how these linkages have been strengthened during implementation.

One final clear impression emerged from the review of project documents. FSR is different from other types of research and extension institution-building efforts in that people and institutions/organizations are being asked not simply to develop new skills and participate in new activities, but to change the way they do things in very fundamental ways. Further, past research efforts have been publicly identified as ineffective or non-productive.

The meaningful collaboration required for effective integration of FSR under these conditions will not be easily established. Effective, meaningful communication among public-sector (not to speak of private-sector) administrative organizations to effect needed changes in service sector support, infrastructure development and the policy environment where little has existed in the past will be difficult to achieve. Creative, flexible and experienced management which is constantly attuned to these requirements will be especially important to the potential achievements of FSR.

All AID Farming Systems Research projects have been designed in explicit recognition that a functional gap exists in the national public-sector technology innovation system. However, in all but one case, there is no indication that an institutional organizational assessment was performed to identify the exact nature of the gap and thus lay the basis for the project. We believe that such an assessment should be considered an essential element in project preparation. The International Service for National Agricultural Research (ISNAR) has been involved with the conduct of this type of assessment in all regions of the developing world. In Africa alone ISNAR assessments have been performed for Malawi (1982), Kenya (1981), Ivory Coast (1982), Rwanda (1983), Upper Volta (1983), Madagascar (1983), and Somalia (1983). Whether or not ISNAR is to be involved in the preparation of future assessments in other countries, such assessment is critical.

In addition, all Africa FSR projects have been designed in recognition of operational weaknesses in both applied research and extension organizations. Theoretically, improved information regarding farm-level reality, obtained through the FSR process, is proposed to strengthen the applied research effort by re-orienting the research toward farmer-identified problem-solving, in full cognizance of the constraints to improvement in those systems. Further, meaningful collaboration among applied researchers working on experiment stations, adaptive field research teams working on farmers' fields, and extension specialists working with both types of research personnel to identify the requirements of effective dissemination is envisioned as the means for improving technology development and dissemination. However, the majority of project designs did not provide an in-depth analysis of the organizational requirements for creating such a dynamic collaborative mechanism. There is a

need for flexibility and we have argued against overspecification in project design. However, certain requirements will likely involve a series of actions with a relatively long lead time and could act to hinder implementation after project approval (e.g., new budget requests and authorities, new administrative procedures, staff recruitment and training, ministerial decrees, etc.). A clearer understanding of what the requirements will be in advance of project approval, even if they are not all met in advance, would provide implementing agencies with a better idea of what needs to happen before the on-farm research can begin.

Somewhat related to this point are the recognized weaknesses in publicly supported extension organizations. Although this fact is recognized in each project paper, there is no plan for improving the extension organization in order that it can play an active support role in the FSR process. Where field extension agents are--across the board--not trained, not supported and not respected by researchers and farmers, seconding a few agents from the ranks to work with project researchers during the term of the project implementation will not solve the problems deeply rooted in those organizations. The problems will still be there when the project terminates and the collaboration which was artificially supported within the context of project implementation can be expected to dissolve. The problem of dysfunctional public-sector extension services needs to be addressed (not necessarily resolved) explicitly in FSR project design in order to understand how the technology dissemination will occur and be sustained over the long run.

The great majority of FSR project designs ignored and/or did not attempt to make explicit the supportive role which IARCs could play in implementation. The IARCs can offer methodological development and training support to country-specific FSR program development and implementation.

All of the FSR project designs proposed a significant data collection effort in order that the technical and human/institutional constraints to improvements in existing farming systems via application of existing shelf technology be understood. This type of information obviously has utility to planning and policy agencies, rural financial institutions, input supply entities, rural development projects and others. Only two projects have explicitly recognized the multiple utility of the data, let alone the possibility that such data, if made available to the correct authority, could provide the basis for intra-organizational dialogue which could result in amelioration of certain types of constraints facing the researcher as well as the farmer. This can be examined through evaluation. At this point, it is assumed that the FSR process collects data which illuminates problems not already known by those with the proper authorities. Is this true? What happens in the case where data were made available to proper authorities? Is the time needed to process data into a form usable by others for other purposes

unreasonably high given the other tasks of the FSR personnel?

All of the FSR project designs pre-set the commodity or subsystem focus in advance of the FSR diagnostic work. The majority of the projects envision working exclusively with field crops. Perhaps there is a good reason for this limitation of focus which is not understood or articulated. Regardless, in the implementation of FSR projects we assume the diagnostic stage does not set parameters on the types of enterprises for which data are collected. To do so would impose a skewed picture of the intermediate value of crop products to other enterprises as well as the inputs of intermediate value to crop production which are produced through non-crop production enterprises. Therefore, it would be useful to determine through evaluation the extent to which the data collected on all farm and off-farm enterprises are shared with commodity and subsystem researchers not working in the FSR mode on production enterprises not included for work by the FSR team(s). To the extent that this information is not shared there is room for improvement in the effectiveness and efficiency of the overall R&E system.

With regard to projects which take a restricted-enterprise focus, we believe one general proposition can be asserted. A very solid case has been made by those working immediately with smallholder farming systems, especially in the African context, for recognition of the complexity of those systems and the relationship between enterprise diversification in those systems and farm families' perceptions of risk, needs for cash, and own produce-consumption requirements. FSR has emerged as a research strategy which explicitly recognizes this complexity. Although it has been acknowledged that we don't really have the methods in hand to conduct research of such an integrated nature, we believe that the potential contributions of FSR to goal achievement cannot be fully exploited with a restricted focus on the cropping subsystem. CSR can meet the functional and organizational requirements for bridging the gap, however, CSR contributions at the goal level will be less than those of FSR.

## 4.0 UNRESOLVED ISSUES WITH IMPLICATIONS FOR FSR PROJECT DESIGN AND IMPLEMENTATION EVALUATION

In the foregoing sections we have presented a conceptual framework for thinking about Farming Systems Research in terms of its functional role and organizational requirements in the agricultural technology innovation process of developing countries; the major objective for FSR; the outstanding characteristics which differentiate FSR from other types of research; and a suggested classification scheme which distinguishes among different FSR approaches currently being implemented around the world. With this conceptual framework serving as "common ground," and focusing on OFR/FSP, we then applied the conceptual framework to AID Africa FSR project design documents which surfaced questions that will be relevant to project evaluators as they begin to think about implementation evaluation of FSR projects. This section discusses eight major unresolved issues for consideration by AID in future FSR project design and implementation evaluation.

These issues represent broad areas of concern, expressed by development professionals in the FSR literature which we consulted, and explored through personal interviews with FSR practitioners and AID/Washington personnel with varying FSR program management responsibilities. These issues are presented as concerns related to the development or design of AID-supported FSR projects/programs. The discussion under each issue surfaces implications which may be considered during evaluation of the implementation of these FSR projects and programs. These issues are:

1. Should FSR be institutionalized into existing agricultural research and extension services in developing countries?

2. How should AID consider the question of FSR cost in relation to such concepts as benefits, effectiveness and efficiency?

3. What is the role of FSR in the national technology extension process in developing countries?

4. What is the role of FSR in providing linkages between in-country research and extension organizations and other in-country agricultural planning, development and service organizations?

5. Should FSR take more than a field crop orientation in setting the research agenda?

6. What is the role of the International Agricultural Research Centers (IARCs) in FSR development at the country level?

7. In the design of FSR projects are time frames and objectives properly aligned?

8. Are there circumstances when FSR should not be considered as an AID-supported program option in implementing agricultural development strategies in developing countries?

1. <u>Should FSR be institutionalized into existing agricultural research and extension systems in developing countries?</u>

Much recent literature (Bremer, 1983; and in Flora #8: Mbalu, 1984; Baker, 1984; Hodgens, 1984; Fresco, 1984) calls for the institutionalization of FSR into national agricultural research and extension systems. Several important questions arise in connection with this issue. First, even within the second type of FSR alone, there is a very wide range of activities and methodologies employed to achieve similar objectives. In this situation, what exactly is it that should be transferred and institutionalized?

Secondly, decisions to "institutionalize" are not typically taken in the "to do" or "not to do" framework. Rather, these decisions are made in a framework which usually involves consideration of the extent to which "x" can assist an organization in achieving its mandated objectives, in comparison with alternatives "y" or "z." In the case of FSR, it is difficult to arrive at an answer to that question, even after a country has had some experience with FSR, and the issue takes on the characteristics of the "chicken-egg" problem. Illustrative of this is the experience of the University of Hawaii:

> "... senior decision makers wanted to see demonstrated results, that could be measured in terms of increased production and income generation potential, before committing themselves to major policy and organizational changes necessary for the institutionalization of FSR&D..." (Harold McArthur, in Flora, #8)

It is possible to put the question differently, in a deductive logic, "if-then" framework as follows:

<u>If</u> it is true that in the majority of developing countries there is an effective gap in the national agricultural technology innovation process, in terms of necessary functions which are not being performed and a lack of organizational collaboration required for performance of these functions in order to develop appropriate technologies for the improvement of local farming systems, <u>and if</u> FSR can bridge this gap by providing for the required organizational collaboration and performance of necessary functions resulting in improved appropriate technologies, <u>then</u> FSR should be institutionalized. However, the problem in arriving at the conclusion is in verifying the second "if" clause. Has FSR proven itself capable of bridging this gap? The answer to this question would be critical in deciding whether or not to institutionalize FSR.

A third question has to do with possible alternatives. In many countries the national (publicly supported) capacity for agricultural research is weak and ineffective or even nonexistent. These countries do not have the human, physical and

financial resources to effectively conduct applied research (technology generation). In this situation, to impose the additional functions of technology testing, adaptation, integration and dissemination is not realistic. Is it possible to look to other agents of change within the country as having the capability and potential willingness to perform these functions? Simmonds points out that in nearly every society there are four agents of agricultural technological change:

- farmers;
- public research, development and extension systems;
- government-supported financial and commercial agencies;
- private commercial entities.

He notes that all four are capable of active, adaptive, on-farm research activities which can result in technological change (1983).

When we speak of institutionalization of FSR within the context of AID projects and programs, we typically mean trying to create the conditions which will enable the publicly supported agricultural research and extension organizations (e.g., Ministries of Agriculture and Extension) to perform these functions. Perhaps providing support for other change agents, or combinations of change agents, to perform FSR functions warrants further consideration, at least in cases where the existing institutional base is weak.

In those situations where the host-country government is capable, ready and willing to take the necessary steps required to institutionalize FSR into the existing research and extension system, what management and administrative reorganization will be required? The answer to this question is, of course, country specific. However, several considerations center on the need to integrate and fuse FSR throughout the administrative and management structure, rather than simply appending another organizational unit onto the existing structure. The need for organizational integration derives from McDermott's observation that the functions of the technology innovation process are not sequential, discrete actions, but in practice are so thoroughly fused and interdependent that they are difficult to distinguish (#5, 1984). This observation speaks to the need for thorough collaboration of the various entities (program administration and management at all levels, disciplinary and commodity specialists working in support of adaptive research and extension specialists (and vice versa) and extension specialists working in support of extension field agents (and vice versa)).

If this integration does not occur and FSR is simply an isolated appendage on the existing structure, FSR will lack security regarding timely budget allocation, personnel assignments and logistical support requirements. In times of budget austerity the probabilities are quite high that an isolated FSR unit would be the "first to go." Hildebrand's experience in Guatemala during the early years of ICTA testifies to these kinds of integration problems:

> "One of the most difficult budget problems involved SER (Socio Economic Research) staff located in the regions. In 1977, the Perito Agronomos were transferred to the regions and the budget that was deleted from the Central SER group was supposed to be added to the regional budgets. This, however, was never accomplished so that we were put in the position of begging from other regional programs. Funds were already tight and the need to share with SER did little to create goodwill...In 1977 and again in 1978, attempts were made and orders given to the Regional Directors to create specific budgets for SER regional personnel, but that was never accomplished. The result was that the Regional Directors, seeing that the SER personnel were budgeted through their regional Technology Testing Teams, wanted to use them as if they were their own staff...It is evident, that budgeting procedures can have important positive and negative effects on attempts at integration of the social sciences with the biological sciences in an agricultural institute." (1979)

* * * *

In summary, a thorough institutional and organizational analysis should be conducted of the publicly supported agricultural research and extension system in a developing country before serious consideration is given to FSR project development. If the assessment indicates a functional gap which could be closed by institutionalization of OFR/FSP <u>and</u> which could cause the existing infrastructure to be more effective in technology development and dissemination, <u>then</u> institutionalization should be considered.

2. How should AID consider the question of FSR cost in relation to such concepts as benefits, effectiveness and efficiency?

The cost of Farming Systems Research, as an issue for project design and evaluation of AID FSR projects has received substantial recent attention both by field practitioners and development assistance donors, including AID. In general, donors are asking questions regarding cost in relation to the concepts of benefit and effectiveness; practitioners are primarily concerned with cost in relation to the concept of efficiency. This difference reflects the relative project implementation/ management responsibilities of these two parties. Benefit/cost estimates can provide donor decision-makers with useful information about the anticipated "investment" impact on the target population and is customarily used ex ante, in the project design and approval processes. Considerations of cost-effectiveness and efficiency are especially useful in mid-term or end-of-project performance assessments.

Two general issues relate to the application of benefit/cost analysis to FSR. First, as we pointed out, benefit/cost estimation is typically considered a tool of ex ante analysis for deciding among alternative investments proposed to address the same objective. While it is generally agreed that it is rarely possible to measure directly the cost and benefit ratio of research programs, it is possible to evaluate progress against goals and objectives if these have been clearly stated. If FSR programs are complementary to existing R&E programs, there is a question regarding the validity of estimation of relative benefit/cost ratios (Gilbert et al, 1980). However, if the Agency has decided to use the measurement of benefits and costs to judge the efficacy of its FSR projects then immediate attention must be paid to the development of a methodology for doing so.

Methodological development or refinement of existing methods is urgently needed to enable the specification of information requirements and data collection methods. An evaluation team cannot approach an FSR project which is three, or seven, or even 10 years into implementation and expect to find the necessary information to be available unless the information required for analysis is specified in advance of project implementation, the methods for data collection are standardized, and the requirement for data collection is made an integral and continuing process and a responsibility of the implementing agency during project implementation. Such a standardized methodology has not yet been developed, and uniform collection of information is not occurring while the FSR portfolio continues to mature.

The second benefit/cost-related issue concerns the time frame within which it is appropriate to assess the impact of research. There is no consensus on this, although development professionals with long experience with adaptive research in the

developing-country context claim that 15 to 25 years is not an unreasonably long time to allow for the technology diffusion and adoption process to occur, and for benefits to be measurable in terms of indices which get at the objective (e.g., increased productivity, increased production and income of adopters, income effects on non-adopters, societal welfare, etc.).

In terms of implementation evaluation the real issues with regard to cost considerations are questions of effectiveness and efficiency (McDermott, #7; Bernsten, 1984, in Flora #8). FSR is being supported as a means of making the existing system of agricultural research and extension more effective in generating appropriate technologies which can and will be adopted by large numbers of farmers, resulting in increased production and income in the agriculture sector and increased welfare of society at large. Ferguson suggests that it is impossible to measure the effectiveness of agricultural research in a time frame of less than 10 to 15 years because of the difficulty of sorting out other factors affecting adoption from the impact of public FSR/D and extension services (1983, p. 6). McDermott points out that the issue of effectiveness of research, including FSR, leads to an examination of the management processes and organizational structure of research and extension systems:

> "One (consideration) is that in a donor project to build indigenous capacity, operational efficiency is not necessarily the first test. Building capacity (to conduct FSR) involves learning, both on the part of nationals and expatriates and donors, and adjustment of both design and operation based on that learning. Given this, the first test is effectiveness. Once it is learned how to be effective, efficiency must be achieved. Based on effectiveness and efficiency, the program must be expanded so that it can have a significant impact on the economy. Craving for economy-wide impact can cause the process to be short-circuited with the result that none of the three are achieved." (#7, pp. 2-3)

Evaluation provides a basis for assessing effectiveness of an FSR project, the results of which can be used by policymakers in deciding on future funding, program administrators in deciding on mid-course corrections and field staff in planning and implementing the research activities. Again, however, there is no standardized methodology for evaluation that by examining both organizational structure and management processes can help answer such questions as: Is FSR effective in reorienting national agriculture research and extension to the task of appropriate technology development and dissemination? If not, why not? Is management and/or organization the problem? If so, how? What can be done to correct these deficiencies?

The development of a standard methodology can begin by refining a conceptual framework for FSR (similar to the framework presented in section 2) which provides functional and organizational requirements for "operationalization" of a technology innovation process, without specifying the precise organizational form these requirements may take. While process evaluations of particular projects are country-specific, a standard methodology would at all times address the essential question: Has management been effective in organizing and allocating resources so that each of the necessary technology innovation functions is being performed in an integrative and collaborative mode? If not, why not?

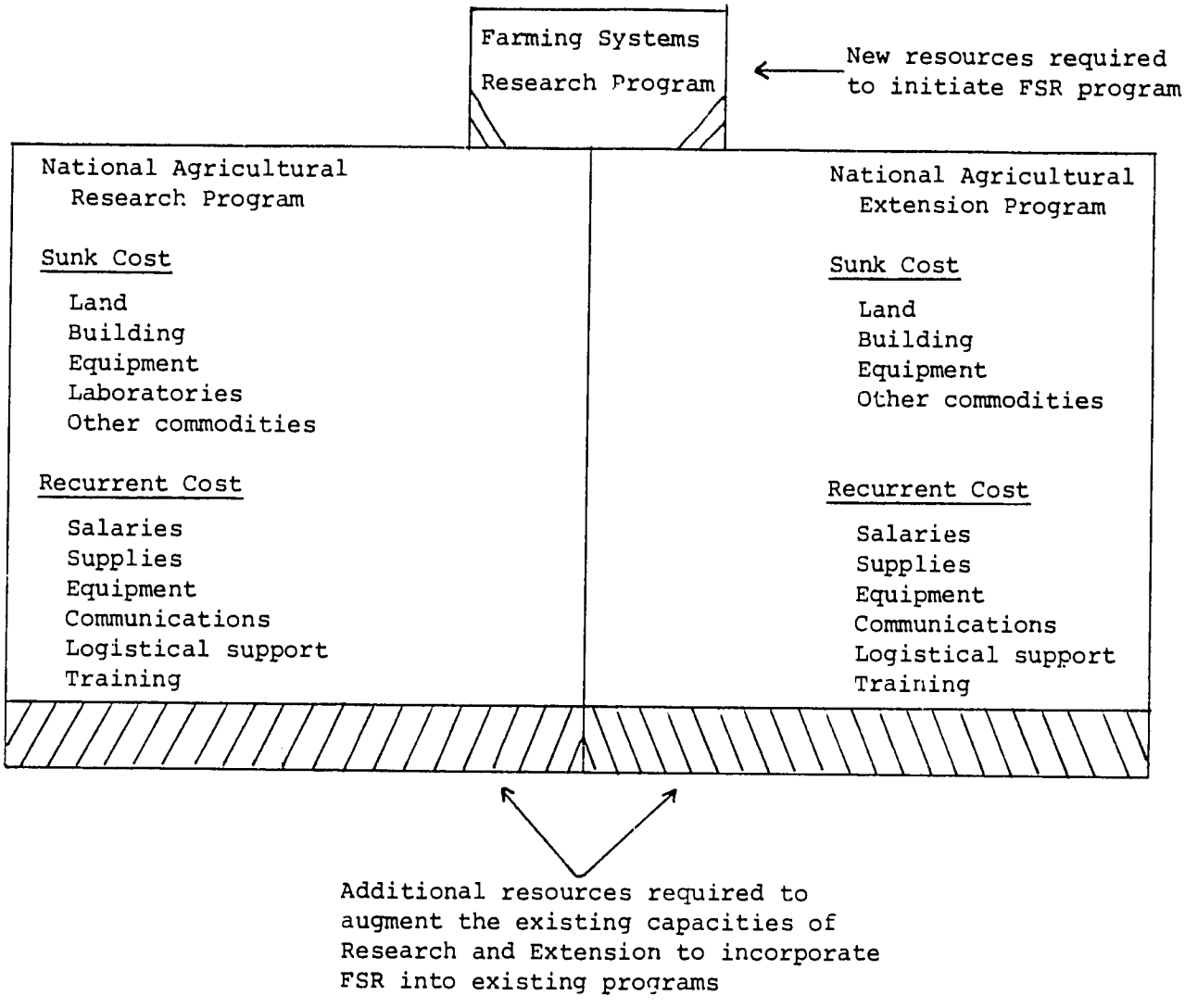
One additional observation on the issue of cost-effectiveness: It is a measurement tool which can give management/administration an idea of the relative performance of alternative approaches to achieving the same objective. But what are the "alternative approaches" to be considered in a cost-effectiveness analysis for FSR? There is no clearly recognized alternative at this time.

For Hildebrand, cost-effectiveness is not the real issue. He suggests that the only "alternative" to FSR would be the existing national agricultural research and extension system, but this is not a genuine alternative (personal conversation, 1984). FSR is complementary and in addition to the existing, more conventional discipline and commodity research programs (Norman, 1980). The costs of integrating FSR into the existing system are in addition to those of the existing system. (Figure 5 presents Hildebrand's conceptualization of these cost relationships.) The issue comes down to the effectiveness of FSR in relation to AID's objectives for it. FSR effectiveness can be measured in terms of how well it addresses the functional and operational gap referred to in section 2. That is, has FSR been effective in serving the needs of upstream applied research, farmers and policymakers (Gilbert et al, 1980)?

Efficiency is a critical cost issue in evaluating FSR and can be examined at two levels, system and activity/methodology. Proponents of FSR claim that incorporation of FSR into the research and extension process and institutionalization of FSR into the existing R&E system will improve the effectiveness and efficiency of the entire R&E process and system. This claim is based on the proposition that such incorporation provides feedback information to on-station disciplinary and commodity research which will assist in reorienting those programs toward real problems identified for applied research effort through the FSR diagnostic and experiment stages, and builds the requirements for technology dissemination into all of the stages of FSR. To the extent that this feedback and incorporation do not occur, improvements in overall system efficiency cannot be expected. This is a clear issue for evaluation.

Figure 5.

**Relationship of Costs: FSR in Comparison to Existing R&E**




Adapted from personal communication with Peter Hildebrand, October 10, 1984.

One of the most common criticisms of FSR is that it is viewed as costly to implement (Gilbert et al, 1980; Harrington, 1980). This is not necessarily the case. What are these cost elements? Typical inputs to agricultural research projects fall into the categories of expatriate and national salaries and support, infrastructure development, commodities and equipment, operating costs and training. In comparing FSR with conventional research/institution-building projects, an examination of budgeted inputs by line item reveals that FSR does not (should not?) involve infrastructure development. Main ministerial office buildings, research station complexes, laboratories, etc., will have all been provided for in the process of building a national capacity for applied (traditional) research. There will be some need for reallocating space and facilities as new staff are brought on board--but no new physical construction should be required. It is true that FSR teams will need to live in the area in which they work, but local housing should be available.

As to the costs of salaries, most planned project expenditures are devoted to these costs and this is an item that AID should examine closely in both project design and evaluation. Local salaries, as an item of current operating cost and planned recurrent cost budgets of host-country institutions, will reflect actual requirements for additional personnel. FSR demands administrative and management personnel, FSR program leaders/research specialists, extension specialists, and locally recruited research assistants/technicians. Because of the special skill training and professional orientation requirements for personnel in each of the areas, there will probably need to be new (additional) personnel brought into the organization(s). However, new personnel can be held to the level required to perform the necessary administrative/management and field research functions. This will be especially important at the beginning of the FSR institutionalization process, as FSR is new and unproven, and problems of institutional jealousy and territoriality arise.

Expatriate salaries represent a substantial part of total cost in FSR projects. This could be an area for real reduction in planned expenditure. Currently, AID budgets between $120,000 and $150,000 per person-year for expatriate salary and support. Given the current five- to seven-year life-of-project period, and calls for extension beyond that, these figures will escalate rather rapidly. The role of expatriates in AID-supported FSR projects requires careful examination. Should AID be supporting expatriates as research management advisers or as field research team members? In either case, do these expatriates need to be resident over the entire term of the project? Can initial long-term assignments be phased out over the first two or three years into short-term advisory services in program and research management?

Training needs have been discussed elsewhere. There is a general consensus among experienced FSR field practitioners that the bulk of training should be short-term, on-location and problem-oriented. In comparison to the costs of formal degree training in U.S. or third-country universities, the costs of short-term, in-country training are much lower. The IARCs have been identified by many FSR practitioners as probably the best source of training assistance. Given the two-way flow of benefits derived from IARC participation in national FSR programs, the costs to AID for IARC assistance should be negotiable (downward).

FSR tends to demand significant expenditure for support commodities and related local operating costs. This has never been a hidden cost element in planning for FSR project implementation: Without question, higher costs are associated with taking research off-station and to farmers' fields throughout the country (Harrington, 1980). For evaluation, the problem of assessing efficiency is confounded by the extent to which commodity and operating costs have been "pre-programmed" in the project design. If FSR projects were designed with a minimal enumeration of specified commodity and local logistical requirements, and with a higher contingency item earmarked for these requirements, then assessments of efficiency would have greater meaning. That is, evaluators would be able to assess the efficiency of research managers in using available resources, rather than the skills of the project designers in prophecy.

There is another area where gains in efficiency can help reduce costs--the ability of technical managers to plan the research process according to the minimum amount of effort required to satisfy the condition of reliability of data and validity of results (Harrington, 1980), in the shortest amount of time (Gilbert et al, 1980; Hildebrand, 1976). Capturing these potential efficiency gains will rely heavily on the experience and skills of technical program management.

This issue pertains to all stages of FSR. In the selection of target areas (recommendation domain identification), how much secondary data need to be collected, organized and analyzed and what are the most likely (and ready) sources of this information? In the diagnostic stage, what level of detail do we need in order to understand the farming system we are studying? Do we use a "sondeo" approach or do we go straight into large-scale, formal surveys? Is the area/population so large that formal surveys must be conducted using strict statistical sampling procedures? Is the farming system so complex that repeat visits and farm record keeping need to be employed in order that we can be sure our diagnosis of the problem(s) is reasonable? Do we need to undertake aerial photography and ground verification, or will a brief reconnaissance of the area by car suffice? In the design/planning stage, what is the nature of the "environmental" constraint set and how many special studies need to be conducted

to understand these constraints in relation to the whole farming system? How many technical components will be simultaneously included in the intitial research and how many researcher-managed and superimposed trials? What size plots? How many treatments and replications? How many check plots? How many animals? How many farmer cooperators? How many farmer-managed tests? Is there a need for formal modeling? In the on-farm research and analysis stage questions primarily center around analyzing experimental results--which technique will yield a level of reliability acceptable by professional/disciplinary standards? What analytical methods are available to integrate and synthesize findings across enterprises and subsystems?. How can we measure and how much data do we need to collect to measure farmer acceptability? In the extension stage, questions revolve around methods of conducting multi-locational tests and pilot production programs. How many tests, farms, seasons, etc.? How strict are the boundaries of recommendation domains? Can FSR recommendations be more widely applied with relatively little management modification?

The range of the above questions underscores the importance of this issue. In every FSR decision taken regarding the actual research activities and methodologies to be used for data collection, experimentation and analysis, there is an associated decision to spend or save salaries, time, logistical support costs, administrative and management support costs. The experience of technical management is critical to cost-efficiency gains in FSR. Conversely, for evaluation, how technical managers deal with these decision-making events is one measure of efficiency.

One final point should be made regarding the cost-efficiency of FSR. To the extent that so-called "shelf technologies" exist in regional, national or international research stations/centers, and to the extent that FSR research managers ignore these essentially "ready" technologies (perhaps needing integration work) then great strides toward inefficiency will have been taken.

* * * *

In summary, there are three important economic concepts which will be used to judge the efficacy of FSR relative to administrative expectations of donor and implementing agencies. These concepts are: benefit, effectiveness and efficiency. An underlying assumption should be made explicit prior to any analysis--that FSR is complementary to existing agricultural research and extension programs. Therefore, the costs of FSR should not be considered in comparison with, but in addition to, the sunk and recurrent costs of the existing R&E system. Without the presence of an existing comparative cost framework for the needed ecnomic analysis, there is a need for the

specification of information requirements and the development and/or refinement of methodologies for data collection and analysis. If such analyses are to be useful to FSR management and administration for interim and end-of-project evaluation, they need to be based on firm data collected as an ongoing function of project implementation monitoring. In order that such analyses be maximally useful to donor agencies, it is critical that these information requirements and methodologies for data collection and analysis be universally and uniformly required of project implementation agencies. In this way FSR portfolio analysis can be performed.

3. <u>What is the role of FSR in the technology extension process in developing countries?</u>

The extent to which FSR should be firmly integrated into the national technology extension process is without doubt one of the most troublesome issues concerning FSR development. If the conceptualization of the technology innovation process, as presented in section 2, is valid, then FSR must have backward (upstream) links into the basic and applied research, (the science and technology generation functions), but also strong forward links into the function of technology dissemination. However, there are several problems in creating the research-extension linkage which are important and demand consideration by host-country governments and donor organizations promoting FSR.

First, extension organizations are very weak and ineffective, if not inoperable, in most developing countries. Second, there are no clearly recognized methods for linking the development of a technology with the requirements for its appropriate extension to those production systems in which the technology is intended to perform. Lastly, there has been little attention paid to the form of the research output expected and extension strategies compatible with this output. If the expectations of developing-country governments and donor agencies for FSR are to be met (i.e., the development and adoption of appropriate technologies which result in significant increases in farm production, productivity, and farm family and societal welfare), then the problems facing extension organizations need to be dealt with immediately.

Historically, extension organizations of most developing countries have been largely abused, both in terms of mission and budget allocation decisions. This neglect has resulted in a largely ineffective public bureaucracy of poorly paid, poorly supported and poorly trained civil servants. Further, governments have used extension organizations to perform regulatory enforcement tasks (tax collection, loan repayment, etc.) because of their immediate contact with large numbers of the rural population, rather than to perform the tasks of technology dissemination. The resulting reputation as "enforcers" rather than "supporters" is clearly recognized by both of the immediate constituencies of extension services--researchers and farmers--and is also recognized by many development professionals as a constraint to the potential effectiveness of FSR. One FSR practitioner has written recently, "It is urgent for extension to modify its historical mission, organization, staffing and training approach in order to exploit opportunities created by FSR...If this does not happen it is unlikely that a change in research, such as a shift to FSR...will be particularly successful in its long-term impact on agricultural development" (Johnson and Claar, 1984, in Flora, #8).

On the other hand, one group of development professionals claims that the on-farm work of FSR, especially if large numbers of farmers are directly involved in the research plan, does the job of extension (Simmonds, 1983). This claim is based on accumulating evidence of the eagerness of farmers to adopt improved technology appropriate to their production system and the dynamic nature of the diffusion process in rural communities. This view of the role of FSR in the technology extension process argues, not for a strengthening of extension agencies as they exist, but rather, for a radical restructuring. From this viewpoint, one institutional alternative would be the creation of highly capable extension specialists with strong disciplinary and commodity training and with clearly identified responsibilities in all of the activities of the FSR cycle, rather than the maintenance of large numbers of field agents whose primary job is to deliver the message from farm gate to farm gate (reference the Training and Visit System). It is not reasonable to develop extension capabilities in all countries along the same model--whichever model is chosen as the most attractive conceptually. What is clear is that there is an immediate need to recognize this weakness and to design a strategy for integrating research and extension <u>functions.</u>

The literature on FSR has been concerned with methodological issues in Farming Systems <u>Research</u> but has been relatively silent regarding methodological requirements for extension purposes. However, this subject is receiving increasing attention, especially the need for ex ante consideration of extension requirements (Chamala and Keith, 1984; Bremer, 1983; Hart, 1983). The earlier neglect of extension requirements seems attributable to the following views being held by FSR program managers: 1) once a relevant technology is developed, extension will be comparatively easy; or 2) we'll worry about it when we get to it (Chamala and Keith, 1984; Bremer, 1983--respectively). But, as Hart points out:

> "...linking extension and research to form a farming systems research and extension (FSR/E) process is not an additive step. Technology transfer activities cannot be simply added on to the technology generation activities; they must be combined to form an integrated process. The reason that this integration has occurred in very few FSR projects is not just because of a lack of linkages between research and extension institutions. Technology transfer is qualitatively very different from technology generation ...FSR is a process that moves from general to particular (area selection, identification of target farmers, specific constraints, etc.), while extension moves from the specific to the general--the goal is to transfer technology to all farmers where it is appropriate." (1983, p. 1)

Hart claims that additional information is needed, and "a systematic attempt to generate this information as part of the technology generation process is the place to start" (1983, p. 4). Bremer goes one step further in insisting that "we should regard the form of the extension message as a determinant of the research design, and not as an issue conceptually separate from it" (1983, p. 17).

The consequences of not incorporating these specific information needs of extension staff as ex ante design considerations of the research process, as reported by Chamala and Keith of their experiences in Australia, were that only in one agro-ecological area did the extension staff have clearly definable systems with a neat package to promote. In other areas they only had vague principles for application under varying agro-ecological conditions (1984). According to many FSR practitioners and observers, much of the FSR technology evaluation work is concerned with multilocational testing. They claim this activity not only helps to define the specific conditions under which technologies can be applied or that extension agents learn the details of the technologies and their application, but that these multi-locational testing programs are part of an extension strategy (Shaner et al, 1982; Zandstra et al, 1981). Given the clearly polar opinions in this area, we think that specific attention needs to be given to an examination of the question of methodological requirements for extension and the ex ante integration of extension into the research process in FSR projects and programs.

Finally, with regard to the issue of the role of FSR in technology extension, we believe it is important to at least surface a concern discussed by Bremer at length--the form of the research output in relation to the development of extension strategies compatible with that output. She observes that the so-called "tech pack" approach to packaging research output was a move on the part of the research communities of developing countries to change the requirements made of an extension field agent from a generalist required to interpret research results for specific application to a conduit for delivering a pre-packaged message, under the assumption that the extension field agents at large were not prepared for or capable of such interpretation. However, it has been widely recognized that "tech packs" are subject to considerable modification by farmers resulting in the possibility of only partial adoption of specific components of the intended package (Hildebrand, 1979; Harrington, 1980; Kampen, 1979; Collinson, 1982).

Bremer then raises the question of reasonable alternatives to the tech pack. She notes the increasing popularity in many countries, primarily resulting from support of the World Bank, of the Training and Visit (T&V) System. The "advantage" of the T&V System is that it "requires even less thought on the part of the extension field agent than the tech pack method. In this system

technologies are divided up into information bits suitable for delivery during a single visit to the farmer" (1983). However, the operating-cost requirements of such a system must be considered prohibitive for most developing countries in a recurrent-cost framework when judged in comparison with nearly any other approach. Bremer identifies three basic "packaging" alternatives (1983):

- modified tech pack -- Recommendations packaged as tech packs for a specific subset of farmers, defined by a common farming system, which would have a specified domain of applicability; the Puebla Project in Mexico is offered in example.

- technology catalogue -- Recommendations packaged as a catalogue of technologies, each of which would have been identified through the FSR process and tested for agronomic and economic effectiveness under small farm conditions; the farmer would then be presented with a range of choices and selection would be based on his judgment of relevancy.

- modular technologies -- Recommendations packaged in modules for adding new enterprises to an existing system or otherwise making relatively major modification to the farmer's system.

The obvious requirement of each of these is a very capable extension field agent. The important point being made here is that the form of the research output and the strategy for extension needs to be matched before extension staff are expected to actively disseminate technologies. This requirement has implications for extension planning at the research design and testing stages of the FSR cycle.

* * * *

In summary, given the cost of publicly supported research and technology development there is a need for widespread adoption of improved technologies. Where prior institutional analysis has shown that the publicly supported extension organization is too weak to provide effective technical input into the various stages of FSR, serious consideration needs to be given in the project planning/design phase to how the functional requirements for technology dissemination will be met.

4. <u>What is the role of FSR in providing linkages between in-country research and extension organization(s) and other in-country agricultural planning, development and service organizations?</u>

The role of FSR in providing linkages between the agricultural research and extension organization(s) and other organizations which serve the agriculture sector is probably the most controversial of the issues surrounding FSR. FSR activities entail the collection and analysis of data on a wide number of both technical and human (e.g., farm management, social, cultural, economic, political, and other institutional) environmental factors which are determinants of the farming systems extant in any country. The heart of the controversy lies in the fact that some FSR practitioners view this data collection and analysis as pertinent only to the research tasks of identifying the nature of environmental constraints and determining opportunities for modification within the constraints which the farmer (management) faces. Others believe that if this information were made available to those in a position to modify the nature of the environmental constraints (e.g., policymakers, bankers, etc.), then the "opportunities set" would widen, giving researchers and farmers a greater probability of achievement of commonly held objective(s).

The proponents of the former argument, who advocate the use of information on socioeconomic constraints to farmer (management) options in the identification of <u>technical</u> opportunities for innovation, would not deny the potential utility of their data and analyses for other purposes. Rather, it is a question of FSR mission, objectives, priorities, and responsibilities. Hildebrand, for instance, sees a short time frame for achieving the technology development mission--work on socioeconomic constraints which generally require a longer time horizon are relegated to the non-solution set of possible alternative interventions:

> "The treatments also should fit within the capabilities of farmers to carry out in the short run. That is, they should not depend on a non-existing infrastructure such as a credit program or the development of new markets, etc. The object is to produce an improved technology which can be put into practice immediately by the farmers so they can begin benefitting..." (1976, p. 7)

For Zandstra, the objective of management and thus the researcher is to increase the efficiency of a given subsystem of farming enterprises. He posits that $Y=f(M,E)$ where yield (Y) is a function of management (M) and environment (E) (1981, p. 7). Researchers consider environmental variables only to the extent that the farmer (management) is to control the environment. To evaluate (ex ante) the functional relationship, the researcher seeks to determine how to vary the enterprises within the

subsystem to get the best returns for different production environments. Because the functional relationship covers a wide variety of subsystems, the researcher must eventually formulate a statement about the effect of different management practices on the performance of different combinations of enterprises within a subsystem in a given environment (Zandstra et al, 1981).

Morris claims no agronomic bias in asserting that the FSR process must deal with questions in order of priority and that "where conditions of agronomic adaptation cannot be met, questions of managerial feasibility and economic viability are academic. Even if managerial feasibility is the stumbling block, technical solutions may be more acceptable to government officials than programs that require massive budget outlays for credit, subsidies and infrastructure development" (1984, p. 14).

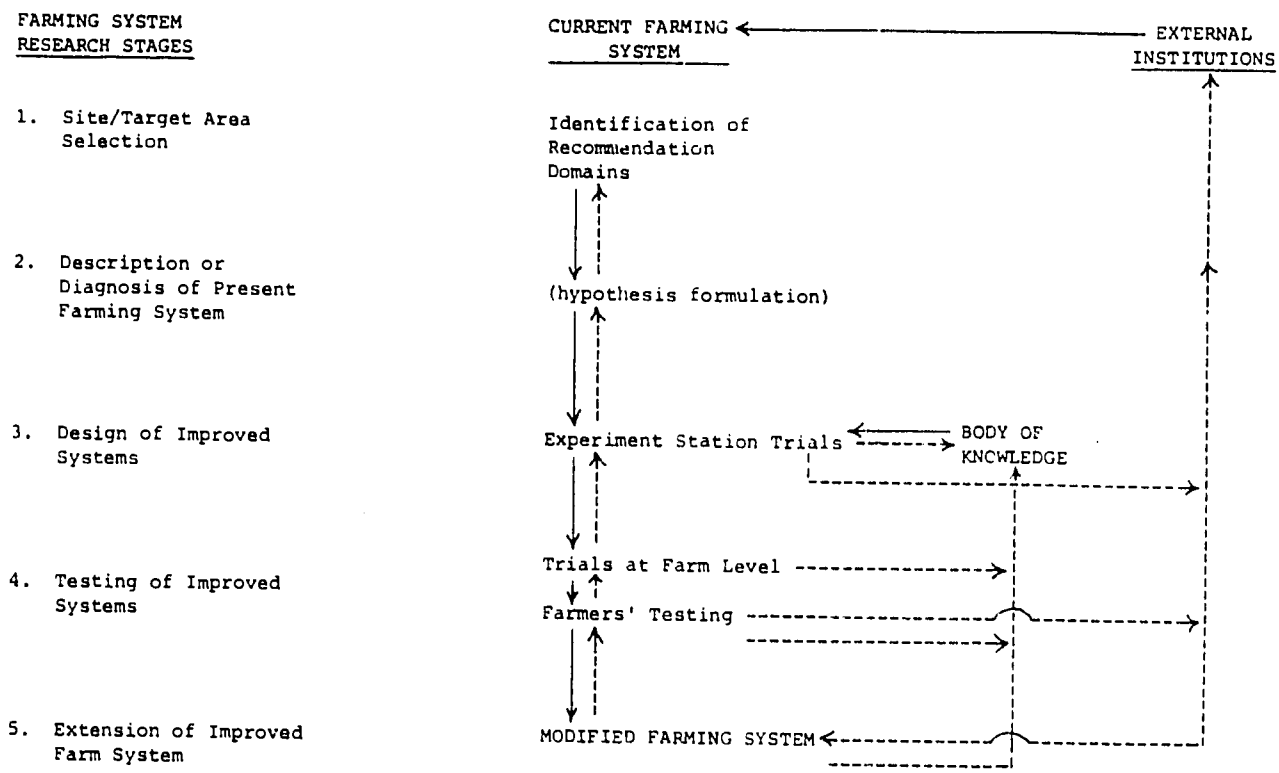
These assertions remind us that the objective of FSR remains technology development, dissemination and adoption by small farmers. They also imply that modification of the technical production environment is contributing to that objective and is within the purview of FSR researchers.

The other side of this argument acknowledges the broader importance of environmental or exogenous human variables in determining the type of farming systems extant in any country, as well as the potential for improving the efficiency of the whole farm system by favorably modifying the constraining exogenous human environment.

Figure 6 presents a schematic framework for Farming Systems Research adapted from Norman (1980, p. 12). The adaptation involves the addition of the site/target area selection stage and the identification of recommendation domains. It is clear from this schematic framework that Norman believes that external institutions are a determinant force in the make-up of any farming system. It is also clear that he believes that information collected and analyzed in the various FSR activities has both a "feedback" and a "feed-forward" utility. Specifically, FSR information/analytical results must flow to external institutions as well as to commodity-oriented applied researchers. Linkages with extension services, delivery system agencies, development project management units, and policy-making agencies are very important in determining the effectiveness of existing support systems (External Institutions in Figure 5) and of anticipated changes in the future. "In most countries micro-level information for policy analysis is scarce...detailed information generated through the FSR approach could be very important for identifying changes in policies that would complement the introduction of improved practices" (Gilbert et al, 1980).

Figure 6.

Schematic Framework for Farming Systems Research




Adapted from D. W. Norman, "The Farming Systems Approach: Relevancy for the Small Farmer," 1980.

Harrington, reporting on a major 1980 CIMMYT-sponsored conference for FSR social scientists, also recognized these feedback/feed-forward linkages and associated responsibilities imposed on the FSR process.

> "Policy makers were also noted as potential users of FSR results. This is, again, a case where the use of research results is potentially significant, but where linkages are currently not well developed. FSR results should be of interest to policy makers because they can often be used to measure the costs (in terms of foregone agricultural production) of current policies and to predict the impact of alternative policies on farmer decision-making. This is not to say that FSR results can be used to decide on correct policy. Rather, research results provide necessary (but not sufficient) information upon which to base such decisions.

Examples of such use of FSR results are, however, rare." (1980, pp. 6-7)

Gilbert et al note that the objective of traditional agricultural research has been narrowly focused on improving the productivity of a single commodity by reducing resources used in the production of that commodity (1980). Within this narrow problem-solving framework (i.e., input use reduction will yield increased productivity, ceteris paribus), the technical factors are the only factors eligible for treatment as variables. However, the objective of FSR is:

> "with the productivity of the entire farming system and, as a result, it will examine non-technical changes that are exogenous--factors such as improving marketing arrangements for inputs and outputs. The flexibility inherent in the FSR approach also assists in linking the micro and macro perspectives in designing strategies more effective for specific rural areas or groups of farmers. National policies, such as pricing and trade policies, that affect agricultural producers may be explicitly considered when diagnosing existing farming systems and designing improvements. Changes in such policies may be the most critical ingredient in efforts to improve the lives of small farmers." (1980, p. 19)

Collinson (1982), speaking from CIMMYT's perspective on FSR in East Africa, states that some device for coordinating the efforts of policymakers, planners, researchers and extensionists is long overdue. He believes that recommendation domains have the potential of helping select research priorities, and promoting communications between farmers and the bureaucracy and among departments in the bureaucracy. In addition, the diagnostic sequence can be used to identify needed changes in policies and institutions to support local development programs.

* * * *

In summary, then, there is no argument among FSR practitioners regarding whether or not to collect and analyze information on "environmental" or "exogenous human" factors determining the farming system. The argument is really based on a major methodological difference between consideration of elements of the non-physical environment <u>as variables</u> with possibilities for modification or <u>as parameters</u> which must be assumed as unalterable throughout the technology development and dissemination phases of the FSR process.

Where FSR assumes the potential for directed change in the environment, there must be effective linkages between the researchers and "outside" organizations in a position to effect this change.

5. <u>Should FSR take more than a field crop orientation in setting the research agenda?</u>

A commodity-based or cropping system orientation in the conduct of adaptive agricultural research, which excludes work in other commodities and subsystems of the existing farm systems, does not qualify as Farming Systems Research. Cropping Systems Research (CSR), as this type of research is referred to, does not share objective, core characteristics (in total) or the entire range of activities. CSR is "a horse of another color." Regardless, there is considerable Cropping Systems Research being implemented as Farming Systems Research and the resulting confusion has been the subject of considerable discussion among FSR practitioners. In actual practice, most FSR has become CSR without full acknowledgement of the implications for method and research resources.

At this point, a common definitional base is useful:

> "Farming systems research addresses itself to each of the farm's enterprises, and to the interrelationships among them and between the farm and its environment. The research uses information about the farm's various production and consumption systems--the animal production system, the cropping system, the secondary production activities such as mat weaving, processed food, etc., that add value to primary products--and about the farm's environment--biophysical, institutional, social, economic--to identify ways to increase the efficiency with which the farm uses its resources.

> "Cropping systems research, on the other hand, is a subset of farming systems research that is confined to the farm's crop-production enterprise. The various crop-production activities are considered modifiable, taking into account the relationships between the crop production enterprise and other production-consumption activities and the physical, biological, and socioeconomic environment. The objective is to increase the benefits derived by crop production with available physical, biological, and socioeconomic resources." (Zandstra et al, 1981, p. 7)

There are several aspects of Farming Systems Research which make it more difficult to practice than to conceptualize and discuss. FSR by definition implies an understanding of the <u>whole farm system</u> before diagnosis and prioritization of research activities can be accomplished.

> "Any systems understanding starts from qualitative description of components and their interactions, goes on to quantitative enumeration of states and flows and, only when the latter are tolerably well defined, attempts modeling or synthesis." (Simmonds, 1983, p. 24)

In regard to FSR, practicality dictates that a qualitative description of components and their interactions and some (limited) degree of quantitative enumeration is as far as the FSR team can go. The limitations are imposed by reason of time, personnel and financial considerations which go beyond the research resource investment capacities of developing countries. This conclusion can be supported by examining the experience of AID in its support for Agriculture Sector Modeling (ASM) projects during the 1970s.

Such detailed understanding goes beyond the level of sophistication required by practically oriented field adaptive research teams.

> "The grandly 'holistic' approach of FSR Sensu Stricto would be satisfied by no less than a description of the entire system. More realistically, and certainly for the purposes of On-Farm Research/Farming Systems Perspective (OFR/FSP), a subsystem is selected (depending on the interests of the investigator) in awareness of the interactions with other subsystems...In real life, therefore, systems isolated for study are always subsystems arbitrarily defined for the purpose in view. They are never 'holistic' in any serious sense of that rather over-used word. In practice what is wanted is sufficient understanding to attain the necessary level of FSP and no more...For OFR/FSP, a partial, non-holistic, subsystem knowledge will suffice or, anyway, has to suffice in practice." (Simmonds, 1983, pp. 25-6)

In addition to the element of practicality in limiting the sophistication of understanding of the whole farm system, there is a lack of methodologies for integrating non-crop commodities or subsystems into the FSR process. According to Norman, who is one of a few who have attempted FSR in the holistic sense of the Sensu Stricto model,

> "Presently there is no standard methodology for undertaking FSR. Indeed, the term farming systems research is somewhat of a misnomer. To date most FSR has been confined to crop production processes. Yet even here methodologies for undertaking such work need to be improved. Apart from pleas for desirability (Boer and Welsch, 1977) the FSR approach has rarely been applied to livestock unless these impinge directly on crop processes. There is a need to develop a more holistic systems approach which goes beyond agricultural and livestock production and includes the marketing process and off-farm enterprises (Gilbert et al, 1980)." (1980, p. 22)

Simmonds (1983) and Zimmermann (1984) have also noted the critical importance of perennial subsystems in tropical farming

systems, as well as the lack of analytical methods for incorporation into the FSR process.

One additional consideration helps explain why FSR in theory has become CSR in practice. The particular operational mandate of any organization conducting FSR activities tends to dictate the scope of its research focus. For example, all of the IARCs (except ILRAD) have organizational mandates to work on specific commodities, in specific resource regimes or regions. The 1978 CGIAR TAC Stripe Review of FSR not only acknowledged that the original mandates of the IARCs embodied the FSR philosophy and included clear scope for the development of FSR (as several centers have done), but strongly recommended that all IARCs, except ILRAD, develop clearly identifiable FSR programs or an orientation of their existing commodity research towards FSR (TAC, 1978). However, in the same document the TAC review team limited the scope of the FSR programs to a focus on those commodities and resource regimes included in their respective Center mandates. Hence, the FSR programs of the IARCs are largely CSR, with some program components focused on New Farming Systems Development (e.g., ICRISAT watershed development program).

* * * *

Thus, there are three major reasons for less than the whole farming system focus in FSR: limitation by reason of practicality, lack of applicable methodologies, and restrictive organizational mandates. The existence of sound reasons for FSR differing in theory and in practice does not, however, negate the validity of concerns expressed over this issue. Trees, grasses, animals, fish and off-farm employment figure prominently in the household-consumption needs and resource-allocation decisions made by small farmers in the developing world. To the extent that these production and income-generation activities of the farm family are not fully incorporated into FSR diagnosis, research prioritization, agenda and experimentation, then FSR will never be more than on-farm Cropping Systems Research with a systems perspective.

6. What is the role of the International Agricultural Research Centers (IARCs) in FSR development at the country level?

According to the 1978 special report of the Technical Assistance Committee (TAC) of the Consultative Group for International Agricultural Research (CGIAR), there is no conflict between the operational mandate of the IARCs and their development of FSR programs. In fact the TAC reporting team recommended that "all commodity/regionally oriented IARCs, except ILRAD, should have a clearly recognized program in, or orientation to, FSR" (TAC, 1978, p. 60). They recognized that most FSR in the IARCs has been concerned with the cropping subsystem (with a specific commodity or resource focus), rather than the whole farm system and that this emphasis should be continued.

The review team also recommended that the IARCs limit their FSR activities to generation of technologies and methodologies which can be generalized, rather than to concern for location-specific practices, whereas national FSR programs are obliged to deal with location-specific problems. In fact they stressed the point that development of FSR methodologies should be the major output of the IARCs. Methodological development of FSR was directed to encompass base data analysis, on-farm studies and research station studies. Finally, the TAC reporting team recognized that training national-level scientists was the major channel for the transmission of FSR methodology and technology from the IARCs, and recommended strengthening of the IARC FSR training activities.

Throughout the FSR literature, training emerges as a major need in national programs which are considering FSR, as well as a major cooperative linkage between the IARCs and national programs. CIMMYT's interest in the development of FSR procedures relates directly to the Center's association with national programs--as a producer of intermediate goods (elements of new technology, procedures and training) which national programs apply in forging new technologies (Winkleman and Moscardi, 1979). Similarly, a basic premise in the establishment of ICRISAT was that the Institute would serve to strengthen and support national research programs through: the provision and exchange of germplasm; assistance in training; promotion of scientific interaction; and provision of technical assistance. "ICRISAT scientists have an important role in providing practical training to local technicians and, in some cases staff scientists" (ICRISAT, 1981, p. 13). Collinson, working since the mid-seventies in East Africa for CIMMYT, states that one of his first objectives was to "teach the farm systems economist the tools of his trade and to expose him to (agronomic) experimental methods" (1982). He also made the observation that in-service and short-term training have preoccupied CIMMYT staff since 1979.

On the basis of the heavy demand for training in the procedures/ methodologies of conducting the diagnostic survey and adaptive research, CIMMYT will likely have to expand its training activities and work closely with FSR programs sponsored by various donors.

Norman, who has long experience in FSR in Africa, claims that:

> "One of the major problems involved in establishing FSR programs is the lack of agricultural scientists and social scientists with FSR training or experience... If FSR programs are to grow and be effective, they must be staffed by individuals with training and experience in FSR which is largely unobtainable outside of existing FSR programs." (Gilbert et al, 1980, p. 77)

The authors go on to say that the nature of FSR, namely its locational specificity and the need to modify methodologies to suit local conditions, strongly favors training on location. The main problem is lack of experience with interdisciplinary research. They argue against formal degree training because of the predominant requirement of degree programs for disciplinary competence and the tendency toward increasing specialization. However, they also argue that in order to participate fully in multidisciplinary research, each FSR member must be firmly grounded in at least one discipline.

Hence, the nature of FSR, e.g., location-specific, practical/hands-on and ground-level or real problem-solving setting, argues for consideration of training assistance to be provided by various IARCs. The need is not, necessarily, for formal academic degree programs in U.S. or third-country universities. The literature finds little motivation among university administrators to train and grant degrees in FSR because disciplinary competence is their collective teaching objective, and the multidisciplinary "competence" required for analysis in a whole farm framework goes beyond the application of concepts, principles and tools of a single discipline. As of 1982, there were only five U.S. universities having expressed interest in such training (Shaner et al, 1982). A similar issue could be raised with regard to IARC training programs, based on the limitations imposed by their farm subsystem or commodity orientation. Such a limited focus (less than whole farming system) could narrow the research perspective in both the diagnostic analysis of the technical and human environment and in the consideration of research opportunities.

Another human resource constraint to FSR project implementation is the lack of trained and experienced U.S. FSR practitioners. The need for experienced FSR technical assistance is another area where the IARCs could be and have been of support to national program development. Policies of individual centers

will have to be examined as to whether or not they allow for such temporary transfers of their scientific personnel. However, such prohibitive policies are not cast in concrete. Given the recognized importance of FSR and location-specific, on-farm research to the continuing progress of the work of the centers (TAC, 1978; Simmonds, 1983; Shaner et al, 1982; ICRISAT, 1981; Zandstra et al, 1981; Morris, 1984), mutually acceptable cooperative agreements could be drawn among individual centers, host-government agencies and AID. There are cases in precedent (CIMMYT) which can be used as prototype or model agreements.

Finally, we would like to emphasize the IARCs' mandated role in the generation of prototype technologies or technology components for transfer to and adoption by national programs in support of their activities in technology development (Winkleman and Moscardi, 1979; TAC, 1978; ICRISAT, 1981). This is the so-called "shelf-technology" issue. Are there technologies which are ready for transfer to national programs and which are suitable for applied and adaptive research at the national level? We know that there are many cases of such transfer having occurred. However, we are not secure in the knowledge that this process is systematic, continuous, responsive, reliable and timely. As Hildebrand has noted from his experiences with technology development in Guatemala, "The frequently conceived notion that a pool of technology is available and waiting for extension techniques to get it into the hands of small farmers is mostly invalid" (1979, p. 22). We recognize the fact that his comment was made with specific reference to national experiment station research results/recommendations, but we think it applies in the larger sense as well. In fact, this question is of such magnitude that AID's Bureau of Science and Technology has notified Congress of its intention to fund an entire project designed to examine the extent of shelf technology in detail. The point is simply that the IARCs could go a long way toward speeding up the process of research planning and design within national FSR (and disciplinary/commodity programs) if this type of comprehensive information were available continuously, reliably and systematically to national-level researchers in their deliberations and considerations of alternatives and opportunities.

* * * *

In summary, the IARCs have a supportive role in national-level FSR program development in the areas of training, transfer of appropriate FSR methodologies, technical assistance and technology transfer.

7. <u>In the design of FSR projects, are time frames and objectives properly aligned?</u>

The crux of this issue is whether or not AID has set its objective(s) for FSR projects at an artificially high level in relation to the time allowed for objective achievement. Both FSR practitioners and Agency staff have voiced concern over this issue because of its implications for the sustainability of FSR.

At the time AID undertook major support for FSR, the Agency would not commit itself to a life-of-project period in excess of five years. Where strong arguments have prevailed this period has been extended to seven years. At the same time, the assumption is that the Agency has clearly stated that <u>improved technology adoption</u> by small farmers is AID's objective for FSR projects. During our interviews with FSR practitioners and Agency personnel, we asked the question, "Given the experimental nature of FSR, beginning with Day 1 of project implementation when would you expect to see results in the form of new technologies designed, tested and adopted by farmers?" In most cases, the answer was hedged, in deference to a perceived difference in research requirements for field crops, small ruminants and large ruminants. Further, all respondents refused to commit themselves to even a rough estimate of the period required for diffusion/adoption--so, the responses cover only the time required to develop releasable technologies. The shortest period of time estimated for the latter was three years for relatively simple agronomic modification in field crop production; the longest period was 25 years for any significant improvement in large ruminant production enterprises.

If we accept the assertion of the existence of a learning curve in institution-building projects--FSR projects must be considered in large part as institution-building--then the issue is clearly one of appropriate project design--an ability to accurately assess human capabilities and the potential for institutional evolution. We don't have the methods for assessing, with a reasonable degree of probability, human capacity for change and the necessary and sufficient conditions to catalyze institutional and organizational evolution. Or else we are not applying the knowledge we do have. In either case, our review of AID-supported FSR indicates undue optimism is being exercised in the process of conceptually and temporily framing an FSR project. We confront such enthusiastic end-of-project-status statements as "500,000 farmers producing 10 million tons more food grain, creating 8,000 more jobs in rural areas and reducing the projected trade deficit by $120 million by the end of Year 5." Even where estimates of output are more reasonable the fact remains that actual farmer adoption of new technologies resulting in production and income increases is AID's objective, and implied measure for FSR project performance (Ferguson, 1983). With as little as we know about the natural process of diffusion in rural developing-country communities, the question is: In

such a relatively short time frame, is the objective of "technology development and farmer adoption and positive upward macroeconomic change" a reasonable one for measuring FSR project performance?

Bremer has suggested that sustainability of FSR programs (during the initial process of institutionalization) requires more modest program goals (project objectives) (1983). Such modesty is especially important when goals are set for institution-building in research and extension with a relatively new and relatively unproven research strategy. "Any new system should be implemented in such a manner that it will be given adequate and necessary support over a period of time sufficient to demonstrate its advantages" (Waugh, 1984, ch. 5, p. 2). One senior AID program administrator has suggested that national research and extension systems are creatures of a political, social and economic process which we don't really understand. We don't know how to build R&E systems that work, but we keep trying. If we accept this position then more modest, perhaps non-quantitative project objectives which reflect progress along McDermott's learning curve should be adopted. Another Agency official responded, "...no, I would not expect to be able to count farmers using/employing a new technology by the end of a project but I would expect to see significant institutional change."

* * * *

Clearly, if program goals and project objectives are set at unrealistically optimistic performance levels, then it will be the odd program or project which lives up to expectation, and this failure will be recorded in negative performance evaluations which may not fairly reflect project accomplishments. In turn, the detractors of FSR will be vindicated, program administrators will face increasing difficulty in justifying full budget/ personnel requests, research and extension talent will work in the FSR mode only as long as donor funding is maintained, and prospects for the continuation and vigor of the FSR program will decline.

The immediate options would be to lengthen the time frame for project implementation or to align project objectives with more accurate assessments of human and institutional capacities for change in the process of technology innovation.

8. <u>Are there circumstances when FSR should not be considered as an AID-supported program option in implementing agricultural development strategies in developing countries?</u>

Given the enthusiastic support which FSR has recently received, this issue has not been given much deliberate attention. Those who have written on this subject have addressed one of three topics: the state of the existing farming system relative to "equilibrium;" proper identification of smallholder farmers having the capacity and intention to increase on-farm production; and the state of the existing national R&E system relative to the degree of change necessary for FSR project implementation.

On the first topic Bremer couches her concern largely in terms of the negative implications of inappropriate applications of FSR on continued methodological development and cost-effectiveness.

> "...FSR is not cost-effective or appropriate for all types of farming systems...This judgment has already been made de facto by the decision not to apply the FSR approach on irrigated, monocrop small farm systems, even where such systems exist side by side with diverse, rainfed multicrop systems (as in the Philippines)." (1983, p. 20)

Bremer proposes the following hypotheses:

> "FSR is most appropriate to small farm situations where the farming system is in transition from a stable, low-level equilibrium to a stable, high-level equilibrium. It is least suited to systems in either type of equilibrium.
>
> "Farmers in a low-level equilibrium situation have honed their system to the point where it is by and large as productive as it can be under their highly constrained circumstances. Comparatively few opportunities to change their system for the better exist to be discovered by agricultural research, until changes take place off-farm (expansion of marketing systems, for example) to open up their system.
>
> "Farmers in a high-level equilibrium situation, by contrast, are more likely to be relatively sophisticated consumers of extension and researcher advice, quite able to apply specific recommendations to their individual farming systems without assistance.
>
> "Farmers in transition (either because of new possibilities created by technological change or, more commonly, negative changes in the economy and ecology around them) are less likely to be able to find their way to a new sustainable

system by themselves. They are therefore more in need of a holistic approach to assist them in making technological adjustments in their farming system, since they themselves may not understand the changes going on around them.

"As a practical matter, more and more small farmers find themselves, knowingly or unknowingly, in a transitional situation. Even farmers pursuing a "traditional" system, such as the slash-and-burn "kaingineros" of the Philippine highlands or the small farmers of West Africa, are in fact facing rapidly changing conditions caused by population growth, new employment opportunities outside agriculture, and deteriorating environments. Their traditional technologies are no longer optimal or even viable under these altered circumstances. These systems should be the first priority for future FSR programs." (1983, pp. 20-21)

Garrett goes a step further by suggesting that all small farmers are not alike and therefore need to be identified according to farm household objectives, as part of the FSR target area selection procedures. Essentially, she sees the smallholder farming population as being stratified according to the orientation of production enterprise: 1) those who produce primarily for the market; 2) those who produce primarily for home consumption; and 3) those whose on-farm production enterprises receive residual resource allocation, after household consumption needs are met via off-farm enterprise (Garrett, 1984). In her view, FSR programs which include the third group as a target for agricultural production improvement will not likely meet with successful objective achievement.

The third topic deals largely with the local capacity for institutional change. Collinson writes: "lessons have also been learned from working with national research services. The most important is the recognition of the need for a flexible and pragmatic approach to different institutional situations and to the personalities involved in each situation. A major strategy (of CIMMYT) is to focus on research services where there is already a strong awareness that research relevance is a problem. Within such establishments, if authority is strong, it may be helpful to introduce FSR procedures. Where direction is weak or conservative or where organization is poor new procedures can be seen as an added source of confusion--a nuisance" (1982, p. 40). Institutional assessment is essential for determining the potential for implementing a systems approach to agricultural research and extension. "The purpose is not to evaluate existing institutions...but to inventory a given situation in such a way that maximum use can be made of existing structures, resources and other organizational conditions as well as to identify changes or modifications that might make research and extension more effective" (Waugh et al, 1983, p. 1).

Toward this objective, Waugh et al have offered guidelines for institutional assessment. They also suggest that "...constraints on the present (R/E) system will not automatically be removed with the introduction of a systems approach. In fact the multidisciplinary, and more disperse nature of the systems focus might exacerbate administrative problems" (1983, p. 8). In cases where the change is imposed on existing R&E organizations, political support may not be forthcoming. In this situation the new FSR program is placed in a disadvantageous position which could affect the efficacy of the research and the ability of the research organization to carry out long-term expansion (Waugh, 1984).

The key elements of an institutional assessment necessary to inform a decision-maker about the appropriateness of an FSR program in particular settings can also be examined during evaluation of ongoing programs. These elements are:

- the existence of inter-organizational linkages (especially between research and extension organizations) which are critical to the potential efficacy of FSR projects;
- the flexibility of the mandate of the proposed organizational "home" for FSR;
- the degree of willingness or intention to <u>integrate</u> social science and biological-physical sciences within the existing organization;
- the existence of an explicit policy orientation which favors groups or classes of farmers other than those considered targets for FSR.

## Additional Unresolved FSR Issues

In addition to the eight issues discussed above, several issues should be raised which focus on the extent to which the FSR process properly incorporates factors that transcend enterprise production per se, but that relate to the maintenance of small farm family welfare. The lack of discussion of these issues in no way implies that they are of lesser importance in relation to those discussed above; rather, no significant discussion of these issues is present in the literature or among FSR professionals. These issues are:

- Given the fact that agriculture is both an energy consumer and energy producer, to what extent are energy requirements (supply and demand) of small farm households incorporated in the diagnostic, design, testing and evaluation stages of FSR activities?

- Given the assumptions that much small farm production occurs on marginal quality land, and that as population pressure continues the quality of the land resource can be expected to decline, ceteris paribus, to what extent does the FSR process include explicit, active recognition of this problem in diagnostic, design, testing and evaluation of new technologies?

- Small farm systems in transition from a subsistence to a market-production orientation may move into a position of nutritional risk as they alter the commodity mix. To what extent are farm family nutrition and health maintenance and improvement objectives of FSR technology development?

- Much current CSR works toward increasing crop production intensity. To the extent that increased cropping intensity increases on-farm labor requirements, are these increases placing undue burdens on family members (specifically women and children) who typically perform the most labor-intensive production operations (e.g., weeding, transplanting, etc.)?

- Where FSR activities/research areas focus on current national development priorities (e.g., increased aggregate production of staple crops), has it been determined explicitly that this focus is consistent with farm family welfare and priorities?

- Where the objective to be maximized in the FSR or CSR process is specified as increased yield, income or combined income, does the objective represent that of the small farm family or does it represent a traditional top-down determination of research objectives?

## APPENDIX A

Relevant Literature and Individuals Consulted

### Literature


Aderogba, K., W. Buggess, G. Hanson, and G. Sullivan. "Farming Systems Research vs. Farm Management/Marketing: A Potential Dilemma for Economists," poster presentation, Fourth Annual Farming Systems Research Symposium, Kansas State University, 1984.

Bremer, J. "But Is it 'FSR'?: Potholes on the Road from Fad to Legitimacy, draft. DAI, 1983.

Byerlee, D., L. Harrington, and D. Winkleman. "Farming Systems Research: Issues in Research Strategy and Technology Design," American Agricultural Economics Association, 1982.

Casey, F., and R. Barker. "A Course in Farming Systems Research: The Cornell Experience," Dept. of Agricultural Economics, Cornell University, 1982.

Chamala, S., Keith, K. J. "Development of Extension Programs Within the Context of FSR&D--The Conservation Cropping Case in Queensland, Austria," Fourth Farming Systems Research Symposium, Kansas State University, 1984.

Christensen, C., et al. "Food Problems and Prospects in Sub-Saharan Africa: The Decade of the 1980's," NTIS, Washington, DC: USDA Economics Research Service, 1981.

CIMMYT/INIAP. "Creating an On-Farm Research Program in Ecuador: The Case of INIAP's Production Research Program," CIMMYT Economics Program Working Paper 01/83.

Collinson, M. P. (#1) "A Low Cost Approach to Understanding Small Farmers," London: Applied Science Publishers Ltd., 1981.

_____. (#2) "Farming Systems Research in Eastern Africa: The Experience of CIMMYT and Some National Agricultural Research Services, 1976-81," Paper No. 3, Dept. of Agricultural Economics, Michigan State University, 1982.

DeBoer, A. J. "Livestock in Farming Systems Research and Development Programs," paper prepared for Farming Systems Workshop, Port of Spain, Trinidad, 1979.

Delgado, C. "The Southern Fulani Farming System in Upper Volta: A Model for the Integration of Crop and Livestock Production in the West African Savannah," AID/afr-G-1261, Michigan State University, 1979.

Dillon, J. L. "The Economics of Systems Research," Agricultural Systems, England: Applied Science Publishers Ltd., 1976.

Eicher, C. K. "Facing up to Africa's Food Crisis, Boulder, Colorado: Foreign Affairs Subscriber Service, 1982.

Eicher, C. K., and D. C. Baker. "Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey," Michigan State University International Development Paper No. 1, 1982.

Ferguson, D. S. "An Appropriate Agricultural Research and Development System for Complex Environments--The Case of CARICOM," Washington, DC: USDA, Office of International Cooperation and Development, 1983.

Flora, C. B., ed. "Farming Systems Research & Extension: Implementation and Monitoring," abstracts, Paper No. 8, Kansas State University, 1984.

_____. "Proceedings of Kansas State University's 1982 Farming Systems Research Symposium--Farming Systems in the Field," Paper No. 5, Kansas State University, 1983.

_____. "Proceedings of Kansas State University's 1983 Farming Systems Research Symposium--Animals in the Farming System," Paper No. 6, Kansas State University, 1984.

Garrett, P. "Agricultural Research and Development: Viable Objectives for Smallholder Programs," unpublished draft. Dept. of Rural Sociology, Cornell University, presented at Fourth Annual Farming Systems Research Symposium, Kansas State University, 1984.

Gilbert, E. H., D. W. Norman, and F. E. Winch. "Farming Systems Research: A Critical Appraisal," Michigan State University Rural Development Paper No. 6, 1980.

Harrington, L. "Methodological Issues Facing Social Scientists in On-Farm/Farming Systems Research," CIMMYT, 1980.

Hart, R. D. "One Farm System in Honduras: A Case Study in Farm Systems Research," presented at the Farming Systems Research and Development Workshop, Consortium for International Development, Fort Collins, Colorado, 1979.

_____. "Using the Concept of Agroecosystem Determinants to Link Technology Transfer and Technology Generation to Form a Farming Systems Research and Extension Process," presented at University of Missouri, 1983.

Hart, R., M. Onim, S. Russon, M. Matuva, K. Otieno, and H. Fitzhugh. "An Analytical Framework for Feed Resources Research on Mixed Farms in Western Kenya," Morrilton, Arkansas: Winrock International, 1984.

Hildebrand, P. E. "Combining Disciplines in Rapid Appraisal: The Sondeo Approach," England: Applied Science Publishers Ltd., 1981.

_____. "Generating Technology for Traditional Farmers: A Multi-Disciplinary Methodology," presented at the Rockefeller Foundation Conference Center, Bellagio, Italy, 1976.

_____. "Incorporating the Social Sciences into Agricultural Research: The Formation of a National Farm Systems Research Institute," report of a five-year tour of duty. New York: Rockefeller Foundation, 1979.

Indonesian Cropping Systems Working Group. "Network Methodology and Cropping Systems Research in Indonesia," 1979.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Farming Systems Research Program Staff. "Farming Systems Research Program at ICRISAT: An Overview (1)," India, 1981.

International Livestock Centre for Africa (ILCA). "Systems Research in the Arid Zones of Mali: Initial Results," ILCA Systems Study, 1981.

Kampen, J. "Farming Systems Research and Technology for the Semi-Arid Tropics," India: ICRISAT, 1979.

Labadan, E., C. Bantilan, R. Gonzaga, J. C. Flinn, and S. K. Jayasuriya. "Screening Crop Innovations in a Whole-Farm Framework," IRRI Saturday Seminar, Kansas State University Library Resources on Developing Countries, 1980.

Lele, U. The Design of Rural Development: Lessons from Africa, World Bank, Johns Hopkins University Press, 1975.

McDermott, J. K. (#1) "Institutions in Agricultural and Rural Development," TPCA Occasional Paper 2, 1981.

_____. (#2) Notes on Management Submitted to FSSP, 1984.

_____. (#3) Notes on Purdue Seminar, 1984.

_____. (#4) "Social Science Perspectives on Agriculture Developments," paper prepared for Faculty Development Seminar, University of Nebraska, 1982.

_____. (#5) "Extension Research Linkage Conceptualization and Management," draft working paper, FSSP, 1984.

_____. (#6) "FSR Project Evaluation," prepared for Second Annual Farming Systems Research Symposium, Kansas State University, 1982.

_____. (#7) "Economic Analysis," draft working paper.

_____. (#8) "Institutionalization," draft working paper.

McIntosh, J. L., and S. Effendi. "Cropping Systems Research Activities in Indonesia," paper presented at Cropping Systems Working Group Meeting, 1978.

Ministry of Agriculture (Research Division), Government of Kenya, and Dept. of Economics, Egerton College, Kenya. "Demonstrations of an Interdisciplinary Approach to Planning Adaptive Agricultural Research Programmes," Kansas State University Library Resources on Developing Countries, Report No. 1, 1975.

Ministry of Agriculture, the Philippines. Integrated Agricultural Production and Marketing Project (IAPMP). "Proceedings: Farming Systems Seminar-Workshop," PCARR, Los Banos, Laguna, Philippines, 1981.

Morris, R. A. "A Decade of On-Farm Research in Lowland Rice-Based Farming Systems: Some Lessons," paper presented at the Fourth Farming Systems Research Symposium, Kansas State University, 1984.

Mosher, A. T. "Some Critical Requirements for Productive Agricultural Research," The Hague: International Service for National Agricultural Research, 1982.

Murphy, J. "Strengthening the Agricultural Research Capacity of the Less Developed Countries: Lessons from AID Experience," AID Program Evaluation Report No. 10, USAID, 1983.

Narendan, V. "Farming Systems in St. Lucia: An Anthropological Perspective," CARDI/USAID Small Farm Multiple Cropping Systems Research Project 538-0015, Trinidad, 1981.

Norman, D. W. "The Farming Systems Approach: Relevancy for the Small Farmer," Michigan State University Development Paper No. 5, 1980.

Norman, D. W., E. Simmons, and H. Hayes. Farming Systems in the Nigerian Savanna: Research and Strategies for Development. Boulder, Colorado: Westview Press, 1982.

Reeves, E. B., and T. Frankenberger. "Socioeconomic Constraints to the Production, Distribution and Consumption of Sorghum, Millet and Cash Crops in North Kordofan, Sudan: A Farming Systems Approach," Report No. 2, INTSORMIL Contract No. AID/DSAN-G-0149, 1982.

Rhoades, R. E. "The Art of the Informal Agricultural Survey," Social Science Dept. Training Document 1982-2. Lima, Peru: International Potato Center, March 1982.

Schultz, T. W. Transforming Traditional Agriculture. New Haven: Yale University Press, 1984.

Shaner, W. W., P. F. Philipp, and W. R. Schmehl. Farming Systems Research and Development: Guidelines for Developing Countries. Boulder, Colorado: Westview Press, 1982.

Simmons, N. W. "Farming Systems Research: The State of the Art," unpublished draft. World Bank, 1983.

Singh, L., and K. P. Srivastava. "Farming Systems Research and Development and Agricultural Engineering in the Eastern Caribbean," paper presented at the Fourth Annual Farming Systems Research Symposium, Kansas State University, 1984.

Stevens, R. D. Tradition and Dynamics in Small-Farm Agriculture: Economic Studies in Asia, Africa and Latin America. Ames: Iowa State University Press, 1977.

TAC. "I--Analysis by the TAC Review Team of Farming Systems Research at CIAT, IITA, ICRISAT & IRRI," 1978.

USAID. (#1) "AID Experience in Agricultural Research: A Review of Project Evaluations," AID Program Evaluation Discussion Paper No. 13, 1982.

_____. (#2) "Agricultural Research in Northeastern Thailand," AID Project Impact Evaluation Report No. 34, 1982.

_____. (#3) "An Evaluation of the CARDI/USAID Small Farm Multiple Cropping Systems Research Project," No. 538-0015, 1982.

_____. (#4) "Central America: Small-Farmer Cropping Systems," AID Project Impact Evaluation Report No. 14, 1980.

_____. (#5) "Economic Constraints to Technology Adoption," Development Support Bureau, Office of Agriculture, Division of Economics and Sector Planning Occasional Paper Series, 1976.

_____. (#6) "Food Grain Technology: Agricultural Research in Nepal," AID Project Impact Evaluation Report No. 33, 1982.

_____. (#7) "Guatemala: Development of the Institute of Agricultural Science and Technology (ICTA) and its Impact on Agricultural Research and Farm Productivity," AID Project Impact Evaluation Report No. 30, 1982.

_____. (#8) "Kitale Maize: The Limits to Success," AID Project Impact Evaluation Report No. 2, 1980.

_____. (#9) "Korean Agricultural Research: The Integration of Research and Extension," AID Project Impact Evaluation Report No. 27, 1982.

_____. (#10) "Tunisia: The Wheat Development Program," AID Project Impact Evaluation Report No. 48, 1983.

_____. (#11) "West Africa Rice Research and Development," AID Project Impact Evaluation Report No. 44, 1983.

Waugh, R. K. "Client-Oriented Agricultural Research and Extension," draft copy for class use, International Programs, Institute of Food and Agricultural Sciences, University of Florida, 1984.

Waugh, R. K., J. Meiman, and J. K. McDermott. "Institutional Assessment for Implementing a Systems Approach to Agricultural Research and Extension," FSSP. WP 101.

Whelan, W. P. "The Nutritional Component of Farming Systems Research," Cook College, Rutgers University.

Winkleman, D., and E. Moscardi. "Aiming Agricultural Research at the Needs of Farmers," paper presented at the Seminar on Socioeconomic Aspects of Agricultural Research in Developing Countries, Santiago, Chile, 1979.

World Bank. "A System for Monitoring and Evaluating Agricultural Extension Projects," World Bank Staff Working Paper No. 272, 1977.

_____. "Costs and Benefits of Agricultural Research: The State of the Art," World Bank Staff Working Paper No. 360, 1979.

_____. "Investment in International Agricultural Research: Some Economic Dimensions," World Bank Staff Working Paper No. 361, 1979.

Zandstra, H. G., E. C. Price, J. A. Litsinger, and R. A. Morris. "A Methodology for On-Farm Cropping Systems Research," galley proofs. Manila: International Rice Research Institute, 1981.

Zimmermann, R. "Integrated Resource Planning and Management in Eastern and Southern Africa," discussion paper prepared for USAID Workshop on Natural Resource Interactions, Nairobi, Kenya. Associates in Rural Development, Inc., 1984.

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## APPENDIX B

AID Project Documents Consulted

| Country | Project | Number | Start-up Date |
|---|---|---|---|
| Botswana | Agricultural Technology Improvement | 633-0221 | 1981 |
| Burundi | Small-Farming Systems Research | 695-0106 | 1983 |
| Cape Verde | Food Crop Research | 655-0011 | 1982 |
| Gambia | Agricultural Development Research and Extension | 611-0201 | N/A |
| | Mixed Farming and Resource Management | 635-0203 | 1979 |
| Guinea | Small Holder Production Preparation | 675-0204 | 1983 |
| | Small Holder Productivity | 675-0210<br>N/A | 1985<br>(antc.) |
| Kenya | Agricultural Technology | 615-0229<br>N/A | 1985<br>(antc.) |
| | Drylands Cropping Systems Research | 615-0180 | 1979 |
| Lesotho | Farming Systems Research | 632-0065 | 1978 |
| Malawi | Agricultural Research | 612-0202 | 1979 |
| Mali | Farming Systems and Extension | 688-0232<br>N/A | 1985<br>(antc.) |
| Niger | Cereals Research | 683-0225 | 1982 |
| Rwanda | Farming Systems Improvement | 696-0110 | 1984 |
| Sahel | OMVS-Agricultural Research II | 625-0957 | FY84 |
| | Mauritania<br>Mali<br>Senegal | 682-0957<br>688-0957<br>685-0957 | |
| Senegal | Agricultural Research and Planning | 685-0223<br>N/A | 1985<br>(antc.) |

N/A = Not Available

| Country | Project | Number | Start-up Date |
|---|---|---|---|
| Senegal | Casamance Regional Development | 685-0205 | 1978 |
| Sierra Leone | Adaptive Crop Research and Extension | 636-0102 | |
| Somalia | Agricultural Delivery Systems (as amended) | N/A | |
| Sudan | South Regional Agriculture Development I | 650-0444 | 1982 |
| | West Sudan Agricultural Research | 650-0020 | 1978 |
| Swaziland | Cropping Systems Research and Extension Training | 645-0212 | 1981 |
| Tanzania | Farming Systems Research | 621-0156 | |
| Upper Volta | Agricultural Development Support (Component IIIA) | 686-0255 | 1984 |
| Zambia | Agricultural Development Research and Extension | 611-0201 | |
| Africa Regional | CIMMYT-Farming Systems Research | 698-0444 | 1982 |
| | Semi-Arid Food Grains Research and Development (SAFGRAD-Misc.) | 698-0393 | |
| | Strengthening African Agricultural Research | 698-0435 | FY82 |
| S&T/AGR | Farming Systems Research and Extension | 936-4099 | 1982 |

N/A = Not Available

# Farming Systems Projects

The following constitute those projects which the BIFAD Task Force was able to identify as either being predominantly farming systems or having a farming systems component (e.g., FSR segment in a research/extension institution building type project). The projects are listed by AID geographic bureaus and in approximate chronological order thereunder according to the FY 1985 Annual Budget Submissions. [Note: CAM = Collaborative Assistance Mode contract, SUM= Standard University Mode contract.]

## AFRICA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lesotho ✓ | 632-0065 | Farming Systems Research<br>FSR [2 year extension] | (100% FSR)<br>( % FSR) | $ 7.3M<br>$ 2.1M | 1978-83<br>1984-85 | Washington State | (SUM) |
| Sudan ✓ | 650-0020 | Western Sudan Agricultural Research (Integrated FSR)<br>Agri. Research [amendment] | ( 50% FSR)<br>( % FSR) | $26.0M (13)<br>$11.3M | 1978-82<br>1985-86 | CID/Wash. State | ( ) |
| Sudan | 650-0035 | Yambio Agri. Research (FSR Activity) | ( % FSR) | $ 1.0M | 1979-80 | open bid RFP | ( ) |
| Kenya | 615-0180 | Drylands Croppings Systems | ( % FSR) | $ 4.0M | 1979-82 | USDA | ( ) |
| Sierra Leone | 636-0102 | Adaptive Crop Research & Extension I | ( 20% FSR) | $ 6.1M 1.22 | 1979-83 | Louisiana State | (SUM) |
| Malawi ✓ | 612-0202 | Agricultural Research | ( 20% FSR) | $ 9.0M 1.8 | 1980-84 | Florida | (CAM) |
| Zambia ✓ | 611-0201 | Agricultural Development Research & Extension | ( 33% FSR) | $12.5M 4.125 | 1980-84 | Illinois W/So. Illinois, MD/ES | (SUM) |
| Senegal | 685-0223 | Agri. Research & Planning | ( 25% FSR) | $ 3.8M .95 | 1981-84 | Michigan State | (CAM) |
| Swaziland | 645-0212 | Cropping Systems Research & Extension Training | ( 75% FSR) | $11.6M 8.7 | 1981-86 | Penn State | (CAM) |
| Tanzania | 621-0156 | Farming Systems Research | ( 60% FSR) | $ 8.3M 4.98 | 1982-84 | CID/Oregon State | (CAM) |

60.475

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cape Verde | 655-0011 | Food Crop Research (FSR Activity) | ( % FSR) | $ 3.7M | 1982-84 | Arizona | (S |
| Sudan | 650-0046 | Southern Agri. Dev't. I (FSR Activity) | ( % FSR) | $10.1M | 1982-84 | open bid RFP | ( |
| Botswana | 633-0221 | Agri. Technology Improvement | ( 80% FSR) | $ 7.8M 4.24 | 1982-86 | MIAC/Kansas State | (SI |
| Niger | 683-0225 | Cereals Research | ( % FSR) | $10.6M | 1982-89 | Purdue | (C/ |
| Rwanda | 696-0110 | Cropping Systems Improvement | ( 85% FSR) | $12.0M 10.2 | 1983-87 | | (C/ |
| Burundi | 695-0106 | Small Farming Systems Research | ( 75% FSR) | $ 7.8M 5.85 | 1983-85 | | (SI |
| Upper Volta | 686-0255 | Agri. Development Support (Component III A: "Farming Systems") | ( % FSR) | $30.0M ($4.0M) | 1983-87 | | (C/ |
| Sahel | 625-0957 | OMVS Agri Research II (FSR activity) | ( % FSR) | $13.5M | 1983-87 | | (SI |
| Guinea | 675-0204 | Smallholder Production Preparation (FSR activity) | ( % FSR) | $ 1.8M | 1983-84 | | (SU |
| Guinea | 675-0210 | Smallholder Productivity (followup to 675-0204) | ( % FSR) | $ M | 1985- | | ( |
| Mali | 688-0232 | Farming Systems & Extension | ( % FSR) | $17.3M | 1984-91 | | (SU |
| Lesotho | 632-0221 | Agri. Production & Institutional Support (FSR activity) | ( % FSR) | $30.4M | 1985-90 | | ( |
| Sierra Leone | 636-0170 | Cropping Systems Dev't. (on-farm trials) | ( % FSR) | $ 8.0M | 1985-89 | | ( |
| Senegal | 685-0265 | Casamance Agri Production (FSR activity) | ( % FSR) | $25.0M | 1985-89 | | ( |
| Kenya | 615-0229 | Agri. Technology (FSR activity) | ( % FSR) | $40.0M | 1985-92 | | , |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Regional | 698-0393 | Semi-Arid Food Grains Research & Dev't (FSR in Upper Volta) | ( 50% FSR) | $13.9M 6.95 | 1977-83 | Purdue | ( ) |
| Regional | 698-0429 | West Africa Rice Dev't Association (WARDA) | ( 30% FSR) | $12.0M 3.6 | 1981-85 | | ( ) |
| Regional | 698-0444 | Farming Systems Research (CIMMYT support) | ( % FSR) | $ 1.2M | 1982-82 | CIMMYT | ( ) |
| Regional | 698-0447 | Semi-Arid Food Grains Research & Dev't. Phase II | ( % FSR) | $15.0M | 1985-89 | | ( ) |
| Regional | 698-0435 | Strengthening Africa Agricultural Research | ( 50% FSR) | $30.0M 15 | 1985-91 | | ( ) |
| Regional | | International Institute of Tropical Agriculture (FSR Support) | | 41.75 | | IITA | |
| Regional | | International Crops Research Institute for Semi-Arid Tropics (FSR support) | | | | ICRISAT | |

ASIA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Philippines | 492-0356 | Eastern Visayas Farming Systems Dev't. | ( % FSR) | $3 M | 1981-86 | Cornell | (SUM |
| Philippines | 492-0334 | Small Farmer Systems II | ( % FSR) | $7.6M | 1983-85 | Experience Inc. | ( |
| Philippines | 492-0366 | Rainfed Resources Dev't. (partially FSR) | ( % FSR) | $10 M | 1982-89 | Open bid RFP | ( |
| | | | | 26.6 | | | |

## LATIN AMERICA & CARIBBEAN

| | | | | | | |
|---|---|---|---|---|---|---|
| Honduras ✓ | 522-0139 | Agricultural Research | ( % FSR) | $2.7M | 1978-83 | CID/New Mexico State( |
| Peru | 527-0192 | Agricultural Research, Extension & Education | ( % FSR) | $2.0M | 1980-84 | No. Carolina State ( |
| Guatemala | 520-0255 | Small Farmer Diversification System | ( % FSR) | $8.1M | 1981-83 | USDA ( |
| Haiti | 521-0092 | Agri. Dev't Support II (FSR activity) | ( % FSR) | $4.0M | 1983-86 | Arkansas w/ Lincoln ( |
| Caribbean | 538-0015 | Small Farm Multiple Croppings Systems | ( % FSR) | $2.2M | 1978-81 | ( |
| Caribbean | 538-0068 | Improved Agri. Extension II (FS extension) | ( % FSR) | $5.4M | 1982-86 | MUCIA/Minnesota ( |
| Caribbean | 538-0099 | CARDI: Farming Systems Research & Development | ( % FSR) | $7.0M | 1983-87 | ( |
| | | | | 31.4 | | |

NEAR EAST

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morocco | 608-0136 | Dryland Agriculture Applied Research (FSR component) | ( % FSR) | $19.4M | 1978-87 | MIAC/Nebraska | (CAM) |
| Jordan | 278-0264 | Rainfed Agri. Dev't. (FSR approach) | ( % FSR) | $ 3.0M | 1985-85 | | ( ) |
| | | | | 22.4 | | | |

WORLDWIDE

| | | | | | | |
|---|---|---|---|---|---|---|
| S&T Bureau | 936-4099.01 | Farming Systems Support Project | (100% FSR) | $9.9M | 1982-87 | Florida |

The Farming Systems Support Project (FSSP) is an AID/S&T/AGR centrally funded cooperative agreement managed by the University of Florida, which collaborates with the below listed institutions. It's responsibilities include expanding the capacity of these institutions to provide technical assistance and training of project participants as well as rendering field support to USAID Missions.

Title XII Universities

Arkansas
Colorado State
Cornell
Illinois
Iowa State
Kansas State
Kentucky
Michigan State
Missouri
North Carolina State
Oklahoma State
Purdue
Southern Illinois
Tennessee
Texas A&M
V.P.I.
West No. Carolina State
West Virginia

Private Firms

Development Alternatives, Inc.
International Agricultural
Development Service
Research Triangle Institute
Winrock International
Livestock Center

Gov't. Agencies

U.S. Dept. of Agriculture
U.S. Agency for International Development

Total 373.215