PD BAT 969

FILE

FARMING SYSTEMS RESEARCH/EXTENSION PROJECT

USAID/MALI
August, 1984

Cover

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: _____

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Mali

3. PROJECT NUMBER: 688-0232

4. BUREAU/OFFICE: AFR/PD/SWAP — 06

5. PROJECT TITLE (maximum 40 characters): Farming Systems Research & Extension

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 94

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 85 B. Quarter ☐ C. Final FY 93

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(4,028)	(532)	(4,560)	(12,720)	(6,380)	(19,100)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		70	70		1,768	1,768
Other Donor(s)						
TOTALS	4,028	602	4,630	12,720	8,148	20,868

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) SH	111	080				19,100		19,100	
(2)									
(3)									
(4)									
TOTALS						19,100		19,100	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 241 012 023

11. SECONDARY PURPOSE CODE: 210 121

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BS	R/AG	PART	XII			
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

To provide institutional support to IER to expand and increase the effectiveness of its farming systems research program in Mali, in order to develop agricultural technology which is relevant to farmers needs and circumstances and to promote the effective transfer of such technology.

14. SCHEDULED EVALUATIONS
Interim MM 09 YY 88 MM 09 YY 91 Final MM 09 YY 94

15. SOURCE/ORIGIN OF GOODS AND SERVICES
☐ 000 ☒ 941 ☐ Local ☐ Other (Specify) _____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a _____ page PP Amendment.)

17. APPROVED BY
Signature: D. M. Wilson
Title: David M. Wilson
Date Signed: MM 08 DD 23 YY 84

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

AID 1330-4 (8-79)

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: _____

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: MALI

3. PROJECT NUMBER: 688-0232

4. BUREAU/OFFICE: AFR/PD/SWAP — 06

5. PROJECT TITLE (maximum 40 characters): Farming Systems Research & Extension

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 94

7. ESTIMATED DATE OF OBLIGATION (Under "B." below, enter 1, 2, 3, or 4)
A. Initial FY 85 B. Quarter 1 C. Final FY 93

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 85 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(4,028)	(532)	(4,560)	(14,971)	(4,127)	(19,098)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		67	67		1,768	1,768
Other Donor(s)						
TOTALS	4,028	599	4,627	14,971	5,895	20,866

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) SH	111	080				19,098		19,098	
(2)									
(3)									
(4)									
TOTALS						19,098		19,098	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 241 | 012 | 023

11. SECONDARY PURPOSE CODE: 210 | 121

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BS	R/AG	PART	XII			
B. Amount							

13. PROJECT PURPOSE (maximum 480 characters)

To provide institutional support to IER to expand and increase the effectiveness of its farming systems research program in Mali, in order to develop agricultural technology which is relevant to farmers needs and circumstances and to promote the effective transfer of such technology.

14. SCHEDULED EVALUATIONS
Interim MM 09 YY 88 | MM 09 YY 91 | Final MM 09 YY 94

15. SOURCE/ORIGIN OF GOODS AND SERVICES
☐ 000 ☒ 941 ☐ Local ☐ Other (Specify) _____

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

17. APPROVED BY
Signature: D. M. Wilson
Title: David M. Wilson
Date Signed: MM 08 DD 23 YY 84

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

AID 1330-4 (8-79)

Film

EXECUTIVE SUMMARY

Mali Farming Systems Research/Extension Project

This is a 10 year $19 million project which will provide institutional support to the farming systems research division of the national agricultural research institute. With this support Mali will be able to intensify its efforts to develop agricultural technologies which are relevant to farmer needs and circumstances, and to promote the effective transfer of such technology in improved extension programs.

The three main components of the project are the...

* Extension of Farming Systems Research and Extension work from the present single zone to the two other principal food production areas of the country.

** Improvement of Research-Extension-Farmer Linkages, as well as those within the agricultural research, training, and policy making institutions.

*** Training and Staff Development of 19 personnel with advanced degrees, the transfer of field methodology and analysis skills at all levels, and the facilitation of fuller professional development.

Sucessful implementation of the project will results in the following:

> Research Results that Lead to Improved Practical Technologies which are technically and economically viable for significant numbers of farmers.

>> Increased Production, Productivity and Incomes for Rural Households.

>>> Improved Organizational Effectiveness among Agricultural Sector Institutions as evidenced by more efficient research management, and closer collaboration amongst crops, livestock and forestry professionals and between these professionals and farmers.

Film

TABLE OF CONTENTS

FARMING SYSTEMS RESEARCH AND EXTENSION PROJECT

Project Data Sheet

EXECUTIVE SUMMARY

I. SUMMARY

Goal 1-5
Purpose
Summary Description
Timing and Project Duration
Cost-Financial Plan
Beneficiaries
Inputs
Implementation Arrangements
Waivers Required
Conditions and Covenants
Contracting Preferences
Design Team

II. PROJECT DESCRIPTION

A. Project Context and Rationale 6-9
B. Project Purpose 9
C Sectoral Goal 10
D. Project Strategy 10
E. Project Activities 11

1.0.0. Expansion of FSR/E into New Zones 11-14
1.1.0. Current FSR Situation 11
1.2.0. DRSPR Headquarters Move 12
1.3.0. Expansion to Two New Zones 12
1.3.1. Expansion into Region II: OHV 13
1.3.2. Expansion into Region V 14

2.0.0. Improvement of Research/Extension Linkages and Coordination 15-18
2.1.0. Linkages Within the Research System 15
2.1.1. On-Farm Trials 15
2.1.2. Training 16
2.1.3. Research Publication 16
2.2.0. Research-Extension Organization Linkages 16
2.3.0. Research-Training Linkages 18
2.4.0. Research-Policy Linkages 18
2.5.0. Linkages with Regional-International Institutions 19

I

3.0.0. Training and Staff Development 19-20
3.1.0. Long-term Training Oversees 19
3.2.0. Short-term Training 19
3.3.0. On-the-Job Training 20
3.4.0. Introduction of FSR/E Curriculum 20

F. Project Outputs 21-24

1. Research Results-Technologies
2. Production Performance
3. Organizational Improvement

G. Project Inputs 25-28

1.0.0. Technical Assistance 25
2.0.0. Training and Staff Development 27
3.0.0. Construction 27
4.0.0. Commodities 28
5.0.0. Recurrent Operating Expenses 28

III. COST ESTIMATES AND FINANCIAL PLANS 30-34

A. Cost Estimates 30
B. Summary Budget Tables 30
C. Recurrent Cost Analysis 30
D. Detailed Cost and Financial Plans 31

1. Table I - Summary Cost Estimate and Financial Plan 32
2. Table II - Costing of Outputs and Inputs by Project Component 33
3. Table III - Annual Expenditure Projections 34

IV. IMPLEMENTATION PLAN AND ARRANGEMENTS 35-39

A. Implementation Arrangements and Schedule 35

1.0.0. Grantee Implementing Agency 35
2.0.0. Recruitment of Grantee Agency Personnel Technical Assistance Team: Selection Process 35
3.0.0. USAID Project Management 35
4.0.0. Financial Management Arrangements 35
5.0.0. Disbursement of Funds 37

B. Procurement Arrangements/Responsibilities 37

1.0.0. Technical Assistance 37
2.0.0. Construction 38
3.0.0. Commodities 38
3.1.0. Shelf Item Procurement 39
3.2.0. Motor Vehicles 39

II

V. MONITORING PLAN 40-41

A. Mission Management 40
B. Project Committee 40
C. Project Task Force 40
D. Reporting Requirements 41
E. Project Reviews and Appraisals 41

VI. SUMMARIES OF ANALYSIS 42-52

A. Technical Analysis 42
B. Social Soundness Analysis 45
C. Economic Analysis 48
D. Financial Analysis 50
E. Institutional Analysis 51
F. Environmental Analysis 52

VII. EVALUATION PLAN 53-54

A. USAID/GRM Joint Review 53
B. External Evaluations 53

VIII. ATTACHMENTS

1. Draft Project Authorization 55
2. PID Approval Message 58
3. GRM Request for Assistance 62
4. Long-Term Training Plan 64
5. Project Staffing Pattern 65
6. Implementation Schedule 66
7. FSR/E Project Implementation Chart 75
8. Project Organization Chart 77
8.1. Organization of Agricultural Research in Mali 78
9. GRM Personnel Required 79
10. GRM Recruitment Schedule 80
11. Position Descriptions: - Long-Term T/A Team and Short-Term Financial Management Team 81
12. Procurement List 93
13. Statutory Checklist 94
14. Waiver Justifications - Vehicles 103
15. Log Frame 105
16. Detailed Outputs 112
17. List of Acronyms and Abreviations 113

ANNEXES

A. Technical Analysis
B. Social Analysis
C. Economic Analysis
D. Financial Analysis
E. Institutional Analysis
F. Environmental Analysis
G. Information Management

I. SUMMARY

Project Goal: To improve the production, productivity and incomes of rural households.

Project Purpose: The purpose of this project is to provide institutional support to the Institute of Rural Economy (IER) to expand and increase the effectiveness of its farming systems research program in Mali, in order to develop agricultural technology which is relevant to farmers needs and circumstances and to promote the effective transfer of such technology.*

Project Description: There will be three main components in the project.

1. Expansion of Farming Systems Research and Extension.

Under this component farming systems research will expand to two agricultural production zones, that of the Operation Haute Vallee in Region II in 1985, and to that of the Operations Mils-Mopti and Riz-Mopti in Region V in 1989. To improve the management of the expanded research program and to improve communication, coordination and logistics, the headquarters of the Farming System Research Division (DRSPR) will be shifted to Bamako from its present location at Sikasso, 380 kilometers from the capital.

2. Improvement of Research-Extension Linkages:

This component will strengthen and/or develop four kinds of linkages: linkages within the research system; between DRSPR, extension agencies and farmers; between DRSPR and training institutions; and between research organizations and those charged with agricultural policy and national planning.

3. Training and Staff Development:

Under this component the project seeks to strengthen the capacity of the national agricultural research and training institutions in Mali to conduct farming systems research and extension by providing four types of training: long-term graduate training overseas, short-term training outside Mali at relevant International Agricultural Research Centers (IARCs), in-country workshops and seminars, on-the-job training and introduction of FSR/E concepts into the curricula of agricultural training institutions.

---

* The IER is the principal agricultural crops research organization in Mali. It has a Farming Systems Research unit known as the Rural Production Systems Research Division (DRSPR) which is the main cooperating body for this project.

Inputs:

To implement the project the following principal inputs will be provided.

Technical Assistance -- 36 Person Years of Long Term Specialists

-- 36 Person Months of Short Term Specialists

Participant Training -- 64 Person Years (or 19 Fellowships) for Masters and Doctoral Level Study in U.S.

Construction -- Headquarters/Regional Office Buildings, and Staff Housing

Commodities -- Vehicles, Computers, Library Resources, Agricultural Inputs, and Research Equipment

Operating Expenses -- Vehicle Running and Maintenance Costs, Field Research Expenses, Expendable Supplies, Extension Materials, Journal Publication, Contract Employees, Per Diem, etc.

Outputs:

Three types of project outputs are expected.

-- Research Results and Improved Technologies

-- Increased Production and Productivity at the Farm Level

-- Organizational Improvements, including better trained researchers, improved coordination and linkages among research, extension and farmers, and more efficient research management

Timing and Project Duration

This will be a 10 year project beginning in 1985 and terminating in 1994. The project will be implemented in phases tailored to the return of Malian research personnel from long-term overseas training.

Cost Financial Plan: Total cost of the project is estimated to be $20.87 million of which USAID will contribute $19.1 million and the Government of Mali will contribute $1.77 million. Of the US contribution the following allocations will be made.

- Technical Assistance - $6.040
- Training - $1.836
- Construction - $1.057

- Commodities - $1.415
- Operating Expenses - $4.413
- Contingency at 10% - $1.476
- Inflation at 5% - $4.629

The financial plan calls for USAID to provide the full cost of technical assistance, training, commodities, and construction. USAID will also pay 82% of the recurrent costs (that is, all except salaries of research personnel and some support personnel) during years 1 through 7. During years 8 through 10 USAID will pay approximately 63% of the recurrent costs and GRM will pay 37% as detailed in the USAID-GRM cost sharing plan. The GRM's share of recurrent costs or the 10 year project life is 26%.

Beneficiaries

Immediate beneficiaries of this project will be the GRM research and extension institutions and personnel, and the farmers participating in on-farm trials. The ultimate beneficiaries will be a broader number of rural households which will enjoy enhanced production, productivity, and income resulting from better technology.

Implementation Arrangements

The grantee will be the Government of Republic of Mali (GRM). Overall responsibility for the implementation of this project will rest with the Institute of Rural Economy (IER) of the Ministry of Agriculture. The DRSPR will be the division of IER responsible for day to day project implementation.

USAID will provide a long term technical assistance team on direct contract to work with DRSPR in project implementation, including responsibility for procurement. USAID will also provide a project manager to plan, oversee, and monitor project implementation.

Waivers

The following waivers will be required.

1. A source/origin waiver for the procurement of passenger vehicles, pickup trucks, motorcycles, mobylettes and spare parts from AID geographic code 899 (approximate amount $604,000).

Contracting Preferences

A technical assistance contractor will be solicited through open competition, including a particular effort to involve U.S. universities. The selection criteria will contain an approriate weighting for those firms and universities who collaborate to provide the best team. This contracting mode was chosen in

recognition of the genuine difficulties which American society and institutions have in supplying French speaking specialists to the Sahel on a timely basis and our real concern that traditional U.S. reserach organizations have technical difficulties in dealing with farm level research programs in West Africa. The technical assistance contractor will be responsible for most procurement and training under the project.

All construction contracts will be competed to secure local host country contractors.

Conditions Precedent and Covenant

In addition to the standard provisions of the project agreement between the Governments of Mali and United States, the Malian Government will be asked to furnish, in a form and substance which satisfies USAID regulations and before any disbursements of funds or the issuance of any committment documents, evidence that:

a) a qualified project director has been officially named and her/his responsibility and authority defined;

b) other civil service personnel as identified in the project description have been officially assigned to the project;

c) special bank accounts to be used exclusively for USAID-provided funds have been established.

In addition, the Government of Mali will be asked to covenant the following:

a) a financial management and accounting system which satisfies USAID regulations will be established;

b) an inventory control and a use/maintenance system will be established for all USAID-financed project equipment;

c) a private sector firm(s) will execute all project construction unless otherwise jointly agreed by the GRM and USAID;

d) assure proper maintenance of all facilities financed by project funds.

e) to establish an adequate system of personnel evaluation to serve as a basis for a system of allowances and incentives.

Project Design Team

USAID

Rollo L. Ehrich	: Agricultural Development Officer, ADO
Sanath K. Reddy	: Agronomist, Principal Designer, ADO
E. Simmons	: Agricultural Economist, Sahel Development Planning Team (SDPT)
Gerald Cashion	: Design/Evaluation Officer
Roger Simmons	: Program Officer
Michael Foster	: Assistant DEO

GRM

Tiécouradié Diarra	: Director DRSPR/IER
Ousman Sy	: Economist, DRSPR/IER

Consultants-Advisors

Jerry Johnson	: Agronomist (PSC), USAID/Mali
Craig Olson	: Team Leader, Development Alternatives Inc.
Steve Franzel	: Economist, DAI
Le Roy Rasmussen	: Ag. Extension Specialist, DAI
Lisa Matt	: Social Analyst, DAI
Monteze Snyder	: Institutional Analyst, DAI
Susan Rogers	: Anthropologist, FSSP-University of Illinois
Ellis Matheny	: IPM Specialist, FSSP-University of Florida
Russell Freed	: Agronomist, FSSP- Michigan State Uni-sity
M. Simpara	: Agronomist, SRCVO/DRA/IER
M. Toungara	: Sociologist, DRSPR/IER
A. Camara	: Economist, DET/IER
D. Van Noy	: Team Leader, Regional Financial Management Project/Mali
Georges Jenkins	: Controller, USAID/Mali
S. Suggs/Jean Durette	: Human Resources Development Officer, USAID/Mali
R. Day	: Assistant Program Officer, USAID/Mali
E. Rhatigan	: Management Officer, USAID/Mali
Jon Anderson	: Forestry Officer, USAID/Mali
L. De Merode	: Program Economist, USAID/Mali

II. PROJECT DESCRIPTION

A. PROJECT CONTEXT AND RATIONALE

Food production in Mali has not kept pace with population growth and food requirements for the last ten years. Currently population is estimated to be growing at a rate of 2.6 percent per year while food production has been increasing at somewhat less than two percent annually. This latter rate of increase is close to the rate of growth in the agricultural labor force, and reflects the continued dependence of many Malian farmers on human labor as the major input into crop production. Urban population and urban food demand have been growing in excess of 4.5 percent since the early 1970's, due in part to repeated years of drought and crop failure on the farm, in part due to the prospects for urban schooling and jobs. Food imports, both commercial and concessional, have thus grown to fill the gap.

Yet Mali possesses relatively rich agricultural resources by Sahelian standards, and the Malian government is committed to reversing the recent downward trend in foodgrain production and attaining self-sufficiency in food production.

To accomplish these broad objectives, it will be necessary for the Government of the Republic of Mali (GRM) to foster a number of efforts: the development and application of more productive agricultural technologies through <u>research and extension</u>, the establishment of a policy environment which will ensure individual Malian farmers the <u>economic incentives</u> to increase their production, and the channeling of its own and external investment resources to provide an adequate <u>physical and institutional infrastructure</u> (roads, irrigation systems, and schools as well as financial and marketing institutions).

This is a tall order. There are more than 500,000 farming households in the country, many of them presently only tenuously linked with the national marketing system for foodgrains. Household labor availability constrains their ability to expand acreage cultivated without making expensive investments in animal traction equipment. Low and uneven rainfall makes the undertaking of such investments a significant financial risk. Lack of technologies to improve the production and/or productivity of traditional production systems to control pests, diseases and weeds poses further threats to increased crop production and farmer incomes.

Nevertheless, the Government of Mali has started to make some progress toward its objectives:

1. by beginning a process of policy reform -- particularly with regard to foodgrain and cotton pricing/marketing and the participation of the private sector in economic growth;
2. by focussing its investment priorities in agriculture through the development of a food sector strategy; and

3. by attempting to put essential public functions on a sound and sustainable financial footing.

Much remains to be done, however. Farmers in Mali still need better technological advice to enable them to respond to the higher farmgate prices resulting from the policy reforms. Their physical access to markets needs improvement -- if all the potential price gains are not to be consumed with higher transport costs. Both external advice and external financial resources are likely to be necessary to permit farmers to take better advantage of rainfall, surface and groundwater resources. Farmers' use of other purchased agricultural inputs (fertilizers, traction equipment, and improved seeds) also needs to be expanded, but such expansion must take place in the face of decreased subsidies and tight credit being imposed under the strict IMF agreements on financial management.

Malian farmers now get most of their advice, inputs, and infrastructure through an Operation -- a regional development organization (RDO) set up by the Government to administer the agricultural and rural development programs in a given area. There are 29 such Operations (or smaller ones, called Actions) in the country. All are managed as more or less semi-autonomous agencies. Many receive project support from one or more donors to enable them to function.

The regional development organization which has been the most "successful" to date is also the largest. The CMDT (Compagnie Malienne pour le Developpement des Textiles) focuses primarily on increasing the production of cotton although it also promotes increased production of foodgrains (sorghum, millet, maize and rice) among the 100,000 farming households in the zone. Part of CMDT's success has been attributed to having viable technical packages for cotton and maize production; this appears to have been the result of many years of experimentation by the French cotton research institute (IRCT). Other reasons for the success have been noted to be: good extension staff, well-trained and well-motivated; the relatively good biophysical characteristics of the region (rainfall, soils, etc.); and adequate financing for support services -- credit for animal traction, fertilizer, and pesticides.

Once attained, however, such success is not sustained without effort. In September, 1983, a loan for the Second Mali- Sud Development project (CMDT Region) was negotiated by the Government of Mali and the International Development Association (World Bank) for $25.9 million; other donor contributions to the project accounted for the remaining external financing of the $60.7 million package. The Government of Mali and the National Agricultural Development Bank (BNDA) are expected to contribute an additional $11.7 million. This project will be largely implemented by the CMDT in collaboration with the BNDA.

Further, such success is not easy to attain. Operation Haute Vallee (OHV) is another such regional development organization,

charged with promoting the production of cotton and tobacco as well as foodgrains -- sorghum, millet, rice, and maize. OHV has received $12 million in external assistance from USAID over the last five years, in addition to assistance from other sources and from the Government of Mali. While OHV is generally thought to be less "successful" than CMDT, the 30,000 farming households in this zone do receive extension advice, inputs on credit, and some marketing services from the Operation. Because the OHV region surrounds Bamako, farmers' access to private marketing services is probably somewhat better than it is among farmers in the CMDT zone, but use of traction equipment and overall farm incomes appear to be, on average, somewhat lower in the OHV than in the CMDT area. Because the rainfall in the OHV zone is also, on average, somewhat lower and less reliable, production per hectare is reportedly lower than in Mali-Sud, and the technical packages being promoted at the farm level are not commonly thought to "work" as well as those in CMDT area.

These observations illustrate the complexity of the agricultural sector in Mali and underline the importance of establishing a research and extension system which can deal with this complexity. Not all farmers have the same soil and water conditions, the same market access, the same financial capacity for undertaking investments, or the same managerial know-how. Technological advice must,therefore, be tailored to specific conditions or the technical information must be presented to farmers in such a way that they themselves can adjust and adapt it to their particular situations.

The research system in Mali has only just begun to develop this kind of capacity*. The national agricultural research organization (the Institut d'Economie Rurale --IER) is just over 20 years old and has only been fully in charge of crop research activities since 1972. Under the Ministry of Agriculture, IER is charged with managing the national crop research program and with coordinating and supervising all research conducted in Mali by international institutions such as ICRISAT and IITA. IER has a professional staff of 225, organized into six divisions: Agronomic Research (DRA); Farming Systems Research (DRSPR); Technical Studies (DET); Planning and Evaluation (DPE); Documentation and Information (DDI); and a Division of Administration and Finance. IER operates a central research station at Sotuba, just outside of Bamako, and three regional stations. Sub-stations (or PARs -- Points d'Appui de Recherche) are located in six other locations. The majority of the senior-level scientists and many of those at junior levels are stationed in Sotuba. Only the Farming Systems Research Division (DRSPR) is headquartered outside of Bamako. The 13 professionals in DRSPR live in and work around Sikasso, 380 km from Bamako, in the heart of the CMDT or Mali-Sud area. It is only in this area that DRSPR has, to date, undertaken the task

---

* See Annex A, Section I for a more detailed discussion of agricultural research in Mali.

of ensuring that technologies generated by the Agronomic Research Division (DRA) are adapted to farmers' varying conditions.

Researchers working in IER have made important progress in understanding plant types and characteristics essential for the development of improved foodgrain varieties, particularly of sorghum and millet. Considerable testing of fertilizer application rates, seeding densities, spacing, and planting dates has been carried on for a number of years. Methods of improving water infiltration and moisture conservation are being designed and tested. While the information base relating to the interaction of bio-physical factors has been improving, there has been limited on-farm validation of these research results. Even technologies currently thought to be "on the shelf" require further testing and adaptation to specific micro-climates and farmers' circumstances, as has been amply demonstrated in recent DRSPR work in seven villages in the CMDT region. Here, for example, it has been shown that poor health and high mortality of draft animals limits the capacity of farmers to apply the recommendations developed for crops which assume animal traction of maximum productivity. Further, it has been demonstrated that farmers with insufficient capital or labor resources have a difficult time with technologies requiring high inputs of fertilizers or timely weeding.

This situation, repeated in villages across Mali, indicates the need to structure and expand on-farm testing and validation of improved production technologies developed in the national research program. It also indicates the need to seek ways to ensure that the technologies which do prove out under experimental conditions at the farm level are transferred effectivaly to those farmers who are potential users.

B. PROJECT PURPOSE

In this project, USAID/Mali proposes to address these needs. Unless new agricultural technologies adapted to farmer conditions are identified and proposed to them, it is unlikely that will be able to provide the increased food supplies so urgently needed. The improved policy environment for agricultural growth and the effectiveness of the regional development organizations in sustaining the supply of inputs will be important factors in stimulating more food production, but they will not in themselves be sufficient to cause or sustain the significant increases required.

The purpose of the project is

1. to develop agricultural technology which is relevant to farmers' needs and circumstances; and

2. to promote the effective transfer of such technology.

C. SECTORAL GOAL

This project's success will contribute to achievement of the Mission's overall assistance objective in Mali -- improving the production, productivity, and incomes of rural households. The strategy presented in the CDSS to accomplish this goal is that being carried out today. USAID/Mali is concentrating investments in crops, livestock, and forestry activities through production, research, and training projects. USAID/Mali is participating actively in the policy reform dialogue, supporting significant grain price liberalization steps with short term grain supply supplements programmed in a Section 206 project.

The Farming Systems Research and Extension (FSR/E) project described in this Project Paper is principally a research project. It will make an important contribution, however, to increasing the numbers of trained technicians in the agricultural sector and the effectiveness of crop and livestock production projects. It is thus an integral part of the Mission portfolio in agriculture.

D. PROJECT STRATEGY

The project strategy is to provide 10 years of institutional support to the Farming Research Division (DRSPR) and related agricultural institutions. This long-term commitment will permit sustained improvement of the overall effectiveness of the national agricultural research system, and its relation to extension organizations and farmers*.

The project will provide three key resources to the national agricultural organization (IER), primarily to the Division for Farming Systems Research (DRSPR):

1. financial resources to expand farming systems research and extension activities into two new regions; to relocate DRSPR administrative headquarters from Sikasso (in the CMDT area) to Sotuba (near Bamako); and to increase effective collaboration in the development and dissemination of new agricultural technologies, first, between commodity researchers in the Agronomic Research Division (DRA), other research and training institutions in Mali, and the DRSPR; second, between the regional development organizations such as CMDT and OHV and the agricultural research system; between farmers and researchers; and, third, between Malian agricultural researchers and their colleagues in other Sahelian and African countries. In this regard, the project will also provide resources to strengthen the relationship between on-station research being carried out by international agencies such as ICRISAT and Malian farming systems research.

2. training opportunities to develop skills in agricultural research, with special emphasis on skills needed to carry out farming systems research and extension; and

---

*See Annex A, Section II for more detailed discussion of strategy and design considerations.

3. technical assistance to strengthen the short-term capability of IER and DRSPR to carry out farming systems research and extension, to assist in the development of a long-term FSR/E program, and to provide specific expertise not now available in Mali.

The project strategy is to provide these resources over a ten-year period, building solidly upon the experience of IER and DRSPR to date. The results of this strategy will hopefully be seen in farmers' fields, in the country's markets, and in the agricultural sector's contributions to the economic growth of Mali as well as in the agricultural research and extension institutions themselves.

E. PROJECT ACTIVITIES

The project activities will be organized in three components: 1) the expansion of farming systems research/extension efforts in two new zones; 2) the improvement of research-extension-farmer coordination and linkages; and 3) training and staff development.

1.0.0. Expansion of Farming Systems Research/Extension

1.1.0. Current FSR Situation

Since the creation of the Division of Farming Systems Research (DRSPR) in 1979, farming systems research/extension activities have been carried out only in the CMDT zone (also known as Mali-Sud or Region III). The principal sources of assistance for this work have been the Netherlands (IRRT) and Canada (IDRC). USAID-/Mali and the Ford Foundation have also provided some financial support; USAID's contribution was $250,000 over four years.

The DRSPR effort in this zone has been carried out by three separate teams or units in three geographic areas: 1) in the Sikasso-Bougouni area; 2) in the Fonsebougou area; and 3) on the Tierouala Research Station.

All three programs are under the general management of the Director of the DRSPR. There are seven senior-level Malian researchers, six junior-level Malian researchers, and 51 support staff. Dutch support provides four expatriate researchers; Canadian support, one more. In 1983, nearly 90 percent of the annual budget of approximately $500,000 was financed by external sources, primarily the Netherlands.

In 1982 and 1983, the two village-oriented DRSPR units (Sikasso-Bougouni and Fonsebougou) worked with farmers in seven villages on a variety of on-farm trials, and involved over 15 villages in extensive surveys of farming practices and farm organization. They collaborated with CMDT and the National Agricultural Development Bank agents (BNDA) in testing possible extension interventions with farming households in two villages. The Tierouala

Research Station (a regional sub-station or PAR in the national system) is presently managed by DRSPR. Here the Division's resea-rchers -- some of whom also work in the village-oriented units -- conducted trials on technologies not yet well-enough developed or understood for on-farm testing (See Annex A. Technical Analysis for details).

The relationship between the CMDT (which is responsible for all extension activities in the region mostly relating to cotton, maize, rice, and millet), and the DRSPR has been one of growing mutual respect. Initially somewhat skeptical of the utility of farming systems research work, CMDT has now negotiated a formal agreement with IER which spells out the relationship between research (DRSPR) and extension (CMDT) efforts in the solution of certain key agricultural development problems in the zone.

1.2.0. DRSPR Headquarters Move

Given this promising base of experience, DRSPR has been encouraged to expand its efforts in other regions as well. There are two obvious, major constraints to such expansion: trained staff and resources. There is another constraint which is less apparent: the location of the DRSPR headquarters in Sikasso. This location, 380 kilometers from Bamako, has meant that liaison with the other researchers and IER administration -- which are located in or near Bamako -- has taken substantial amounts of precious DRSPR staff time. If DRSPR were to expand field activities to other zones as well, coordination and communication from the Sikasso base would be impossible.

The Government of Mali (GRM) has thus expressed willingness to move DRSPR headquarters from Sikasso to Sotuba, the headquarters of IER's crop research activities and just ten kilometers from Bamako. Headquarters of other Malian research organizations, such as the Institute for Forestry, Hydrobiology, and Livestock (INRZFH), and of international research organizations represented in Mali (ICRISAT) are also located in the Sotuba/Bamako area. The Farming Systems Research and Extension project will assist the GRM to implement this move by providing financing for the construction of a DRSPR office complex near Sotuba.

1.3.0. Expansion to Two New Zones

The project will assist the DRSPR to expand its field activities to two new zones--in 1985, to that covered by the Operation Haute Vallee and, in 1989, to that covered by Operation Mils Mopti or Operation Riz Mopti in the Fifth Region (See Maps). The DRSPR/ Sikasso effort will be continued with more or less the present financing arrangements. The expansion will permit farming systems research/extension activities to touch as much as 50 percent of the Malian farming population, a 115 percent increase over the present level of coverage. The schedule for expansion into these zones is a gradual one, reflecting the staffing and financing constraints already noted. Keeping in view the availability of trained Malian staff currently in-country and those already in

training overseas, it is estimated that the field units in the two zones will not be completely staffed by qualified Malian researchers until the seventh year of the project (1991). However, technical assistance provided by this project will make it possible to expand into the two new regions in this project's time frame and Malian staff will be able to sustain the effort following project termination.

In the initial years of project implementation the Malian field research staff will be supplemented by the assignment of two expatriate research advisors to each of the two new field units. As each of these field units will be fully staffed by Malians in the last three to four years of the project, adequate overlap (18 months to two years) between expatriate technical assistance and Malian researchers returning from training will be assured.

Each field unit will consist of four senior level researchers (agronomist, economist, livestock specialist and social scientist), two field supervisors, and eight research assistants. The senior level staff will have at least the equivalent of a master's degree (Doctorat du Troisième Cycle in the French system). Field supervisors are expected to have a ITA/ISA degree (approximately B.S. degree equivalent) and the research assistants will be Moniteurs (three years of training in agriculture after 9th grade). In addition, there will be a number of support personnel (data clerks, accountants, typists, janitors, guards, and drivers). (See Attachment 4 Project Staffing Pattern).

1.3.1. The Second Region

The area covered by the Operation Haute Vallee (OHV) has been selected as the first FSR/E expansion zone. The reasons for selection of this zone are: 1) it is an area of significant agricultural potential, relatively well-endowed with rainfall (800-1200 mm), surface water resources, and cultivable soils. Many of the farming households already possess animal traction equipment; 2) Operation Haute Vallee is already implementing a major agricultural production project funded by USAID; and 3) it is logistically and administratively feasible for both IER and USAID. The field offices for the DRSPR effort in the OHV can be located in the same complex which will be built with project financing for the relocation of DRSPR headquarters in Sotuba.

The field unit for the farming systems research/extension effort in the OHV area will be established by: 1) assigning an agronomist and an agricultural economist to this new zone from DRSPR's present CMDT-zone staff based in Sikasso. These experienced personnel will be replaced in the DRSPR/Sikasso effort by two newly-trained researchers returning from France, 2) assigning a sociologist and a livestock specialist returning from training in France by mid-1985 to the DRSPR/OHV, 3) assigning a sociologist and livestock specialist currently on the DRSPR/Sikasso staff to the OHV area during the interim period (between project implementation and mid-1985). This is feasible

as the southern portion of the OHV and the Sikasso-Bougouni areas are contiguous, and 4) providing two expatriate long term experts to work exclusively with the DRSPR in the OHV area. This T.A. team of agronomist and agricultural economist will be supplemented as needed by short term consultants in social sciences and livestock.

1.3.2. The Fifth Region (OMM/ORM)

The second zone slated for expansion is the Fifth Region (see map). This zone includes two crop-based regional development organizations: Operation Mils Mopti, which deals with farmers whose major crop is millet, and Operation Riz Mopti, charged with irrigated rice development in the Niger River Basin area near Mopti. The reasons for selection of Region V are: 1) the Southern Mopti zone is already an important supplier of foodgrains (principally millet), while the northern riverine area is a center of rice production; 2) there are already two research stations in the region. The IER station PAR at Koporo, badly in need of rehabilitation and expansion, focusses on millet, sorghum and cowpeas, and the WARDA station in Mopti focuses on irrigated rice development; 3) There is also a regional development organization for livestock in the region, the Opération pour le Développement d'Elevage à Mopti (ODEM). DRSPR experience to date has shown a strong relationship between crop and livestock problems and production performance at the farm level. The active presence of ODEM opens possibilities for effective research/extension efforts on such problems in the Fifth Region.

Although a decision has been made to work primarily with rainfed cropping systems, USAID and the GRM will jointly evaluate results in the second region and decide on the precise location of the project site in Region V after the third of the project.

In order to ensure that adequate experiment station infrastructure is in place in this region by the time that farming systems effort is scheduled to get underway, the project will support infrastructure development at the Koporo station regardless of the outcome of the above-mentioned evaluation. It is a major center for millet research, a crop which accounts for approximately 30 percent of the total foodgrain supply produced in Mali. The station currently lacks housing, office space and other research facilities. To underpin the FSR program, proposed infrastructure developement under this project consists of expanded laboratory office space, two senior staff quarters, four junior staff quarters, and a guest house for visiting researchers.

2.0.0. Improvement of Research-Extension Linkages

The farming systems approach to research evolved from the need to establish a working linkage between the developers and the users of new technolgy. It soon became apparent in the first efforts to apply this approach that it made sense to include those people

normally charged with making the connection between technological advances on the research station and technological requirements at the farm level; that is, the extension agents.

In addition to carrying out farming systems research with farmers and extension agents in two new zones, an important set of activities in this project will be focussed on actually making the linkages between the agricultural research-extension systems functional. The project will attempt to strengthen five kinds of linkages.

1) Within the research system: between DRSPR, other Divisions of IER, and related agricultural research organizations outside of IER -- especially the Agricultural Engineering Division (DMA) in the Ministry of Agriculture and the National Institute for Forestry, Hydrobiology, and Livestock Research (INRZFH) in the Ministry of Rural Development;

2) Between DRSPR and the extension agencies in the three zones;

3) Between DRSPR and the principal training institutions; and

4) With other organizations and agencies charged with agricultural policy and long-term developmental planning.

5) With regional and international research institutions, such as ICRISAT, INSAH and ILCA

2.1.0. Linkages Within the Research System

The linkages between DRSPR researchers and scientists in other parts of the national agricultural research system will be strengthened in three ways: 1) Collaboration in the design and conduct of on-farm trials; 2) Joint training opportunities; and 3) Publication of a research journal.

2.1.1. Collaboration in On-Farm Trials

The section of the Division for Agronomic Research (DRA) which is charged with foodgrain improvement (SRCVO) has been collaborating with DRSPR in conducting on-farm trials. The Division of Agricultural Machinery has worked with DRSPR to modify animal traction equipment and to develop efficient ox-drawn carts. DRSPR and INRZFH have collaborated on the development of recommendations for on-farm management of livestock. A joint effort by DRSPR and the Central Veterinary Laboratory demonstrated vividly the relationship between animal health and farmers' abilities to implement better plowing practices.

Experience has shown that effective collaboration depends on the collaborating agencies having adequate transportation facilities and enough funds to pay for initial on-station research and development costs. Given the current state of IER financing (see

Annex D.), it is clear that DRA in general and SRCVO in particular will need additional resources if they are to be responsive to DRSPR's needs. While there are sufficient qualified and motivated staff willing to cooperate with DRSPR, provision must be made in the budget to enable DRSPR to contract with these units to conduct either on-station or on-farm research on specific problems identified in the village-level surveys and diagnostic analyses. This mode follows already established precedents such as an ODIPAC contract with SRCVO. Funds will also be provided by this project for cooperative travel enabling DRSPR to invite researchers from other organizations to participate in field visits and experimentation. A vehicle and operating expenses will also be provided to SRCVO to enable them to assist DRSPR in all phases of the on-farm testing program.

2.1.2. Training

Training planned under this project will provide another opportunity to strengthen the linkages between DRSPR researchers and those working elsewhere in the national agricultural research system. Several long-term training positions have been set aside for non-DRSPR staff. A number of workshops and seminars as well as in-country training programs on farming systems research are also planned. These will involve the agricultural training institutions as well as the research. Specific training objectives and plans are discussed further below.

2.1.3. Research Publications

The third mechanism for linking agricultural researchers will be financing the publication of a research journal. Mali does not yet have a research publication where researchers can share the results of their efforts with others. The sole mechanism for this kind of interchange to date is the system of Annual Reports prepared for the Specialized Technical Commissions which meet each year. Publication of a professional journal will permit more substantive presentation of findings which now have to be summarized in the Annual Reports.

2.2.0. Research-Extension Organization Linkages

The linkages between the DRSPR and the CMDT to date have demonstrated some of the ways in which research-extension communications can be assured. The following formal and informal methods will be used to develop strong linkages with regional development organizations (RDOs) in the two expansion zones.

2.2.1. The RDO in Region II (Operation Haute Vallee) has a research coordinator on its regular staff. DRSPR will work with the research coordinator in all phases of farming systems research in the zone including selection of villages, selection of recommendation domains, and selection of farmers to conduct on-farm trials. A similar approach will be followed with the relevant personnel in the RDO of the second expansion zone.

2.2.2. OHV extension agents assigned to villages where on-farm tests will be conducted will be involved in supervising and managing the on-farm trials. The OHV research coordinator will be closely involved with the supervision of such an on-farm trials program. Again, similar involvement is expected in the second zone.

2.2.3. To increase information sharing, DRSPR will routinely brief the collaborating RDO on major findings relating to problems and constraints in the zone and will involve RDO personnel in identifying themes for on-farm experimentation.

2.2.4. The project will provide short-term training opportunities outside of Mali for middle and upper level extension personnel, to develop their awareness of and knowledge about farming systems research and extension approaches. DRSPR will also provide in-country training opportunities for lower-level extension personnel.

2.2.5. Extension-research coordination committees will be organized jointly by DRSPR and the RDO involved. The committee will consist of the four FSR/E team specialists, the Director of DRSPR, the Director of the RDO (such as OHV), the RDO's research coordinator, the head of the RDO's Technical Division, supervisory extension personnel responsible for the villages where DRSPR is working, and a representative of the SAFGRAD project in Mali. The purpose of this committee will be: 1) to ensure that the RDO's research concerns are addressed by DRSPR; 2) to resolve issues arising out of participation of RDO extension personnel in the on-farm trials program; 3) to share information and identifying and approve research themes; 4) propose ways to increase farmer participation.

A similar committee will be established in Region V when the project expands into the region.

2.2.6. DRSPR will organize an annual workshop for all collaborators to share perspectives on on-farm production problems. Farmers as well as researchers and extension personnel will be included as "collaborators" in this two-day workshop. Funds have been provided under the project to cover the costs of participants from outside of DRSPR and the national agricultural research system.

The purpose of this workshop will be to prioritize production problems and constraints identified in the field and to develop a research agenda which can be used by researchers to formulate their research problems. This workshop will be held in January each year (before the specialized Technical Commissions meetings in March/April) to enable the researchers to include several of the prioritized problems in their research proposals.

2.2.7. DRSPR will extend support to the Regional Development Organizations for the development and publication of technical information (<u>fiches techniques</u>) based on extension themes or

technologies tested under the project.

2.2.8. Organizational Protocols. Formal agreements will also be used to establish linkages between DRSPR and the extension organizations. In 1982, an agreement was negotiated with the CMDT regarding the sharing of information and training of extension agents in technologies developed or tested by DRSPR. An agreement is already under negotiation with OHV regarding the delineation of homogenous production systems (recommendation domains) and the identification of production constraints. The OHV-DRSPR agreement provides for two vehicles and operating funds to be provided by OHV to DRSPR for a one-year period.

Similar formal agreements structuring research-extension linkages will be negotiated with selected extension agencies in other zones as well.

2.3.0. Research-Training Linkages

In the long run, it is vital to the improvement of the quality of agricultural research and extension in Mali that the local agricultural training institutions introduce farming systems research/extension concepts into their curricula. It is from these institutions that future researchers and extension personnel will emerge. An early understanding of the FSR approaches and methods will provide a useful foundation for developing a problem-oriented approach to agricultural development and will emphasize the importance of cost-effective, farmer-acceptable solutions.

2.4.0. Research-Policy Linkages

While this project is not intended to have a major focus on macro-economic issues and national agricultural policies, it is clear that such factors as grain prices, input prices, and the input distribution system will emerge as production constraints in most areas. In such an event, the need for further investigation of these constraints and their effect on production will be communicated to other entities, such as those in the Cereals Marketing Restructuring Project and the Food Sector Strategy Commission, which are responsible for conducting policy research and making policy recommendations. The key institutional link is with the Division of Technical Studies of the IER, whose chief (Director) serves as President of the Food Sector Strategy Commission (CESA), an ad hoc committee charged with coordinating implementation of the officially adopted Food Sector Strategy. The latter strategy, moreover, will be the basis for the agricultural component of the forthcoming five-year Development Plan (1985-1989). This channel is the conduit through which research-produced policy issues will reach higher level decision makers in the Ministry of Agriculture and thence to the Ministry of Economy and Plan.

2.5.0. Linkages with Regional and International Research Institutions

ICRISAT and ILCA are implementing bilateral research projects in millet, sorghum and cowpeas and forages, respectively, under AID funding. These programs will be formally linked to activities under the FSR/E project through: 1) joint development of annual research plans. 2) jointly-sponsored in-country training activities, 3) exchange of technical advisors, and 4) jointly executed field trials. Moreover, three CRSPs (INTSORMIL, TROPSOILS, PEANUT) are active in Mali, providing direct links to the broader American University University Research Community.

3.0.0. Training and Staff Development

The success of this project will depend ultimately on the quality of the research conducted by the Malian staff of DRSPR and cooperating agencies. There are 225 professional staff in IER, but only about ten of these have advanced degrees. Several more are now in training abroad, scheduled to return over the next five years. It has generally been accepted that the core personnel of a farming systems research team should have at least the equivalent of a Master's degree in a professional discipline.

This project will provide four types of training: 1) long-term training overseas; 2) short-term training outside of Mali;3) on-the-job training programs and 4) introduction of farming systems research concepts into the curriculums of agricultural training institutions in Mali.

3.1.0. Long-Term Training Overseas

To help obtain a critical mass of personnel trained in farming systems research, the project will provide a total of 19 post-graduate fellowships for study in U.S. universities. The majority (13) of these fellowships will be for Master's degrees and will be allotted as follows: DRSPR-7; DRA-2; IPR-1; CAA-3*. Six fellowships will be for Ph.D.- degree training: DRSPR-3; DRA-2; and IPR-1. Participants from DRSPR and DRA will be trained in agronomy, livestock, agricultural economics, anthropology, and agricultural extension. Trainers/Faculty from the CAA's and IPR will receive graduate training in their specialities. Course work in farming systems research concepts and methodologies will be required for all participants (See Attachment 4: Long-Term Training Plan).

3.2.0. Short-Term Training Abroad

The project will also provide researchers with short-term training opportunities at international agricultural research institutions, U.S. universities, and other research

---

* IPR = B.Sc. Level training institute.
CAA = Institutes for training village level extension agents

organizations. Each course is expected to last six months or less. Training topics might include: FSR methodologies, crop production technologies, research design and evaluation, extension methods, design and analysis of on-farm experimentation, and other courses suited to needs of project personnel. These training courses will provide a relatively inexpensive way of upgrading professional skills in a short time period. Maximum advantage will be taken of various international programs in this project. Given the orientation of IER toward applied research and the adaptation of technologies developed outside of Mali, the greater familiarity of IER researchers with International Agricultural Research Center programs will be an additional useful outcome of short-term training in these institutions.

Another aspect of short-term training will be third country observation/study tours. There are presently many other farming systems research programs in Africa experiencing and solving many of the issues of concern to DRSPR. Project resources will enable senior researchers and GRM decision-makers to visit such projects and to develop collegial relationships with counterparts elsewhere.

The project will fund up to 96 person-months of short-term training (approximately 16 people) and 16 person-months of study tours. This will allow two to three people to travel outside of Mali each year.

3.3.0. On-the-Job Training

On-the-job training will take place in two ways: first, through organized workshops and seminars focussing on immediate job-related problems and skills; and, second, through continuous interaction between experienced Malian and expatriate researchers on the teams and their less-experienced and/or less-trained colleagues. Workshops (from one to several days in duration) will improve the professional skills of research and extension personnel and the coordinators of field extension activities. Seminars and workshops will draw heavily upon senior reseachers, both Malian and expatriate, working in projects such as ICRISAT, and IPM. Possible topics are: FSR methods and concepts, on-farm experimentation, data processing and analysis techniques, interview techniques, and extension-research relationships.

3.4.0. Introduction of FSR Curriculum

Long-term training opportunities extended to IPR and CAA faculty members will provide the basis for curriculum changes. In addition, short-term assistance will be provided for designing courses in the area of farming systems research-extension. Introduction of this FSR curriculum in the CAAs will be coordinated with the USAID-funded Agricultural Officers Training

Project which has been introducing new curriculums at the CAA level since 1982. The FSR/E project will also provide funds for IPR students to work with the FSR field teams in the OHV and Region V areas, backing up the academic introduction of the approach with on-the-ground experience. Moreover, the recently completed evaluation of the Agricultural Officers Training Project and independent analysis carried out by the USAID Agricultural Division recommends that a planned follow-on project refocus its efforts to concentrate on the so-called "third year" problem in extension education. The third year activities, now a part of the CAA curriculum, provide field experience for students under the supervision of the RDOs. This activity is a natural point of entry for the FSR/E project to further its goal of introducing field level research methodology into existing training programs for extension agents.

F. PROJECT OUTPUTS

This project's impacts will be evident in three areas: 1) in the research results produced by DRSPR working in collaboration with farmers, extension agents, and other agricultural researchers; 2) in the production performance of the farmers in the zones covered and 3) the organizational changes induced. The later changes will be manifest principally in the scope and effectiveness of work of the DRSPR, as well as other parts of the national agricultural research system and in the three regional development organizations with which DRSPR will work closely during the life of the project.

The project's effects will be visible within the ten-year life of project, especially in terms of research findings and organizational change. But the stream of production benefits initiated by this project is expected to continue for many years into the future. For effective monitoring of the project, expected project accomplishments are specified here according to the three phases of the project. The first phase (1985-1987) will see the beginning of project construction activities, expansion of farming systems research in Region II, and participant training. The second, (1988-1991), will see the consolidation of the OHV field effort and initiation of farming systems research activity in Region V; and the third, (1992-1994), will see the Malian DRSPR staff take over from remaining technical assistance personnel and sustain full-scale farming systems research activities in the two expansion zones.

The following chart summarizes project outputs by major component and phase. A more detailed listing is to be found in Attachment VIII-16.

A SUMMARY LOOK AT FSR/E PROJECT OUTPUTS, BY COMPONENT AND PHASE OF ACTIVITY
EXPANSION OF FARMING SYSTEMS RESEARCH AND EXTENSION

PHASE ONE, 1985-1987

Research Results

- Village reconnaissance surveys in OHV zone
- 3 to 5 villages selected for intensive collaboration
- Baseline surveys, on-farm trials, thematic surveys and other appropriate studies conducted for 1-2 years
- Annual reports: baseline data tabulation, analysis, planning
- farmers/OHV agents/DRSPR discussions on trials; written feedback

Production Performance

- Better methods of animal traction use and animal management and introduction of new technologies in on-farm trials in the continuing DRSPR/Sikasso program
- No effect in OHV unless animal health/forage findings in Sikasso prove readily adaptable

Organizational Outputs

- DRSPR HQ moved to new office complex in Sotuba
- DRSPR/OHV team constituted
- DRSPR HQ fully staffed
- USAID long-term TA on board in research management, financial management, data processing/statistics, agronomy, and agricultural economics
- Financial management and inventory control systems operational
- Functional data processing system set up; one Malian staffer trained and assigned full-time
- Library at DRSPR HQ established
- GRM/USAID joint review process established; decision on Fifth Region collaboration RDO made

PHASE TWO, 1988-1991

Research Results

- Full program of thematic surveys, on-farm trials, and other farming systems research conducted in OHV
- Village reconnaissance surveys in Fifth Region
- Baseline surveys, on-farm trials, thematic surveys conducted for 2-3 years in Fifth Region
- Annual Reports on FSR/E efforts in each region regularly prepared by field units
- Other reports on particular research problems, findings and experiences issued each year

Production Performance

- In OHV, farmers production performance should reflect positive FSR/E findings and effect of closer communication on technology issues between OHV agents, DRSPR and farmers
- Fifth region production performance is unlikely to reflect FSR/E findings

Organizational Outputs

- DRSPR/Region V effort lauched; staffed recruited in place, 2-3 years of field activities
- Two additional long-term experts provided by USAID
- DRSPR permanent staff improved with incorporation of researchers returning from training
- DRSPR will have demonstrated capability to manage larger FSR/E program: (1) defined and delineated roles and responsibilities of HQ and field units; (2) developed mechanisms for disseminating research findings regularly; (3) developed capacity for timely reporting of results; and (4) effectively managed both HQ and field units

PHASE THREE, 1992-1994

Research Results

- DRSPR field units continued annual reporting on results of on-farm trials, thematic inquiries and special surveys, technologies adoption, and further research needs.
- In addition to Annual Reports of research results, all teams making regular contributions to IER Research Journal and participating in international conferences and seminars to present results

Production Performance

- Measurable improvements in production and/or productivity of farm households in three zones
  - through annual feedback sessions
  - through periodic measurements with formal surveys
  - external analysis of more global agricultural indicators

Organizational Outputs

- All DRSPR field teams fully staffed by Malian researchers
- All Malian researchers experienced and have worked at least with TA personnel
- All DRSPR offices (HQ and field) fully functional competent managing logistics, a full-scale field research program, data processing and analysis, and long-term research planning

IMPROVED COORDINATION AND LINKAGES

PHASE ONE, 1985-1987

Research results

- DRA/SRCVO scientists and DRSPR designed and supervised at least one season's trials
- SRCVO plant improvement program at Koporo expanded upon completion of additional facilities constructed
- DRSPR prepared papers on findings to date and Journal has published them
- Two issues of Journal will have been published
- DRSPR will, if adequate progress made on identifying viable technologies, have developed validation program with SRCVO/SAFGRAD for wider testing

Production Performance

- None expected

Organizational Outputs

- DRSPR annual reports discussed with other IER Division to begin process of joint formulation of research priorities
- DRSPR and OHV negotiated formal agreement
- Formal FSR/E Research Coordination Committee functioning
- Cooperative research agreements set with relevant research units (SRCVO, DMA, INRZFH) to conduct upstream research on problems identified in field

PHASE TWO, 1988-1991

Research Results

- Continued cooperative research involving DRSPR and SRCVO, DMA, INRZFH, and others in OHV and CMDT zones
- Cooperative research proposals developed for Fifth Region cooperation
- IER Research Journal continuously published at regul intervals

Production Performance

- As defined by activities undertaken successfully in previous phase. Production impact should be measurable in OHV
- Impact will be gauged by annual farmer, RDO staff, and DRSPR feedback sessions
- RDO Monitoring and Evaluation Units will also evaluate production impact of FSR/E activity at farm level

Organizational Outputs

- DRSPR negotiated formal agreement with one or more RDOs in Region V. OHV agreements updated
- OHV/DRSPR Research Coordinating Committee continued
- Similar committee established in Fifth Region
- DRSPR held at least 1 annual workshop to share research findings
- DRSPR Annual Reports discussed with other research units in January of each year. Process of joint formulation of research continued
- Further means for improving effectiveness of linkages defined and endorsed by IER management
- Farmers and extension agents in RDOs involved in annual feedback sessions on on-farm trials Written reports

PHASE THREE, 1992-1994

Research Results

- Cooperative research program continuing to produce results reported both in Annual Division Reports and in IER Research Journal as well as in conference and seminar papers
- The technology "shelf" continually replenished as viable ones are tested in FSR/E program and pre-extension programs, moved into outreach and extension in the RDOs, and adopted by farmer

Production Performance

- As a result of the increased dialogue among researchers, extension agents, and farmers stimulated by this project, ALL agricultural research should have more visible impact at the farm level. Adoption rates of research-proposed interventions will be used to measure this impact

Organizational Outputs

- A regular process of consultation about research problems and priorities established, involving farmers, RDOs, and research scientists in all national research organizations
- IER Research Journal recognized as means for intraorganizational communication of research findings
- Malian researchers actively participating in variety of African and international research networks, particularly those dealing with FSR/E issues

TRAINING

PHASE ONE, 1985-1987

Research Results

- DRSPR provided internships to IPR and CAA students; results of studies available

Production Performance

- Effective training of farmers reflected in general production performance

Organizational Outputs

- DRSPR organized at least 2 seminar on FSR approaches
- DRSPR organized at least 2 extension-research workshops to improve research prioritization
- DRSPR Director and Research Management Advisor will assessed effectiveness of DRSPR and OHV field staff conducting on-farm trials
- At least 6 DRSPR researchers received short-term training in FSR/E approaches and methods
- All DRSPR staff received refresher/introductory training in data collection, processing, and management
- At least 6 senior professionals from IER or other research institutions completed study/observation tours of FSR/E projects elsewhere

PHASE TWO, 1988-1991

Research Results

- DRSPR continued internship programs with IPR and CAAs. Results of studies available

Production Performance

- The long-term relationships in intensive OHV villages and in newer Region V villages should have visible production effect
- Production impact of training will be special concern of second project evaluation in 1991

Organizational Outputs

- DRSPR provided assistance to IPR and CAAs in curriculum development and instructional programs in FSR/E
- At least 7 persons gone for graduate training
- At least 14 persons returned from long-term training abroad
- At least 8 DRSPR researchers received short-term training in FSR/E methods and approaches
- At least 2 in-country refresher courses held for DRSPR field staff and participating extension agents from OHV and Region V
- All DRSPR staff in Region V received in-country training in data collection, processing, and management as well as in statistical methods
- At least 6 senior-level researchers from IER and other institutions completed study/observation tours of FSR/E programs in Africa
- At least 3 DRSPR researchers participated in major conferences or seminars relevant to FSR

PHASE THREE, 1992-1994

Research Results

- IPR/CAA internship program regularly established as part of DRSPR field work. Analyses conducted by students part of overall output of research results by DRSPR
- Quality of research markedly improved over beginning of project status: statistical analysis, field trial techniques; overall cost-efficiency of both surveys and agronomic trials enhanced

Production Performance

- Training aspect of on-farm trials continued. Effect should be visible. Special effort in final evaluation made to suggest ways of improving training of collaborating farmers or adapting for other extension purposes

Organizational Outputs

- National agricultural research and training institutions strengthened by long and short-term training of 30 professional staff members
- Skills of more than 100 junior- and middle-level professional increased through in-country training courses
- More than 100 IPR and CAA students as well as 150 people in RDOs familiar with concepts, approaches and methods of farming systems research and extension

G. Project Inputs

The total USAID contribution over the 10 year life of project is estimated at $19.1 million. These funds will be utilized to cover the costs of technical assistance, training, commodities, construction, and operating expenses. A review of each of these inputs is found below.

1.0.0. Technical Assistance ($6.040 million)

1.1.0. Long Term ($5.5 million)

A total of 36.5 Person Years of long term technical assistance will be provided and is broken down by person year in the following table:

YEAR	1	2	3	4	5	6	7	8	9	10
Finance Sys.Spec.-Hdqtrs	1	.5								
Research Manager-Hdqtrs		1	1	1	1	1	1			
Finance Mananger		1	1	1	1	1	1			
Data Process Spec.-Hdqtrs		1	1	1						
Agronomist - OHV		.7	1	1	1	1	1	.3		
Ag. Economist - OHV		.7	1	1	1	1	1	.3		
Agronomist - Region V					1	1	1	1		
Ag. Economist - Region V					1	1	1	1		

Project staffing will begin with the hiring of a Personal Services Contractor for 1 1/2 years to set up the financial accounting and management systems, and to train the DRSPR staff in them. This person will also assist the Project Officer and DRSPR Project Director to begin procurement of commodities and arrangements for construction. This is considered essential in view of the time lag generally experienced in recruiting and placing long term technical assistance teams (for details, see Section V, Implementation Arrangements).

At the headquarters in Bamako the project will finance three TA positions. One will be a Research Management Specialist for 6 PYs who will serve as the research advisor to the DRSPR Project Director, and as the chief of party of the TA team. The second position will be that of the Financial Manager (also for 6 PYs) who will take over the operation of the accounting and procurement systems from the earlier contractor. The third headquarters person will be a Data Processing/Statiscal Specialist for 3 PYs. This individual will set up the computer systems, the formats in which field data can be entered, the programs by which they can be analyzed, and train DRSPR staff in the operations and maintenance of the system.

In the field, two long term advisors (one Agronomist, one Agricultural Economist) will be posted to help develop, test, and

apply field methodologies over a six year period in the OHV zone. Along with their senior Malian colleagues, these advisors will have the responsibility for transferring skills to more junior researchers. Following an evaluation in the fourth year of the project, two more advisors with the same skills mix may be posted to the Fifth Region for a period of four years each. The exact need for the level of technical assistance for the Fifth Region will be assessed at the time of the evaluation.

As noted in detail in attachment 11, the Agricultural Economics qualifications must include adequate training and experience in anthropology or sociology. Serious issues raised by the Social Analysis (annex B), relating to participation by farmers and the tendency for information flows to be unilateral from the top down, make it imperative that an advisor skilled in anthropological methodology be placed with the field units. As funding limitations and GRM sensitivities prohibit adding a full time advisor in sociological concerns, the Mission has concluded that the problem would receive adequate attention if the advisor (ag. economist) were to have significant background in economic anthropology or a similar discipline.

1.2.0. Short-Term ($540,000)

Short-Term TA under the project will be of two types. First, 36 person months (PMs) are programmed in the project for specialized needs that occur from time to time. These could be in areas such as anthropology, agricultural extension, agro-forestry, data base management, research methodology, livestock, and assistance to FSR curriculum development at IPR and the CAAs.

The second source of short-term TA will be <u>collaborative assistance from existing research projects</u>. Other AID supported projects will be asked to provide assistance as needed. For example, in the area of plant pathology and entomology the project will collaborate with and draw assistance from the Integrated Pest Management project. Similarly, in animal husbandry-related aspects, the FSR project will be able to secure assistance from the INRZFH/ILCA forage production research efforts, and the USDA assisted Livestock Sector animal health, veterinary extension, and finish feeding components. In soil management/soil conservation, assistance will be drawn from the IFDC and Tropsoils CRSP; and for animal traction related issues, collaboration will be secured from the Division of Agricultural Machinery (DMA) where French and Swiss donors are working.

Appropriate formal and informal arrangements will be made with these institutions as needed. In some cases simple memoranda of understanding will suffice, as for example in securing collaborative assistance from the Integrated Pest Management unit attached to the IER. In other cases, such as acquiring significant levels of input from the ILCA expatriate advisors, formal amendments to existing cooperative agreements will be sought. The pool of expatriate and Malian scientists working in these specialized fields will be sufficient to provide an

adequate base of short-term expertise. Thus drawing assistance from other projects will contribute directly to the development of collaborative relationships among all programs.

2.0.0. Training and Staff Development ($1.836 million)

The principal activities of this component are:

Long-Term Training - 13 Masters Degrees

- 6 Doctoral Degrees

Short Term Training - In-country Workshops, Seminars, Short Courses Abroad, and Observation Tours.

As noted earlier, training opportunities are to be provided to collaborating commodity research divisions as well as to faculty at the two principal training institutions. Naturally, substantial amount of training in FSR will be taking place on-the-job as the FSR research program moves ahead.

3.3.0. Construction ($1.057 million)

The project will finance construction of essential offices and staff housing, as follows.

Bamako/Sotuba
- 1 Office for DRSPR Headquarters
- 1 Office for OHV Zone researchers
- 2 Senior Staff Houses
- 2 Junior Staff Houses

Fifth Region (Probably Mopti or Sevare as DRSPR regional office location)

- 1 Office for Regional Headquarters
- 4 Senior Staff Houses
- 2 Junior Staff Houses
- 1 Guest House

- (Koporo Research Station Location)

- 1 Office Addition
- 2 Senior Staff Houses
- 3 Junior Staff Houses
- 1 Guest House

This construction will provide the most important basic facilities for backstopping research activities. Local A & E Services and construction coordination are provided for in the budget. The support to the Koporo millet research station recognizes the complementarity of the commodity and FSR approaches, and will promote linkages between the DRA and DRSPR divisions. Such support is critical for accelerating research on the problems of millet growing in the Fifth Region. By the time the project expands into the Fifth Region there will be adequate

infrastructure in place which will have contributed to expanded millet research; and there will likely be some technologies ready for field-testing and adaptation to farmer conditions.

4.0.0. Commodities ($1.415 million)

There are four basic categories of commodities to be purchased over the 10 year life of project (See Attachment 12). These are:

Vehicles - 8 Passenger Cars
- 20 Four Wheel Drive Vehicles
- 10 Pick-up Trucks
- 12 Motorcycles
- 52 Mobylettes

Research Equipment - Field Equipment
- Computers, Software
- Library Books/Journals

Housing Furnishings & Equipment - Furniture and Appliances for Senior, Junior and Guest Houses

Office Equipment - Typewriters, Copying Machines, Desks, Chairs, Files, Tables, etc.

A source/origin waiver will be requested for the vehicles.

Computers are increasingly common in Mali, with a rapidly spreading network of users who assist one another. There have been few serious problems once basic training in operation and maintenance has been given.

5.0.0. Recurrent Operating Expenses ($4.413 million)

The principle categories of operating expenses are shown below (and are detailed in Annex D, Table 2).

Personnel - This includes principally the salaries of contract support staff, travel per diems, and incentive allowances

Vehicle (gasoline, oil, repair) - Running and maintenance costs for vehicles

Office Supplies - Expendables

Research Supplies - Expendables, for seasonal inputs

Cooperative Research/ Studies - Contracts with other research divisions and organizations for on-station and related field research

Rents, Utilities, Building Maintenance - For temporary quarters during DRSPR move, and utilities and maintenance for offices and housing

Publications - Research journal publication and extension materials printing

Evaluations - In years 4, 7 and 10

As discussed in the Economic and Financial Analysis Summaries (and taken up in detail in Annex D, Tables 2 and 4), USAID recurrent cost support will be reduced over the 10 year life of project. The GRM will pick up an average of 37 percent of annual recurrent costs during years 8 through 10. This is considered to be a realistic and attainable goal, given the current period of financial reform underway with IMF assistance.

Of all these operating expenses, perhaps the most significant for project success are the cooperative research studies. These funds will enable DRSPR to support collaborating research institutions (such as the DRA/Food Crop Section, the Agricultural Engineering Group, the National Institute for Forestry and Livestock, and the Land Use Inventory Unit) to conduct problem-oriented field research based on farmer concerns identified by the DRSPR. The collaboration of scientists from all of these other organizations is often necessary to solve certain farm level problems. Regrettably, these organizations frequently lack the relatively small vehicle running, per diem, and operating costs to accomplish research for which their personnel are already well qualified. Thus, the FSR/E project will be able to tap into underutilized resources, facilitate more relevant research by others, and lay a practical groundwork for close collaboration.

Included in the operating expenses are contingency funds to support the Sikasso area FSR/E activities. It is possible that the Canadian International Development Research Center may not be able to continue funding for Sikasso beyond 1986. Because of its importance to the overall FSR effort, the project would be able to pick up the modest costs of about $50,000 per year during the years 3-7 and 35,000 per year during the years 8-10.

III. COST ESTIMATES AND FINANCIAL PLAN

A. Cost Estimates

The total cost of this project is estimated to be $20,866 million dollars over a ten year period. Of this amount $19.106 million will be provided by AID and $1.760 million by the GRM. The GRM contribution in-kind (experimental fields, time of extension agents collaborating in research, management assistance, etc.) has not been fully costed and is, to that extent, somewhat understated. Foreign exchange costs of the project are $14,971 million and local currency costs are $5,895 million.

B. Summary Budget Tables

Table I presents a breakdown by capital costs--technical assistance, commodities, construction, training-- and by recurrent costs (operating expenses). This format also notes the contributions by the AID and GRM in both foreign exchange and local currency components.

Table II portrays project costs by the major output categories.

- Expansion of Farming Systems Research ($10.4 million)
- Improved Coordination and Linkages ($1.2 million)
- Participant Training, ($1.8 million), and
- Other Expenses ($1.3 million) and
- Contingency and Inflation ($6.1 million)

Each of these are then subdivided into the particular input costs. Recurrent costs are given in somewhat greater detail.

Table III presents the annual financial plan over the 10 year life of project by ouput component and principal input expenditures.

C. Recurrent Costs Analysis

Detailed negotiations were undertaken with the GRM to consider what was desirable and feasible in this important realm. A realistic plan was developed in which the USAID will cover the principal operating costs for project years 1 through 7. The GRM agreed to provide the entire professional staff required for the successful implementation of the project, and to pay all their salaries. USAID will cover travel allowances incentive payments for this professional staff cadre.

After year 7, the GRM will take over about 35 percent of the project's recurrent costs. These include such items as vehicle maintenance, office supplies, research supplies, and publication expenses. The rationale for this arrangement is based on the

assumption that the present finarcial constraints faced by will be eased by that time as a result of the economic policy reforms now being implemented by the GRM under agreements with the IMF and other donors (reduction of public employment, the GRM's maintenance of strict budgetary controls on public and parastatal sectors, and continued liberalization of prices and markets). Performance to date in the reform program has been very positive. It is obviously difficult to predict the course of events over the next 7 to 10 years with regard to revenues. Few less developed countries can promise with precision what they will be able to allocate to a sector some years hence. However, the track record in improved financial management to date is good. And as the economic analysis points out, there is reason to believe that even modest rates of adoption of technologies developed through the project will generate a stream of benefits adequate to cover the additional research costs to the GRM which this project will incur. As improved agricultural research is vital to Mali's development and is the proper province of public sector activity, the USAID agricultural development strategy envisions a 20 year horizon in research work. Thus, the arrangements for recurrent costs are thought to be appropriate for this fourth poorest country in Africa.

D. Detailed Budget and Financial Plan

The following three tables summarize the cost and financial plans. Annex D gives a more detailed discussion of the budget, describes the basis for cost estimation, and considers the recurrent cost policy questions. Tables 1 through 5 in the Annex provide highly detailed cost and financial plans for both capital and operating expenses of the project by ouput component, inputs, AID/GRM shares, and year.

TABLE I. SUMMARY COST ESTIMATES AND FINANCIAL PLAN
IN $000 U.S. ($1 = 750 FM)

	USAID		GOV'T OF MALI		TOTAL		GRAND
	FX	LC	FX	LC	FX	LC	TOTAL
A. CAPITAL COSTS							
Technical Assistance (a)	6040	0	0	0	6040	0	6040
Commodities	1129	286	0	0	1129	286	1415
Construction	0	993	0	64	0	1057	1057
Training (b)	1531	305	0	0	1531	305	1836
Subtotal Capital Costs	8700	1584	0	64	8700	1648	10348
Contingency @ 10%	870	158	0	6	870	165	1035
Inflation @ 5% per annum	2441	445	0	0	2441	445	2886
TOTAL CAPITAL COSTS	12011	2187	0	70	12011	2257	14269
B. RECURRENT (OPERATING) COSTS							
Personnel (c)	0	865	0	928	0	1793	1793
Vehicle, POL, Maintenance	0	288	0	35	0	323	323
Rents, Utilities, Maint.	0	222	0	26	0	248	248
Office Supplies	0	188	0	23	0	211	211
Research Supplies	0	170	0	22	0	192	192
Cooperative Research	0	612	0	0	0	612	612
Publications	0	137	0	18	0	155	155
Evaluations	480	0	0	0	480	0	480
Sikasso FSR Support	0	355	0	45	0	400	400
Subtotal Recurrent Costs	480	2837	0	1097	480	3934	4414
Contingency @ 10%	48	284	0	110	48	393	441
Inflation @5% per annum	181	1070	0	491	181	1561	1742
TOTAL RECURRENT COSTS	709	4191	0	1698	709	5888	6597
C. TOTAL PROJECT COSTS	12720	6378	0	1768	12721	8146	20866

Source: Tables 1 through 4 in Annex D. Slight differences in totals are due to rounding.

(a) Long-term TA @ $150,000 per year; total of 36.5 person-years.
Short-term TA @ $15,000 per month; total of 36 person-months.

(b) Includes part-time training coordinator (25%) in U.S. @ $20,000 per year for FY 86-FY 93.
13 MS degrees are estimated to take 30 months on average, at cost of $1,700 per month.
6 PhD degrees are estimated to take 42 months on average; same cost per month as MS degrees.
19 English language training courses in Mali are budgeted at $5,000/person.

(c) See Table 2 in Annex D for breakdown of these costs by position.

	USAID		GOV'T OF MALI		TOTAL		GRAND
	FX	LC	FX	LC	FX	LC	TOTAL
EXPANSION OF FARMING SYSTEMS RESEARCH							
-- Relocation of DRSPR Headquarters							10416
Technical Assistance	2500	0	0	0	2500	0	4577
Construction	0	212	0	64	0	276	2500
Commodities: Vehicles	232	0	0	0	232	0	276
Office Equipment	90	0	0	0	90	0	232
Research Equipment	120	0	0	0	120	0	90
Furnishings	0	86	0	0	0	86	120
Operating Costs: Personnel	0	328	0	252	0	580	86
Vehicle Op/Maintenance	0	85	0	8	0	93	580
Rents, Utilities, Maint	0	138	0	11	0	149	93
Office/research supplies	0	46	0	5	0	51	149
Sikasso FSR Support	0	355	0	45	0	400	51
-- Expansion of FSR/E into OHV Region							400
Technical Assistance	1800	0	0	0	1800	0	3115
Commodities: Vehicles	192	0	0	0	192	0	1800
Operating Costs: Personnel	0	361	0	398	0	759	192
Vehicle Op/Maintenance	0	131	0	13	0	144	759
Office/research supplies	0	200	0	20	0	220	144
							220
-- Expansion of FSR/E into Fifth Region							
Technical Assistance	1200	0	0	0	1200	0	2724
Construction	0	432	0	0	0	432	1200
Commodities: Vehicles	120	0	0	0	120	0	432
Office Equipment	40	0	0	0	40	0	120
Furnishings	0	160	0	0	0	160	40
Operating Costs: Personnel	0	177	0	278	0	455	160
Vehicle Op/Maintenance	0	73	0	13	0	86	455
Rents, Utilities, Maint.	0	84	0	15	0	99	86
Office/research supplies	0	112	0	20	0	132	99
							132
IMPROVED COORDINATION AND LINKAGES							
Construction: Koporo Station	0	207	0	0	0	207	1174
Commodities: Vehicle, SRCVO	60	0	0	0	60	0	207
Reference Materials	100	0	0	0	100	0	60
Furnishings	0	40	0	0	0	40	100
Operating Costs: Coop Research, Studies	0	612	0	0	0	612	40
Publications	0	137	0	18	0	155	612
							155
TRAINING							
Master's Degrees	663	0	0	0	663	0	1836
PhD's	428	0	0	0	428	0	663
Short-term	280	305	0	0	280	305	428
Training Coordinator (U.S.)	160	0	0	0	160	0	585
							160
OTHER COSTS							
Unallocated short-term assistance	540	0	0	0	540	0	1337
Field equipment	175	0	0	0	175	0	540
Construction/A&E supervision	0	142	0	0	0	142	175
Evaluations	480	0	0	0	480	0	142
							480
TOTAL (without contingency and inflation)	9180	4423	0	1160	9180	5583	14763
Contingency and Inflation	3540	1957	0	607	3540	2564	6104
GRAND TOTAL	12720	6380	0	1767	12720	8147	20867

Source: Tables 1 through 5 in Annex D. Slight differences in totals are due to rounding.

TABLE III.

ANNUAL EXPENDITURES FOR THE FSR/E PROJECT (AID AND GRM)
IN $000 U.S. (1$ = 750 FM)

	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	ALL YEARS
EXPANSION OF FARMING SYSTEMS RESEARCH/EXTENSION											
Technical Assistance	165	760	750	750	900	900	900	375	0	0	5500
Construction	70	108	248	222	60	0	0	0	0	0	708
Commodities/Field Equipment	194	33	99	279	153	3	164	133	23	134	1215
Malian personnel costs	134	134	134	134	210	210	210	210	210	210	1796
Support for Sikasso FSR	0	0	50	50	50	50	50	50	50	50	400
Vehicle op/maintenance	22	24	24	24	37	38	38	38	38	38	321
Rents, utilities, etc.	22	22	22	12	29	29	29	29	29	29	252
Office/Research supplies	27	27	27	27	49	49	49	49	49	49	402
IMPROVED COORDINATION AND LINKAGES											
Koporo Station Constr/Rehab.	28	85	85	49	0	0	0	0	0	0	247
Cooperative research/studies	61	61	61	61	61	61	61	61	61	61	610
Vehicle, SRCVO	15	0	0	15	0	0	15	0	0	15	60
Reference materials	40	2	10	2	20	2	10	2	10	2	100
Publications	10	10	15	15	15	15	15	20	20	20	155
TRAINING											
Master's degrees	41	102	163	143	133	61	20	0	0	0	663
PhD's	0	10	31	61	102	102	82	41	0	0	429
Short-term: Abroad	35	35	35	35	35	35	35	35	0	0	280
In-country	40	45	45	40	35	20	20	20	20	20	305
Training coordinator	0	20	20	20	20	20	20	20	20	0	160
OTHER COSTS											
Unallocated short-term assistance	90	90	90	90	80	50	20	10	10	10	540
Construction/A&E supervision	20	29	41	35	16	0	0	0	0	0	141
Evaluations	0	0	0	160	0	0	160	0	160	0	480
ALL COMPONENTS	1014	1597	1950	2224	2005	1645	1898	1093	700	638	14764
Contingency at 10 percent	101	160	195	222	201	165	190	109	70	64	1476
Inflation @ 5% per annum	56	180	338	527	609	615	850	574	327	552	4628
GRAND TOTAL: FSR/E PROJECT	1171	1937	2483	2973	2815	2425	2938	1776	1097	1254	20868

Source: Tables 1 and 2 of Annex D. Slight differences in totals are due to rounding.

IV. IMPLEMENTATION PLAN AND ARRANGEMENTS

A. Implementation Arrangements and Schedule

The detailed implementation of project activities is presented in the implementation schedule (Attachment 6) and Implementation Chart (Attachment 7). The major implementation arrangements are described in this section.

1.0.0. Grantee Implementing Agency

The primary implementing agency will be the Institut d'Economie Rurale (IER) of the Ministry of Agriculture. IER will implement the project through its Farming Systems Research Division (DRSPR) where the principal activities of the project will be centered. The Director of DRSPR will manage both the technical and administrative details of the project with the assistance of the T.A. team (See Attachment 8, Project Organizational Chart). The nature of this project requires close collaboration between the Farming Systems Research Division and other divisions of IER, as well as coordination with other research organizations (such as INRZFH and DMA) and extension agencies. IER will have the major responsibility for establishing and ensuring coordination between different divisions of IER and other organizations such as DNA, DMA, INRZFH, CAAs and IPR.

2.0.0. Recruitment of Grantee Agency Personnel

As discussed in the Institutional Analysis, the DRSPR cannot presently staff the project with personnel who have the needed qualifications. Therefore, the Institute will identify and recruit technical and support personnel from outside its ranks (see the recruitment schedule, Attachments 9 and 10). If this recruitment is unsuccessful, the GRM has agreed to transfer required personnel from other divisions in IER or from other government agencies to fully staff the project.

3.0.0. USAID Project Management

USAID will provide a project officer experienced in agricultural research management. At the USAID level, he/she will be responsible for project work planning, budgeting implementation, monitoring, reporting and obtaining necessary clearances and decisions from USAID. He/she will serve as the primary contact point for the contract Chief of Party and will serve as liaison between USAID and the IER. A Senior Malian Project Assistant will also work full time on the project.

4.0.0. Financial Management Arrangements

Long-term: A provision has been made to provide long-term technical assistance in financial management for up to six years. The long-term financial management specialist will a) ensure that proper financial management and control systems are established, b) assume operating responsibility for the financial management

system until it is certified by USAID and c) be responsible for training DRSPR accounting staff (see Attachment 11 job description for details).* Separate bank accounts for the project funds will be established and a system of cosignatures with the Project Director will be required.

Start-up Activities: Due to the delays experienced (usually anywhere from 12 to 18 months) in contracting for and arrival of the long-term T.A. team, a provision has been made in the project to provide essential administrative and financial management (FM) assistance to ensure an efficient and early start up of project activities*. To avoid cost overruns and ensure timely implementation, the project will need to fund start up activities (e.g.: transfer of DRSPR headquarters to Bamako, payment for rents, utilities; office supplies and equipment; recruitment, positioning and training of key project staff; begin training activities for research staff; initiate construction plans, purchase a few vehicles and pay for various operating costs). USAID will ensure that funds to be spent during the start up phase are properly controlled and accounted for and that the financial management systems adopted will be compatible with those to be used in the operations after the arrival of the long-term T.A. team.

Therefore, soon after signing the project agreement USAID will provide under the project a two-member administrative and financial management team for up to 18 months or until the arrival of the long-term T.A. team.** The team will work with the Director of DRSPR, the DRSPR accounting staff, and the USAID Controller to set up financial management, accounting, procurement, and inventory control systems. The objectives of this assistance will be to:

1. Design FM and accounting systems corresponding to the eventual scope and scale of full project operations.
2. Operate FM and procurement systems during the preliminary period prior to the long-term T.A. team's arrival.
3. Train both supervisory and technical accounting personnel in their responsibilities in operating FM systems.
4. Assure the existence of the necessary equipment, materials, and information flows to operate the FM system.
5. Assist the T.A. team in assuming operating responsibility for the FM system.

---

* If arrangements are not made for an early start of project activities, project implementation will be delayed by 18-24 months awaiting the arrival of the T.A. team and installation of financial management systems.

** See Organization Chart and Job Descriptions in Attachments 8 and 11. The Junior financial management specialist will be a qualified Malian accountant.

USAID/Mali will request assistance from the Sahel Regional Financial Management Project in identifying and selecting qualified candidates for the two positions, assessment of staff training needs and start up of the management systems commensurate with USAID requirements and compatible with GRM reporting needs. The team will work closely with the USAID Controller and the Director of the Sahel Regional Financial Management Project.

The USAID Project Officer will have the overall responsibility for requesting disbursement and accounting of funds during the initial period. The short-term FM assistance team will work under the supervision of the USAID Project Officer, and in close collaboration with the Director of DRSPR, and USAID Controller for the implementation of the mutually agreed upon purposes of this project.

5.0.0. Disbursement of Funds

USAID will disburse funds for local operating costs on the basis of procedures to be defined in the project agreements. Funds for construction, payment to the T.A. contractor, overseas procurement, and vehicles purchased locally will be directly paid by USAID. Specific financial procedures following the signing of the project agreement will be spelled out in the project implementation letters. No funds will be directly under the control of the implementing agency.

B. Procurement Arrangements/Responsibilities

Technical assistance, commodities, and construction services will be procured during the project. The USAID in close collaboration with the DRSPR, will arrange for a TA contractor. Procurement of commodities and construction services will be the contractual responsibility of the TA team Financial Manager, except during the 12 to 18 month start-up period. During the start-up phase, the USAID Project Officer in cooperation with the DRSPR Director and assisted by the two person administrative and financial management team, will be responsible for procuring initial requirement of vehicles and equipment. The USAID Management Office with the assistance of the REDSO/WCA specialists, will provide advice on procurement matters and guidance on the requirements set forth in the U.S. Federal Acquisition Regulations.

1.0.0. Technical Assistance: The technical assistance will be procured via a direct contract by USAID. A total of 35 person year of long term TA will be provided.

The T.A. team will consist of an experienced agricultural research management specialist who will also be the chief of party (6 years), a financial management specialist (6 years), and a data processing specialist (3 years) at DRSPR headquarters. The T.A. team Chief of Party will work with the DRSPR Director in all aspects of project implementation, both technical and

administrative. The financial management specialist will be responsible for managing project funds, setting up and operating USAID approved financial procedures, initiating procurement requests, purchasing local goods and services, requesting and accounting of USAID funds and training Malian staff in these procedures.

At the field level, USAID will provide an agronomist and an agricultural economist for each of the two field unit for a period of six years in the case of Region II (OHV) and four years in the case of Region V. Specific duties and responsibilities of the T.A. team members are described in the Position Descriptions found in Attachment 11.

Contracting Preferences

A technical assistance contractor will be solicited through open competition, including a particular effort to involve U.S. universities. The selection criteria will contain an appropriate weighting for those firms and universities who collaborate to provide the best team. This contracting mode has been chosen in recognition of the genuine difficulties which American society institutions have in supplying French speaking specialists to the Sahel on a timely basis. The technical assitance contractor will also be responsible for all procurement and training under the project.

Once bids have been received in Washington and reviewed by a Project Review Committee including selected AID/W personnel and Mission agricultural officers, a short list of qualified candidate firms will be prepared. The FSR/E project will provide funds for GRM officials to visit the short-listed U.S. institutions and to participate fully in the final selection process.

GRM representatives (from IER and DRSPR) will continue to be involved in the ongoing TA team selection process (review of curriculum vitae of all individual candidates; interviewing the potential candidates) along with USAID/Mali; and AID/W personnel.

2.0.0. Construction: All services and materials for construction will be procured via the host country contracting method.

Offices and staff housing to be financed by USAID will be built to standard GRM designs. These will be reviewed, and modified if necessary, by a local private Architectural and Engineering company which will also supervise construction. USAID Engineer will approve the final plans and estimates before bids are advertised.

3.0.0. Commodities

Most of the commodities including vehicles will be procured from local suppliers out of shelf-items (locally made or imported). Micro-computers and books/journals are not available locally.

They will require stateside procurement.

3.1.0. Shelf-Item Procurement

The commodities to be procured with AID financing under this Project will be of two categories: those of local manufacture or imported from code 899 countries, but not code 941 (office supplies and fertilizers). The estimated value of the latter is not expected to be over $250,000 and therefore within the limits of the $250,000 set forth in AID Handbook 1, Supplement B, Chapter 18 on shelf items originating in countries included in code 899 but not in code 941.

3.2.0. Motor Vehicles

A source/origin waiver and a waiver of the requirement of Section 636 (i) of the Foreign Assistance of 1961, as amended, is requested to permit the procurement of 48 mopeds, 12 motorcycles, 24 four wheel drive passenger vehicles, 10 pickup trucks and spare parts, from AID geographic code 935 countries (France or Japan). The estimated cost of such procurement is $604,000.

American manufacturers have yet to enter the Malian market. Repair facilities and spare parts are not locally available for vehicles of U.S. manufacture. The project requires passenger vehicles for use of project operation and management personnel both in Bamako and in the field. Because of the lack of spare parts and repair facilities for vehicles of U.S. manufacture, French and Japanese vehicles will be procured; parts and services for such vehicles are locally available. The project also needs mopeds and motorcycles for project personnel in the field. Mopeds and motrocycles of U.S. manufacture are not available. (A waiver request is enclosed: Attachment 14).

Delivery, Receipt and Utilization

All project commodities imported into Mali will be shipped CIF Bamako. Suppliers will provide all-risk marine insurance in the amount of 120% of the CIF cost of the commodities and similar insurance for inland freight. AID's marking requirements for overseas shipments will be observed by suppliers of commodities.

The GRM is responsible for the proper reception and clearances of incoming project commodities. Inspections of incoming shipments must be made, and receiving documents shall be annotated with comments on evident damages/losses. The GRM will file claims when necessary.

The GRM project agencies are required to put into project use all commodities procured for the project within one year of receipt. USAID/Bamako will inspect the GRM's utilixation reports as a matter of course.

V. MONITORING PLAN

The detailed outputs noted in Attachment VIII-16 will provide the basis for monitoring program achievements. The monitoring plan proposed in this project will consist of the following elements:

A. Mission Management

Mission management resources will be reorganized to accommodate the needs generated by this project as discussed in the Institutional Analysis. At the moment, one full-time agronomist (at the Ph.D. level) is under long-term contract and the ADO is experienced in FSR approaches. A senior level project management position will be redefined to emphasize research management experience and agronomic skills. Recruitment for this position is underway, thus providing for a project officer. A FSN Project Assistant with a Masters in Agricultural Economics has been hired. In addition, the Mission Agricultural Economist has a background in FSR work.

B. Project Committee

In order to provide continuity and coordination within the Mission, USAID will establish a project committee consisting of the ADO, the project officer and a representative each from the Program, Evaluation and Controller's offices. This project committee will serve as a Mission management tool. It will meet once a month or as needed to review progress and resolve any issues.

C. Project Task Force

USAID/Mali and GRM will also set up a Project Task Force (PTF) consisting of GRM project director, T.A. contractor chief of party, and USAID project officer. The PTF will meet once every two months to review implementation progress. It will focus on achievement and/or non-achievement and reasons thereof (problems, delays, etc.) in meeting planned objectives. The PTF will pinpoint specific actions to be taken by the concerned agencies (e.g., IER, the contractor, or USAID) in order to meet expected targets. Minutes of the PTF meeting will be prepared, signed and forwarded to the heads of agencies (USAID Director and Director General of IER). The PTF will request, as needed, participation of governmental agencies which are fully or partially responsible for progress on certain activities (e.g. DRA, CAAs and IPR for participant training). While the USAID project officer will be in frequent contact with the project implementation agents (DRSPR and T.A. team) resolving day-to-day issues, the role of the Project Task Force will be to identify and record serious implementation problems (arising from unfulfilled obligations) and draw high level attention of the donor and the grantee agencies.

D. Reporting

1.0.0. The T.A. contractor Chief of Party will provide USAID/Mali with six-month progress reports on project activities detailing project progress, problems and delays encountered and corrective actions taken and requested. The format of reporting will be jointly developed by USAID and the T.A. contractor to meet USAID reporting and monitoring needs.

2.0.0. An annual report will be submitted by the T.A. Chief of Party focusing on key project activities: on-farm research, development of coordination and linkages and training activities.

E. Project Reviews and Appraisals

Implementation progress will be looked at in the Mission each month during the Director's review of the agricultural portfolio. Any problems impeding project progress will thus be surfaced and receive necessary attention.

Moreover, at least, every six months the Mission Agricultural Development Officer will meet with the Director General of the Institute of Rural Economy to formally review project progress. The agenda will be prepared by responsible staff of the GRM and USAID and will be supported by adequate research into alternative solutions to major problems.

Finally, an annual review of the project will be conducted jointly by the Director of Cabinet of the Ministry of Agriculture and the Director of USAID.

VI. SUMMARIES OF ANALYSES

A. Technical Analysis - Agricultural Research in Mali and the FSR/E Project

Mali has natural resources which remain underexploited and which hold out the possibility of Mali attaining and sustaining food self-sufficiency or even generating an exportable surplus. Developing these resources has been--and continues to be-- the long term objective of the Government of the Republic of Mali (GRM). The strategy for achieving this objective has, however, changed over time. In the early 1960's, the emphasis was on large public investment in the irrigated sector, and self-reliance and community action for the predominantly rainfed farming areas. Gradually, the public role in agricultural development was expanded with the formation of regional development organizations (RDOs) in the early 1970's. These RDOs were charged with providing input delivery and marketing services as well as extension advice and generally "animating" the rural areas.

The promise of government-led growth in the agricultural sector was not, however, achieved with this strategy. In the mid-to late 1970's, the strategy began to change. The changes stemmed from many causes: the continued reoccurence of the drought; the excessive financial debts incurred by many of the state organizations through overambitious expansion or simply poor management; the recongnition that the technologies which farmers had been expected to adopt were not as well suited to their needs as had been thought; and the overall realization that the top-down approach to agricultural development was not working.

Many changes have been made--and are being made--by the GRM to improve the situation. This project can be part of the process od change, focussing specifically on the problem of generating technology which is better suited to the farmers' needs and expanding the possibilities for doing agricultural research and development from the bottom up.

Technology development is, of course, the principal responsibility of the national agricultural research system. The Malian system is comprised of several organizations, including: the Ministry of Agriculture's Institut d'Economie Rurale (IER) which is principally concerned with crop research, and in which the Division for Farming Systems Research (DRSPR) is also located, the Agricultural Engineering Division (DMA), and the Ministry of Rural Development's National Institute for Research on Livestock, Forestry, and Hydrobiology (INRZFH).

All three organizations are capably directed by Malian professionals and recognized to be important components of the national agricultural system. All are committed to applied research. The research organizations are expected to relate to the regional development organizations charged with providing extension services to farmers as well as to interface with the agricultural training institutions. There are a number of

committees and commissions which ensure that such coordination and communication regularly take place. Each organization, committee, and commission is described in some detail in Annex A. A short summary of the operations of the principal organizations with which this project will work, however, follows.

IER has about 750 staff members, of which 225 are classified as professional employees (that is, with at least four years of professional training after high school). Only about 10 of the professional staff members have degrees equivalent to MS or higher. There are presently 22 expatriates working in IER. It is organized into six Divisions (Agronomic Research, Farming Systems Research, Technical Studies, Planning and Evaluation, Documentation, and Administration and Finance), and manages a network of research stations, regional substations (PARs) and permanent experimental sites (PEPs). The central research station is located at Sotuba, just outside of Bamako, and is used for research on cereals, oil seeds and cultural practices. The five other stations are more specialized research stations (irrigated rice, irrigated wheat, cotton, fruits and vegetables, semi-arid foodgrains) and are widely dispersed. The smaller PARs and PEPs are also located all over the country. The Division of Agronomic Research (DRA) manages all the six research stations, PARs, and PEPs, with the exception of the PAR near Sikasso. This is managed by the DRSFR and focuses on "upstream farming systems research". In addition, IER conducts experimentation at two other research stations funded and managed by regional organizations: West African Rice Development Association (WARDA) and Senegal Valley Development Authority (OMVS).

The nature and quality of experimentation conducted by IER is generally thought to be quite high. Designs are generally sound and the quality of management of the on-station trials is good. Further, in spite of the hierarchical nature of the research organization and the split of research efforts among different ministries (use of animal traction, for example, is addressed by both the Agronomic Research Division (DRA) of IER and the Agricultural Engineering Division which is not under IER), there is evidence of useful interaction and experimental collaboration between research units.

The Farming Systems Research Division has demonstrated working approaches to multidisciplinary research not only by its management of its own staff, but also by coordinating research trials with the DRA staff. Other trials have had the advice and participation of INRZFH, DMA personnel, the CMDT extension services and the National Agricultural Development Bank.

Several weaknesses of the Malian agricultural research programs for developing and testing new agricultural technologies are, however, apparent:

a. the analysis and evaluation of experimental data;
b. the validity of results for all of Mali's many agroclimatic zones;
c. the relationship of experimental conditions and

objectives to farmers' conditions and objectives; and

d. weak linkages among various agencies and between research and extension agencies.

The analysis and evaluation of experimental data suffers from time constraints, the nature of the international agreements, and a lack of sufficient in-country analytical capability. Harvest data are generally not in hand until the end of the calendar year, but results must be tabulated, summarized, and printed for presentation at the IER Technical Commissions by March. Given the low level of data handling equipment available in IER--and certain skill gaps which hamper effective utilization of equipment which is available--time poses a real constraint to detailed analysis. Mali's participation in many international experiments also poses problems. As many as 15 variables per trial are often collected, but only the biological yield data are ever analyzed in Mali (unless the international team is resident). While the other data are sent back to the proposing institution, these results may not be available until some time later--and then often only in publications with limited circulation. Part of the analytical constraints also stem from the paucity of IER senior staff with graduate level training, While middle and junior level staff have been shown to be competent managers of experimental trials, not all of them have enough training to be competent analysts of the results. Results thus must be examined by a small number of senior researchers--many of whom have had limited opportunities for field observation during the growing season, due to extremely limited travel budgets.

The validity of experimental results in agroclimatic zones or on soil conditions other than those which are found on the research station, a major problem encountered in the experimental program, is related closely to the third problem-- the relationship between experimental conditions and farmers' conditions.

Mali has a wide range of climate and soil types (1200 mm of annual rainfall in the south and zero in the north, for example) and, while the network of stations is fairly widely dispersed, not all of the possible soil, temperature, and rain combinations are found on these sites. Further, farmers often differ widely in their technical knowledge, capital bases, access to markets, and their control of both human and natural resources. To increase the quality of results and ensure their application elsewhere, efforts to more carefully control for such variables are needed. While DRSPR has been most directly involved in trying to overcome this gap between on-station experimentation and the farmers' requirements, the efforts to date have not been entirely successful. Both more work on methodology (delineating useful recommendation domains, for example) and more on-farm experimentation are required. The expansion of the FSR program to two new regions will be key in this regard.

A description of each of those zones where DRSPR will work under this project is found in the Technical Annex A. At least one

regional development organization (RDO) is found in each zone and will provide the extension service base with which farming systems researchers will work. Operation Haute Vallee, the RDO for the zone surrounding Bamako, has already received support from USAID for several years. An area of relatively good agricultural potential, the OHV zone also has access to urban markets and a large group of farmers already well-equipped for animal traction. Its proximity to Bamako will facilitate the DRSPR taking on this particular expansion zone at the same time as it focusses on establishing a more capable research management operation headquartered in Bamako.

In sum, the FSR/E project can strengthen the research-extension-training system in Mali by releasing some of the present budget contraints, by increasing the numbers of highly trained staff, by reducing the barriers to communication among researchers, extension personnel, and farmers, and by fostering more joint agreement on objectives and approaches to research. Farm-level impact can be broadened by the expansion of focus to more production regions, and by improving the quality of farming systems research done at the farm level.

Technical considerations are largely responsible for project design choices regarding the planning of research and training activities to extend beyond the DRSPR, for the rate at which farming systems research activities can be expanded, for the level of technical assistance required, and for the appropriate level of funding. The three-component project described in summary above is the result.

B. Social Soundness Analysis

The purpose of the project is to develop technologies for small farmers based on clearly identified technological needs of small farmers. In order to do that the project seeks to strengthen the capacity of the research organization to conduct farming systems research and to develop effective linkages between researchers, extension workers and farmers. Therefore, the immediate beneficiaries of the project will be the research and extension institutions and their personnel and rural populations included in the farming systems effort. In the long run the beneficiaries will be the farmers and rural populations who would benefit from increased production and productivity. (See Annex B for details).

1. Sociocultural Feasibility

An essential requirement for the success of the FSR/E effort is the building of strong linkages between DRSPR and other research institutions and between the research and Rural Development Organizations (RDOs) and farmers Certain features of the Malian social structure present opportunities to facilitate these linkages while others serve as constraints. Both need to be considered in project design and implementation.

One of these features is an orientation toward strongly hierarchical structures with centralized patterns of authority. Status differences are generally clearly marked and taken seriously in social relationships. This is the case both at the village level and in the institutions that will be involved in the implementation of this project. Status markers include titles, number of subordinates, educational levels, residence, and salaried employment.

An important expression of status and power is control of information on which decisions are based. Information tends to passe only in one direction. Persons of higher status play the role of transmitters. Those in superior positions are unlikely to accept information from inferiors or to pass down all the information they have. Communication between equivalent individuals or groups may be blocked by the reluctance of either side to risk being placed in the inferior role of information receiver. Horizontal communication is further inhibited because in this type of hierarchical structure, one takes orders from and is responsible to one's superior, and little incentive exists to establish links among equals.

The existence of a centralized authority structure means that a large number of individuals can be mobilized for a given effort relatively quickly and efficiently. For example, if those in the higher administrative levels of IER decide to make a full-scale commitment to the FSR approach, then much of the research establishment will be oriented in that direction. Similarly, if a high level decision is made in the RDOs to collaborate in the FSR/E effort, then this collaboration can be accomplished, be at the directorate-level or at the field level. At the village level, leaders are readily identifiable, and have the capacity to mobilize cooperation and support from farmers.

Thus support for this project from individuals in positions of authority should be enlisted from the outset. Their ability to mobilize opposition is likely to be as strong as their ability to mobilize support.

The generally top-down flow of information characteristic of Malian social structure has further implications for the FSR/E effort. FSR/E is based on information flowing from farmers to extension workers to researchers. This means that those in a position of information givers are unlikely to accept the position of information receivers. It also means that those in the lower status positions -- farmers, enumerators, and extension field agents -- might not be given enough information about the overall goals and purposes of particular FSR/E activities to be able to provide proper feed back. Appropriate mechanisms for increasing their involvement in the process will need to be found, In general, over-emphasis on bottom-up information flow can be expected to be socially disruptive and to meet with considerable resistance. The design of FSR/E in Mali must be a realistic in terms of the amount of multi-directional communication that can reasonably be achieved.

FSR/E also requires effective communication between commodity researchers and FSR researchers, and between researchers and extension agencies. However, the strong orientation toward top-down communication renders delicate communication between parallel institutions or groups, such as different divisions of IER or research institutions and RDOs. Mechanisms for promoting communication between, DRA and DRSPR or IER and OHV will have to be carefully and explicitly worked out.

2. Participation and Motivation

The FSR/E approach is based on the active participation of both farmers and extension personnel. Participation, however, is a nebulous concept and may cover a range of activities, varying from the supply of labor, to playing a full partnership (decision-making) role in the research effort.

Motives for participation and potential benefits to be derived vary between and within different social groups. All share the goal of increased agricultural production and farmer income levels, and stand to benefit from activities that will ensure an adequate diet for Malian farmers and the urban population or enhance cash crop production. However, priorities and time-horizons are not the same for all concerned. For example, farmers are apt to give higher priority to food crops than to cash crops and to prefer risk minimization over production maximization. They are likely to be interested in short-term, practical results and will be motivated to participate if they view the effort as contributing to the enhancement of their family's well-being. RDOs, on the other hand are concerned with their financial viability and thus give high priority to cash crops and production maximization. They too will be motivated to participate insofar as short-term practical results relevant to these goals are forthcoming. The research institutions not directly concerned with their own economic viability, tend to operate with a longer time horizon and less concern for practical results.

These divergent interests are not necessarily incompatible. FSR/E design and implementation, however, need to be built around all of them to assure a distribution of benefits consistent with the FSR/E philosphy and the project goals.

3. Role of farmers' associations in FSR

In Mali, RDO's are promoting farmers' associations for economic, social and cultural development. The five year (1981-85) economic and social development plan of Mali places considerable emphasis on the role of these organizations in the rural development process. In the OHV (first phase of FSR/E expansion) there are three types of farmer associations: "Ton Villageois", "Groupement Villageois" and "Groupement de Vulgarisation". The first two associations are mainly credit and marketing cooperatives also involved in

certain community development activities at the village level. The third, Groupement de Vulgarisation (extension committee), consists of farmers with similar cropping systems. These are meant to facilitate wider coverage by extension agents as contacts can be made with groups rather than individual farmers. The associations can play a very important role in several phases of FSR/E, such as in the identification of production constraints and problems, assessing the potential of proposal solutions, identifying farmers for on-farm tests and providing feed back about on-farm test results. These associations could also contribute to the design of interventions requiring group consensus and effort. The FSR/E project will find ways of involving these associations in relevant phases of FSR/E.

C. Economic Analysis

1. Policy Context

Mali is one of the poorest countries in the world and its economy depends almost entirely on agriculture. The agricultural sector employs 85 percent of the active population, accounts for nearly all exports, and generates 40 percent of gross domestic product.

During the last two years, the Government of Mali has instituted certain changes aimed at improving the performance and productivity of both private and public enterprises in the sector. These reforms relate to restructuring of public enterprises, liberalization of grain marketing, and increasing the role of private sector participation. The liberalization of grain marketing is expected to lead to higher farm gate prices and to increase farmers' receptivity to and demand for new technologies; and these will help them to increase their production and their productivity. The role of agricultural research is to supply technologies which meet this demand.

2. Economic Impact of Agricultural Research in Mali

The effectiveness of agricultural research can be measured in three ways: (a) by the rate at which the technologies developed are adopted by farmers; (b) by the gains which farmers realize by using these technologies; and (c) by the net benefit which society as a whole realizes from the utilization of these technologies.

Quantitative estimation of the impact of agricultural research in Mali to date is difficult. Statistics are poor both on the investments in research and on the value of benefits realized.

Cotton production data, however, are better than those available for foodcrops (as all fibre is exported through a single market), and they indicate that cotton research has had a significant impact on both farm level output and on national incomes. The release in 1975-76 of an improved cotton variety (B-163) developed in Mali has led to sustained increases in yields since that time. The design of the Mali-Sud Development Project (1984-

1990) explicitly recognizes the benefits derived from research and has allocated about 13 percent of project funding (about $1 million/year) for research. The research program will consist of varietal improvement of cotton and the foodgrains with which cotton is rotated in cultivation patterns, and for the development of cost-effective input packages (fertilizer, pesticides, animal traction).

Assessments of agricultural research outside of Mali support the conclusions indicated by the cotton example in Mali. It is generally agreed that agricultural research pays. Economic returns to agricultural research activities typically exceed 26 pc.cent per year and frequently exceed 40 percent. Such high levels have been widely used as powerful arguments for significantly greater investments in agricultural research in general.

Examination of several possible scenarios for application of hypothesized results from farming systems research/extension activities in the Operation Haute Vallee and Operation Mils-Mopti areas (in Annex C) indicates that there are good opportunities doe realizing a technology-production benefit from this FSR/E project over the next 20 years. If all the costs of the FSR/E project in the OHV area (plus one-third of the DRSPR Headquarters costs) were to be covered by the gains in production realized over a 20 period, for example, an annual increase in yields of only two percent per year after year 5 on about 60 percent of the land planted to sorghum, millet, and maize would be required. In the Operation Mils-Mopti region, a similar rate of yield increase on only 25 percent of the millet land after project year 7 would amply cover the costs of research there. Alternatively, if one projects that, without new technologies, yield levels will decline at, say, a rate of one-half percent per year, then the costs of the project in the OHV area, for example, would be more than amply compensated by the losses avoided were the project to result in the introduction of technologies which simply permit farmers to maintain present yield levels. Other scenarios examined--which also are shown to generate a positive net benefit--assume different kinds of adoption patterns (a one-time adoption of a higher-yielding seed variety, for example) and more efficient use of animal traction equipment to permit the same number of workers to cultivate larger areas of land.

While the FSR/E project could be justified on these grounds alone, it is also suggested in the economic analysis that the expanded use of the farming systems approach will generate a benefit in the form of increased efficiency of research. Examples from farming systems research projects in the Sahel support the likelihood of such a benefit being realized in Mali as well. Expanded DRSPR activity id expected to help to ensure that other research conducted responds to farmers'real problems; that it will take better account of farmers' risks; and that, through the collaborative research efforts with DRA, INRZFH, and DMA, will help to overcome the differences in on-station conditions and farmers' field conditions.

In sum, the economic analysis supports the potential returns to* proposed expenditures in agricultural research efforts in Mali. The project has the potential both to develop the recommendations and extension themes on new technologies which can make farming systems more profitable and productive and to make the agricultural research system more cost-effective by helping to focus on farmers' priority concerns.

D. Financial Analysis

The overall cost of the FSR/E project has already been described in some detail above. The proposed funding levels reflect detailed consideration of three principal issues:

1. future recurrent financing capability of the GRM;

2. appropriateness of the level of expenditures compared to similar IER activities; and

3. appropriateness of the levels of expenditure compared to the results expected.

Overall, the proposed level of project funding is about 18 percent higher than anticpated in the PID. The complete financial analysis in Annex D contains a detailed table comparing PID and PP estimated levels of expenditure by major items in both the capital (technical assistance, training, construction, and commodities) and recurrent budgets (Malian personnel costs, vehicle operation and maintenance, research supplies, cooperative research, publications, etc.). The greatest differences are found in the recurrent budgets. As more detailed calculations were made, it became apparent that Malian staff costs would be higher than initially anticipated; that more office and expandable research supplies would required; and that the rents, building maintenance, and utilities budget should be slightly increased. It is noted, however, that costs projected for expansion of DRSPR activity to two new sites are in line with those now being realized in the DRSPR/Sikasso activity.

Many of the judgments made in both the financial and the economic analysis with regard to the reasonability of the proposed level of project financing assume that the GRM will hold steady on the course of policy reforms already initiated. Specifically, it is assumed that the GRM will: maintain national budgetary control according to terms laid out in the IMF Stand-By agreements; continue to reduce overall public employment and increase its effectiveness; and sustain liberalization of the foodgrain markets, recognizing the importance of producer price incentives to long-term increases in food dupply. The implications of these reforms for the FSR/E project are several.

First, IER now receives more than half of its budget from external aid, a very small amount from internal cash generations, and the balance from the national budget. While the national

budget contribution to IER has grown from year to year, much of the increase has gone to personnel costs for a growing staff. IER, as a government agency, has been under an obligation to recruit a share of each current year's graduates. This has had consequences both for the quality of the IER staff (increasing numbers of junior members) and for fact that the greastest part of available national budgetary resources has gone to pay staff salaries.

Thus, as the GRM holds the line on overall budgets, it is likely that the IER will have to continue to depend on donors for operating costs and for the training investments needed to gradually upgrade their on-board staff.

It is the Mission's judgement, therefore, that IER cannot commit itself to financing non-salary recurrent expenditures or to the payment of additional employees. It is only over the long-term, as the national financial situation improves, and as the policy on restricting mandatory recruitment is vigorously implemented, that IER's ability will increase in this regard.

One of the factors, of course, which is expected to improve the national income is the increased agricultural production arising in response to improved producer price incentives. As is discussed in considerably greater length in the Project Paper for the Cereals Market Restructuring Project (a Section 206 project recently launched), it is USAID/Mali's view that such prices incentives are critically important to stimulating long-term agricultural growth.

Finally, it is the premise of this FSR/E project that new technologies for production are also needed to stimulate agricultural growth. As the economic analysis points out, there is reason to believe that even modest rates of adoption of technologies developed and adapted to farmers' conditions through this project's activity will generate a stream of benefits. It is reasonable to expect, then, with the growth will be adequate to cover the recurrent cost obligations which the GRM and IER have agreed to assume over the course of the project life.

E. Institutional Analysis

The FSR/E project can be implemented successfully, and the design will support its capacity-building objective.

. DRSPR provides an appropriate organizational base for placement of the project.

. The approach of phasing expansion into new regions provides the opportunity to learn from the experience of early project activities.

. The project can provide adequate mechanisms and processes for involving commodity and disciplinary researchers as well as extension organizations.

. The training plan can be implemented. However, it will not provide staff for the program until 1988.

. To initiate project activities as scheduled with the specified Malian staff, it will be necessary to recruit agricultural economists, sociologists, and livestock specialists from other divisions of IER and the Ministry of Rural Development. It will be difficult to recruit M.S.-level agricultural economists and sociologists/anthropologists because there are currently very few in IER. Short term technical assistance in these disciplines will be required to initiate regional activities as scheduled.

. Staff in DRSPR, DRA and the RDOs will also require training in FSR methods and in team-building processes.

. The existing system of rewards and incentives must be improved.

. A technical assistance contractor will be required to manage procurement, and most of the construction, contracting, and finances in order to keep the management burdens on the USAID and IER to the minimum.

. The technical assistance contractor may require team building work and specialized workshops prior to arrival in country.

F. Environmental Analysis

The AID/Washington Africa Bureau environmental officer has granted a categorical exclusion for research activities relative to the environmental threshold decision and a negative declaration for the construction and the housing proposed in this project. A risk-benefit analysis will be required before pesticides can be procured. The reason for this is that although the FSR/E efforts will be carried out under carefully controlled conditions, the potential end user will be the small farmers.

Even when pesticides are used or recommended, they should be viewed only as a secondary pest management system. The primary pest management system should emphasize traditional integrated methods such as cultural practices, resistant varieties, and the preservation of naturally occuring agents.

IX. EVALUATION PLAN

Evaluation plan for this project consists of a joint USAID-GRM review and three external evaluations during the life of the project.

A. USAID-GRM Joint Review

In year 3 a joint review will be conducted by the GRM and USAID with the following specific purposes: a) to assess the project progress under various activities, b) to recommend to the GRM and USAID steps, if any, to be taken to improve project performance and implementation, c) to recommend specific location of the FSR/E project team in the Fifth Region, d) to recommend whether the FSR/E project should concentrate on one of both of the farming system prevailing in the region (i.e., millet-livestock farming systems or rice-livestock farming systems), and e) to assess the progress made in developing coordination and linkages between the organizations.

B. External Evaluations

Three external evaluations will be conducted during the life of the project in years 4, 7 and 10. These will be in-depth evaluations conducted jointly by USAID and the GRM. In each case an independent multidisciplinary evaluation team will be contracted by USAID which will include members nominated by the GRM. These in-depth evaluations will focus not only on the progress made in various project activities, problems and delays encountered in implementation, but also on achievements and progress made in the generation of farm level technology and its acceptance by farmers. The first external evaluation in particular will 1) insure that proper data is being collected and proper records are being maintained to permit measurement of progress, 2) assess the realistic nature of objectives and whether they can be accomplished within the time and resources allotted, and 3) based on experience gained during the expansion of FSR/E in the OHV Zone, suggest changes/mid-course corrections relating to staffing pattern, level of resources, coordinating mechanisms, etc., needed during expansion into Fifth Region.

The second evaluation to be done in project year 7 will assess the entire range of project activities with reference to the progress made and problems encountered in three key areas: development and acceptance of technology, institutional linkages and training. Special attention will be given to the relationship between these two divisions and remedial steps needed if any to strengthen the linkages between these two divisions.

The final evaluation among other things will examine the sustainability of the expanded FSR/E efforts, their impact on agricultural production and rural incomes in the project area and need for continuing donor support.

Each of the three evaluation teams will include five external evaluators (agronomist, ag. economist, rural sociologist/ anthropologist, extension/organization specialist and financial management specialist) and two GRM nominees from outside the IER (agronomist and sociologist). Due to the interdisciplinary nature of the project and logistical and scheduling problems involved, it is suggested that the evaluation team will be limited to a maximum of 7 persons. However, a couple of months immediately preceding the evaluation USAID and GRM might contract locally with specialized agencies or persons to develop special reports on specific project activities (e.g., data processing and analysis, animal traction interventions, livestock interventions, agro-forestry, etc.). These reports will feed into the evaluation.

It is expected that each specialist will require about six weeks, including document study, interviews, field visits and write-up time. The budget for each evaluation includes a total of 8 person months of expatriate evaluators, 3 person months of Malian evaluators and 6 person months of special studies, in-country transportation, translation, and interpretor, and secretarial services. The total cost of each evaluation is estimated to be $160,000.

ATTACHMENT 1

DRAFT PROJECT AUTHORIZATION

Name of Country/Entity: Mali

Name of Project : Farming Systems Research and Extension

Number of Project : 688-0232

1. Pursuant to Section 201 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Farming Systems Research and Extension Project for the Government of the Republic of Mali, involving planned obligations of not to exceed $19,100,000 (nineteen million one hundred thousand United States Dollars) in grant funds over a ten year period from date of authorization, subject to the availability of funds in accordance with the AID OYB allotment process, to help in financing foreign exchange and local currency costs or the project. The planned life of the project is ten years from the date of initial obligation.

2. The purpose of the Project will be to provide instituttional support to the Institute of Rural Economy (IER), Mali to expand and increase the effectiveness of its farming systems research program to develop agricultural technologies which will be relevant to farmers needs and circumstances and to promote the effective transfer of such technology.

To accomplish the purpose, there will be three main components in the Project: (1) Expansion of farming systems research/extension into two zones; (2) Improvement of research-extension-farmer linkages; and (3) Training and Staff development to strengthen the capacity of the national agricultural research, extension and training institutions in Mali to conduct farming system research.

The project activities will begin with the transfer of the DRSPR headquarters to Bamako from its present location in Sikasso (380 km from Bamako). This will greatly contribute to improved coordination and enhanced linkages with the agricultural research and development system. The project will also select and send 19 Malian researchers for long-term post graduate training. These researchers upon their return will eventually replace the technical assistance personnel. The project will establish a DRSPR research unit in the Haute Vallee Zone (Region II). After four or five years, the project will establish a second farming system research unit in the Fifth Region. This is another populous and important food producing zone in Mali.

The project may also provide financial support to the existing FSR unit in Sikasso (Region II) if other donors currently supporting that unit do not continue their assistance.

3. The Project will provide funds for technical assistance, training, construction, commodities and for operating cost support to GRM agencies to enhance their capacity for conducting farming system research and extension.

4. The Project Agreement which will be negotiated and executed by the officers to whom such authority is delegated in accordance with AID Regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.

5. Source and Origin of Commodities, Nationality of Services

Commodities financed by AID under this project shall have their source and origin in Mali or in the United States except as AID may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have Mali or the United States as their place of nationality, except as AID may otherwise agree in writing.

Ocean shipping financed by AID under this project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States.

6. Conditions Precedent and Covenants

In addition to the standard provisions of the project agreement between the Governments of Mali and United States, the Malian Government will be asked to furnish, in a form and substance which satisfies USAID regulations and before any disbursements of funds or the issuance of any committment documents, evidence that:

a) a qualified project director has been officially named and her/his responsibility and authority defined;

b) other civil service personnel as identified in the project description have been officially assigned to the project;

c) special bank accounts to be used exclusively for USAID-provided funds have been established.

In addition, the Government of Mali will be asked to covenant the following:

a) a financial management and accounting system which satisfies USAID regulations will be established;

b) an inventory control and a use/maintenance system will be established for all USAID-financed project equipment;

c) a private sector firm(s) will execute all project

construction unless otherwise jointly agreed by the GRM and USAID;

d) assure proper maintenance of all infrastructural facilities financed by project funds.

e) establish an adequate system of personnel evaluation to serve as a basis for a system of allowances and incentives.

6. Waivers

The following waivers to AID regulations are hereby approved:

A source/origin waiver for the procurement of passenger vehicles, pickup trucks, motorbike, mobylettes and spare parts from AID geographic code 935 (approximate amount $604,000).

In connection with the waiver granted above, I certify that special circumstances exist which justify waiving the requirement set forth in Section 636 (i) of the Foreign Assistance Act of 1961 that all motor vehicles purchased with AID funds be manufactured in the U.S.

Signature:

M. M. Edelman
Assistant Administrator,
Bureau for Africa

Attachment 2

UNCLASSIFIED

RECEIVED AUG 10 1983

SSSSVV TAA8P2ESC101
RR RUEAHO
DE RUFHC #3324/01 2213639
ZDH UUUUU ZZH
P 292/347 AUG 83
FM SECSTATE WASHDC
TO AMEMBASSY BAMAKO 1185
BT
UNCLAS SECTION 01 OF 03 STATE 223324

ADM AID

E O. 12356: N/A
AGS:
SUBJEC : MALI FARMING SYSTEMS RESEARCH AND EXTENSION PROJECT (688-0232); PID ECPR RESULTS

1. SUMMARY - AN EXECUTIVE COMMITTEE PROJECT REVIEW ECPR, FOR THE SUBJECT PROJECT DOCUMENT WAS HELD ON JULY 11, 1983 AND CHAIRED BY DAA/AFR, JAY JOHNSON. THE DOCUMENT AND ACCOMPANYING GUIDANCE AS PROVIDED IN THE PID ISSUES PAPER WERE REVIEWED AND APPROVED. SINCE IT IS EXPECTED THAT THE PROJECT PAPER DESIGN WILL INCREASE THE LIFE-OF-PROJECT FUNDING BEYOND THAT PRESENTED IN THE PID, THE PP WILL BE REVIEWED FOR AUTHORIZATION IN AID/W.

2. FOLLOWING PARAGRAPHS SUMMARIZE ECPR DISCUSSION AND RESOLUTION OF ISSUES, AS DESCRIBED IN ISSUES PAPER.

A. ISSUE - BASED ON THE GUIDANCE FOR INCREASING THE SIZE OF THE TECHNICAL ASSISTANCE COMPONENT PARA 3.I., BELOW;, THE LOP FUNDING LEVEL WILL INCREASE BY AN AS YET UNDETERMINED AMOUNT.

DISCUSSION - THE COMMITTEE FELT THAT THE BUDGET WAS CONSERVATIVE IN CERTAIN RESPECTS, AND THAT THE INCREASED TECHNICAL ASSISTANCE WAS JUSTIFIED. HENCE, IT WAS

AGREED THAT THE LOP FUNDING LEVEL WOULD LIKELY RISE SIGNIFICANTLY DURING THE PP DESIGN. IT WAS FELT INAPPROPRIATE TO PLACE A CEILING ON THE LOP FUNDING LEVEL BEFORE THE DESIGN TEAM IS COMPLETD. THE MISSION, HOWEVER, RESERVES THE RIGHT TO DESIGN DOWN TO A LESSER COST IF THAT IS MORE APPROPRIATE.

B. ISSUE - UTILIZATION OF D.O.A. 140 REVISED

DISCUSSION-- AS A RESULT OF ISSUE A AND THE CONTROVERSIAL NATURE OF FARMING SYSTEMS RESEARCH, IT WAS DECIDED TO BRING THE PROJECT PAPER BACK TO AID/W FOR REVIEW.

C. ISSUE - USE OF A PRIVATE FIRM FOR THE PP DESIGN AND THE COLLABORATIVE ASSISTANCE MODE WITH A UNIVERSITY.

DISCUSSION - THE MISSION IS PLANNING TO USE A PRIVATE FIRM THROUGH UNIVERSITY OF FLORIDA'S COOPERATIVE AGREEMENT WITH THE FARMING SYSTEMS SUPPORT PROJECT FSSP; TO PROVIDE THE DESIGN TEAM FOR THE SUBJECT PROJECT. OBJECTIONS WERE RAISED TO USING A PRIVATE FIRM FOR THE DESIGN OF FARMING SYSTEMS RESEARCH PROJECTS, SINCE IT IS ANTICIPATED THAT THE IMPLEMENTING PARTIES WILL BE EITHER UNIVERSITIES OR ORGANIZATIONS CLOSELY TIED TO UNIVERSITIES. THE MISSION HAS BEEN ADVISED TO DEPEND ON FLORIDA'S FARMING SYSTEMS SUPPORT PROJECT FOR THE DESIGN TEAM ASSISTANCE, WHETHER IT BE DIRECTLY THROUGH THE UNIVERSITIES OR THROUGH THE MEMORANDUM OF UNDERSTANDING WITH PRIVATE FIRMS.

223324

[illegible] THE [illegible] TITLE [illegible] IN [illegible] PROJECT IMPLEMENTATION AND [illegible] TO DETERMINE THE INTEREST OF VARIOUS [illegible]. THE MISSION MAINTAINS THE VIEW THAT CERTAIN OF THE SUBJECT PROJECT FUNCTIONS ARE MORE APPROPRIATE FOR PRIVATE FIRMS AND WISHES TO ENCOURAGE SOME TYPE OF JOINT VENTURE WITH THE PRIVATE SECTOR.

3. OTHER CONCERNS TRANSMITTED AS GUIDANCE TO THE PP DESIGN TEAM:

A. COMPLETENESS OF PROCUREMENT PLAN - THE MISSION IS INSTRUCTED TO PREPARE A DETAILED PROCUREMENT PLAN FOR THE PP, INCLUDING ALL WAIVERS, A SPECIFIC LIST OF COMMODITIES AND TIMETABLE FOR PROCUREMENT THEREOF, AND AN INDICATION OF WHO IS RESPONSIBLE FOR PROCUREMENT.

THE MISSION IS REMINDED THAT ALL PESTICIDE AND HERBICIDE PROCUREMENT ACTIONS MUST COME TO AID/W FOR APPROVAL. IN ADDITION, THE SOURCE ORIGIN WAIVER FOR VEHICLES MUST COME BACK TO WASHINGTON FOR APPROVAL, SINCE IT EXCEEDS DOLS 50,000.

B. CONDITIONAL NATIONALITY WAIVER - THE CONDITIONAL NATIONALITY WAIVER IS PERMISSIBLE PROVIDED THE LANGUAGE ALLOWS FOR THE FORMAL PROCESS OF ADVERTISING FOR EACH CONSTRUCTION ACTION IN THE U.S. SINCE IT IS EXPECTED THAT NO U.S. FIRMS WOULD BE INTERESTED IN BIDDING ON SUCH WORK, THE WAIVER WILL BECOME EFFECTIVE AT THE END OF EACH FORMAL ADVERTISING PERIOD. THIS IS INTENDED AS A TIME-SAVING MECHANISM, RATHER THAN A MEANS OF CIRCUMVENTING U.S. FIRMS.

C. LENGTH OF PROJECT - THE 10-YEAR PERIOD FOR THE PROPOSED PROJECT WAS DISCUSSED. THE MORTGAGE INVOLVED IN A PROJECT OF THIS SCOPE WAS DISCUSSED, AS WAS THE NEED FOR SOME TYPE OF BENCHMARKS. HANDBOOK 3 ALLOWS FOR 13-YEAR AUTHORIZATIONS IN RECOGNITION OF THE LONG-TERM COMMITMENT REQUIRED TO ACCOMPLISH THE PURPOSES OF SOME AID PROJECTS. AID AND AFRICA BUREAU DOCUMENTS EMPHASIZE THE NEED IN THE AGRICULTURE SECTOR OF LONG-TERM AID COMMITMENT TO SUPPORTING AND STRENGTHENING AGRICULTURAL RESEARCH INSTITUTIONS.

D. RELATIONSHIP OF PID TO OTHER RESEARCH ACTIVITIES - THE PID PLACES MUCH EMPHASIS ON THE COMPATIBILITY OF THIS PROJECT WITH OTHER RESEARCH PROJECTS IN MALI, BOTH ON-GOING AND PLANNED ICRISAT AND OMVS AGRICULTURAL RESEARCH II,. THESE ACTIVITIES ARE VIEWED AS COMPLEMENTARY TO THE SUBJECT PROJECT.

E. THE ISSUE OF PRODUCTION BENCHMARKS FOR THE SUBJECT PROJECT WAS DISCUSSED. WHILE IT WAS CONCLUDED THAT PRODUCTION BENCHMARKS, BEYOND MEASURES OF THE RESULTS OF SPECIFIC FIELD TRIALS, MAY NOT BE FEASIBLE FOR RESEARCH PROJECTS, EVALUATION OF THE PROJECT REQUIRES SOME TYPE OF CRITERIA AGAINST WHICH TO MEASURE PROJECT EFFECTIVENESS. THE PP DESIGN TEAM WILL INCLUDE AN ANTHROPOLOGIST/FSR EXPERT WHOSE SCOPE OF ACTIVITY INCLUDES DESIGN OF THE LONG-TERM EVALUATION COMPONENT OF THE PROJECT, INCLUDING PRODUCTION BENCHMARKS.

F. INTERNAL RATE OF RETURN - GUIDANCE FOR THE MISSION

ON THE RECOMMENDED FORMAT FOR ECONOMIC ANALYSIS IS PROVIDED IN THE FORM OF A STAFF PAPER FROM AFR/TR/ARD, BEING HANDCARRIED BY ADO, EHRICH.

G. INSTITUTIONAL LINKAGES - THE COMMITTEE STRESSED THE IMPORTANCE OF THE PP DESIGN TEAM'S ANALYSIS OF THE INSTITUTIONAL LINKAGES. THE ANALYSIS SHOULD CLEARLY DELINEATE HOW THE PROJECT FITS INTO THE IER, AND HOW THE LINES OF COMMUNICATION WILL BE ESTABLISHED WITH

[illegible] POLICY PAPERS. AS STATED, THE PID [illegible] THE PROBLEM, BUT THE PP GIVE MORE ATTENTION TO DEFINING THE INFORMATION FLOW AND BENEFITS TO RECIPIENTS AT EACH LEVEL. THE INTERDISCIPLINARY LINKAGES WILL ALSO NEED FURTHER ANALYSIS, BOTH LATERALLY AND VERTICALLY. FOR EXAMPLE, THE PP SHOULD EXPLORE THE LINKAGES BETWEEN CROPS, FORESTRY, LIVESTOCK, AND OTHER RESEARCH PROJECTS, ETC. MORE THOROUGHLY. IT IS ADMITTEDLY A DIFFICULT TASK, BUT THE SUCCESS OF THE FARMING SYSTEMS APPROACH DEPENDS ON THE CLOS. COORDINATION OF THE AGRICULTURE AND AGRICULTURAL RESEARCH INSTITUTIONS.

H. TRAINING COSTS - THE TRAINING COSTS FOR THE PHD.S WERE FELT TO BE SOMEWHAT UNDERESTIMATED, AND THE MISSION IS INSTRUCTED TO REVIEW THE COSTING AND PROVIDE MORE DETAIL IN THE TRAINING BUDGET.

I. T.A. TEAM COMPOSITION - THE TECHNICAL ASSISTANCE COMPOSITION SHOULD BE STUDIED MORE CLOSELY TO CONSIDER THE POSSIBILITY OF ADDING AN EXTENSION SPECIALIST AND FORESTER. IN ADDITION, IT WAS FELT THAT THE RESPONSIBILITIES OF TEAM LEADER SHOULD BE BORNE BY A PUBLIC ADMINISTRATION SPECIALIST OR PERHAPS SIMPLY AN ADMINISTRATION/ LOGISTICS PERSON. THE ANTHROPOLOGIST SHOULD HAVE COMMUNITY DEVELOPMENT SKILLS AS A MAJOR AREA OF EXPERTISE FOR DEALING WITH THE FARMER ASSOCIATIONS. THE MISSION IS INSTRUCTED TO CONSIDER THESE ADDITIONS.

J. ENVIRONMENTAL CONCERNS - THE BUREAU ENVIRONMENTAL OFFICER HAD THE FOLLOWING GUIDANCE WITH RESPECT TO THE ENVIRONMENTAL THRESHOLD DECISION :

--1. A CATEGORICAL EXCLUSION IS GRANTED FOR RESEARCH ACTIVITIES;

--2. A NEGATIVE DETERMINATION IS GRANTED FOR CONSTRUCTION AND HOUSING ACTIVITIES;

--3. A RISK/BENEFIT ANALYSIS IS REQUIRED BEFORE PESTICIDES CAN BE PROCURED. AFR/TR, S&T/AGR, AND MISSION ARE ARRANGING TO INCLUDE AN IPM SPECIALIST ON THE PP DESIGN TEAM.

K. INCENTIVE ALLOWANCES - IT IS A.I.D. PRACTICE, AS AGREED UPON BY THE SMDC, NOT TO PAY SALARY SUPPLEMENTS OR INDEMNITIES UNLESS SUCH PAYMENTS ARE THE APPROVED PRACTICE OF THE HOST GOVERNMENT AND AN AGREEMENT FOR THIS PURPOSE EXISTS BETWEEN THE MISSION AND THE HOST GOVERNMENT.

L. RECURRENT COSTS - AS IN MOST MALIAN PROJECTS, THE ISSUE OF RECURRENT COSTS WAS RAISED. WHILE THE FSR PID ADDRESSES THIS ISSUE, CITING THE AID POLICY PAPER ON SUBSIDIES, THE COMMITTEE FEELS THE TREATMENT OF RECURRENT COSTS IS INSUFFICIENT. THE PID PROPOSES TO SUPPORT THE IER WITH A CONSTANT RATE OF OPERATING COSTS OVER THE LOP. THE COMMITTEE RECOMMENDS THE PP DESIGN TEAM IDENTIFY A MEANS FOR THE GRM TO DEMONSTRATE THEIR INTEREST IN THE PROJECT BY ABSORBING A GREATER SHARE OF

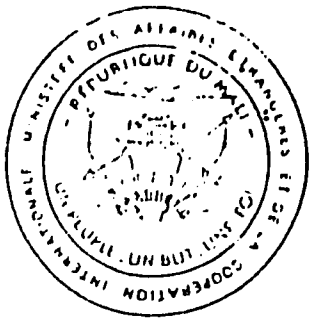
[illegible] THE LIFE OF PROJECT. THE [illegible] THAT WILL BE [illegible] TO THE PID, P. 19, [illegible], [illegible], FOLLOWING [illegible] LIFE OF PROJECT [illegible]: [illegible] WILL [illegible] OF THE OPERATING COSTS FOR THE FIRST FIVE YEARS AND NO MORE THAN ONE HALF OF THESE COSTS DURING THE LAST FIVE-YEAR PERIOD. AGREEMENT WILL BE REACHED WITH THE GRM TO EFFECT THIS COST SHARING ARRANGEMENT PRIOR TO SIGNING THE PROJECT AGREEMENT. DURING THE PROJECT PAPER DESIGN PROCESS, THE MISSION AND GRM WILL EXPLORE ALTERNATIVE TIME-PHASED PLANS FOR COPING WITH THE RECURRENT COST ISSUE.

DURING THE ECPR, IT WAS SUGGESTED THAT THE DESIGN TEAM INVESTIGATE WAYS OF SHARING THE COSTS FROM AN EARLIER POINT IN THE PROJECT. IT WAS ALSO SUGGESTED THAT THE QUOTE RECURRENT COSTS UNQUOTE POLICY PAPER BE CONSULTED TO ASSURE THAT THE FOUR CONDITIONS UNDER WHICH RECURRENT COST FUNDING IS JUSTIFIABLE ARE SATISFIED IN THE CASE OF THIS PROJECT. AID/W FEELS THE RECURRENT COSTS ISSUE SHOULD BE DEALT WITH FROM THE BEGINNING, RATHER THAN DELAYING THE INEVITABLE.

M. PROJECT MANAGEMENT - BECAUSE OF THE COMPLEXITY OF THE PROJECT, THE COMMITTEE RECOMMENDS THE ADDITION OF SOME FORM OF IMPROVED MANAGEMENT, BEYOND THE TECHNICAL ASSISTANCE MENTIONED IN THE PID. THE MISSION WILL CONSIDER AN ADDITIONAL ADMINISTRATION/LOGISTICIAN POSITION AS MENTIONED IN PARA I, ABOVE.

N. RISK TO FARMERS OF ON-FARM TRIALS - IN ADDITION TO THE GUIDELINES PROVIDED IN HANDBOOK 3, THE SOCIAL SOUNDNESS ANALYSIS OF THE PP SHOULD PROVIDE MEASURES TO MINIMIZE RISKS TO FARMERS FOR PARTICIPATING IN ON-FARM FIELD TRIALS. ONE SUCH MECHANISM IS THE INCLUSION OF AN INSURANCE SCHEME TO PROVIDE PROTECTION AGAINST UNFORESEEABLE CROP OR INCOME LOSSES FOR PARTICIPATING FARMERS. THERE APPEARS TO BE A PROVISION FOR SOME TYPE OF FARMER PROTECTION IN THE PROPOSED BUDGET - DOLS 63,000 FOR FIELD TRIALS AND DOLS 300,000 FOR FOOD CROP RESEARCH. HOWEVER, THE EXACT PURPOSE OF THESE BUDGET ITEMS IS NOT C-EARLY SPELLED OUT IN THE PID. THE PROJECT COMMITTEE, THEREFORE, REQUESTS THAT THE PP MORE EXPLICITLY IDENTIFY MECHANISMS AND SUPPORTING BUDGET ITEMS TO PROVIDE PROTECTION FOR FARMERS PARTICIPATING IN FARMER TRIALS. SHULTZ
BT
#3324

Attachment 3



N° 1717 /MAEI /DCSE/S3

Le Ministère des Affaire Etrangère et de la Coopération Internationale présente ses compliments à l'Ambassade des Etats Unis d'Amérique à Bamako (Direction de l'US. AID) et à l'honneur de lui faire parvenir la lettre n°0407/MA/IER EN Date du 4 Mai 1984 relative au projet système de production Rurale et Vulgarisation.

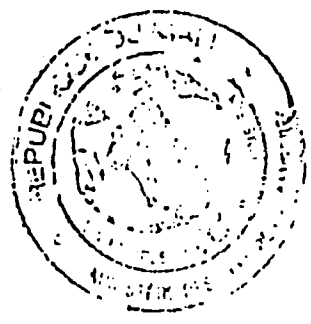
Le Gouvernement de la République du Mali qui attache une importance particulière aux actions de recherche et de vulgarisation agricoles, apprécie très hautement l'assistance que le Gouvernement des Etats-Unis d'Amérique ne cesse d'apporter au peuple Malien dans sa lutte pour l'auto-suffisance alimentaire.

Le Ministère des Affaires Etrangères et de la Coopération Internationale saurait gré à l'Ambassade des Etats-Unis d'Amérique à Bamako (Direction de l'US-AID) de son appui pour le financement de ce projet.

Le Ministère des Affaires Etrangères et de la Coopération Internationale remercie d'avance l'Ambassade des Etats-Unis d'Amérique à Bamako pour sa bonne collaboration et saisit cette occasion pour lui renouveler les assurances de sa haute considération.

AMBASSADE DES ETATS-UNIS
D'AMERIQUE A
-:- B A M A K O:-:-

BOULKASSOUMBOUGOU, LE 14 MAI 1984



Attachment 3

TD/Abc C .-/

N° 2407 /M.A/IEL-f.-

Bamako, le 04 MAI 1984

LE MINISTRE DE L'AGRICULTURE

à Monsieur le Directeur de l'US AID

- DAKAR -

s/c du Ministre des Affaires Etrangères et de la Coopération Internationale

- KOULOUBA -

OBJET : Projet système de production rurale et vulgarisation

Monsieur le Directeur,

Me référant au document de projet ci-dessus cité en objet et ayant fait l'objet de négociations fructueuses le Mardi 17 Avril 1984 entre les représentants du gouvernement du Mali et ceux de votre Agence, j'ai l'honneur de vous demander de bien vouloir prendre les dispositions nécessaires auprès du gouvernement de votre pays en vue du financement dudit projet.

Je profite de l'occasion pour vous confirmer toute l'importance que le gouvernement du Mali attache à l'aboutissement de ce projet.

En vous félicitant pour la qualité de l'assistance que votre Agence ne cesse d'apporter au Département de l'Agriculture dans ses efforts pour promouvoir un développement harmonieux du monde rural Malien je vous prie d'agréer Monsieur le Directeur, l'assurance de ma considération distinguée./.-

P/Le Ministre p.o.
Le Directeur de Cabinet

Amadou Hocten TRAORE.-

- LONG-TERM TRAINING PLAN - FY: 1985-1994 PROJECT YEAR: 1-10 ATTACHMENT 4

ORG	Trg Level and Slot		85 1	86 2	87 3	88 4	89 5	90 6	91 7	92 8	93 9	94 10
DRSPR	MS	SMD-1 (a)			x							
		SMD-2				x						
DRSPR	MS	1	LT-UST	UST	UST	x						
	MS	2		LT-UST	UST	UST	x					
	MS	3			LT-UST	UST	UST	x				
	MS	4			LT-UST	UST	UST	x				
	MS	5				LT-UST	UST	UST	x			
	MS	6				LT-UST	UST	UST	x			
	MS	7					LT-UST	UST	UST	x		
DRA	MS	8	LT-UST	UST	UST	x						
	MS	9			LT-UST	UST	UST	x				
IPR	MS	10	LT-UST	UST	UST	x						
CAR	MS	11	LT-UST	UST	UST	x						
	MS	12		LT-UST	UST	UST	x					
	MS	13			LT-UST	UST	UST	x				
DRSPR	Ph.D	1				LT-UST	UST	UST	UST	x		
	Ph.D	2					LT-UST	UST	UST	UST	x	
	Ph.D	3					LT-UST	UST	UST	UST	x	
DRA	Ph.D	4		LT-UST	UST	UST	UST	x				
	Ph.D	5				LT-UST	UST	UST	UST	x		
IPR	Ph.D	6			LT-UST	UST	UST	UST	x			
Total PM:												
- Lang Trg. (PM)			24	18	30	24	18					
- US Trg (PM)			24	56	114	120	138	96	60	24		

LT = Language training
UST = U.S. Training, Long-term
MS = Duration 36 months
- 6 months language training: 40 hours per week at 4,000 MF/hr = $5,000 or 835 per month
- 30 months U.S. training at $51,000 or 1,700 per month

Ph.D = Duration 48 months
- 6 months language training: 40 hours per week at 4,000 MF/hr = $5,000 or 835 per month
- 42 months U.S. training at $1,700 per month

x = Year of return of trainee: making allowance for slippage of time, trainee is expected to return during the second half of year.

(a)= USAID/Mali has assigned 2 long-term slots under Sahel Manpower Development Program for training in farming systems research. Training under this program will begin even before the training under FSR/E project.

(b)= June departure are anticipated to enable the candidate to take a few courses during summer session, get acquainted with the systems and adjust to the climate. Language training is expected to begin 6-8 months before the ETD.

FSRE PROJECT STAFFING PATTERN

```
                                  --------
                                  | MOA |
                                  --------
                                     |
                                  --------
                                  | IER |
-------------------------------------------------------------------------------------------------------------
|                                  DRSPR HQ                                                                |
|                                                                                                          |
|                                                                                                          |
|                                                                                                          
```

Implementation Schedule

The following target timings for implementation actions will have to be met if the project objectives have to be achieved within the allocated time frame. Implementation schedule is based on major actions: Technical Assistance, Training, Construction, Procurement, Expansion into Region 2 and 5, Evaluation, and GRM recruitment.

Year/Quarter	Action	Responsibility
FY: 1984		
4th Quarter	PP submitted to AID/W	AID/Mali
	PP reviewed, approved	AID/W
	Request for expression of interest issued	AID/W AID/Mali
	Project authorized	AID/W
FY 1985:		
1st Quarter	Project Agreement signed	AID/Mali-GRM
	Two Senior GRM researchers visit FSR sites in two countries	
	Recruitment initiated for Financial Management PSC and for construction coordinator	AID/Mali
	GRM recruitment initiated for Region 2 team	GRM
	GRM notifies AID of transfer of DRSPR headquarters to Bamako	GRM
2nd Quarter	CPs to initiate disbursements satisfied	GRM
	Preparations to move DRSPR to Bamako begin: Location and search of office space	GRM-AID/Mali
	FM team begins work	AID/Mali

	Construction coordinator begins work	AID/Mali
	PIO/T issued for TA contractor	AID/Mali
	DRSPR moves headquarters to Bamako	GRM
	ALE Form requested for developing construction plans for DRSPR Headquarters	GRM.
	FM systems set up and positioned	AID
	USAID Project committee set up	AID
	Selection of site for DRSPR Headquarters completed	GRM
	Recruitment of research staff (per schedule) completed: 8 MA, 2 ISA, 2 ITA, 1 Stat., 1 Sociologist	GRM
	1 ISA and 1 ITA depart for SI training at IITA/ICRISAT	AID/DRSPR
	Commodities ordered: vehicles for DRSPR headquarters, vehicles for Region II, office equipment, field equipment	AID/Mali
3rd Quarter	Construction plans for DRSPR HQ finalized	GRM-AID/Mali
	Long-term Training: 4 candidates begin English language training (1st Batch)	IER/IPR/CCA
	Project task force set up	IER.AID
	TA contractor selection process begins; site visits to U.S. institutions	AID/Mali:GRM

	Local hire project staff hired	AID/Mali
	GRM-OHV FSRE team in place	IER/DRSPR
	Plans for Acquisition of reference books and journals begin	GRM
	T.A. contractor selected, approved by GRM, contract signed	AID/W-GRM-AID/M
	Construction bids advertised, contractor selected and construction begins	GRM-AID/Mali
	Two short-term consultants arrive to assist in OFR Planning	AID/Mali
	OFR* Planning begins - Arrangements with OHV - Training of research and ext. staff - secondary data review - planning reconnaissance surveys	DRSPR/ST-TA
4th Quarter	T.A. placement arrangements in process	AID/Mali
	Four long-term trainees depart (1st Batch)	AID/Mali
	Action on research journal initiated	IER
	OFR Planning continues	DRSPR/ST,TA
	Housing for TA team acquired	FM team/ USAID-Mali
FY 1986		
1st Quarter	TA team arrives, installs, begins work	USAID/Mali
	Language training begins for 3 long-term trainees (2nd batch)	GRM/IER/CAA

* On-Farm Research

	OFR Constraints Analysis begins	DRSPR/TA Team
2nd Quarter	Construction Koporo station Archetectural plans completed	A&E Firm, IER TA Team
	OFR Constraints analysis (continues)	DRSPR/TA Team
	Extension - Research Seminar to sensitize research and extension agencies to FSRE approach	DRSPR/TA Team
3rd Quarter	2 GRM Senior research personnel depart for FSRE/E observation tours	DRSPR/TA Team
	Koporo station construction bids advertised Contractor selected and construction begins	A&E Firm GRM/USAID
	OFR: Constraint analysis continues	DRSPR
	OFT based on shelf-technologies	TA Team
4th Quarter	OFR: Constraint analysis/ surveys continue. OFT in Progress	DRSPR/TA Team
FY 1987		
1st Quarter	Recruitment: GRM recruits 2 ISA's and 1 ITA	IER
	Training: Language training of 5 trainees begins (3rd batch) Short-term training of 2 (ISA, ITA) begins	DRSPR/TA Team
2nd Quarter	Construction: DRSPR HQ Region II offices completed DRSPR moves into new building	DRSPR/TA Team
	OFR: First round of cons-	

	traint analysis completed and OFT results analysed	DRSPR/TA Team
	Long-term research planning begins	DRSPR/TA Team
	Extensions: Research workshop organised to exchange results, of previous years	DRSPR/TA Team
3rd Quarter	Joint review of Project Progress by GRM/USAID and decision of Project location etc. in Region V	GRM/AID-Mali
	Building plans and estimates for 5th Region offices completed	DRSPR/TA Team
	Five long-term trainees depart for U.S. (3rd batch)	DRSPR/TA Team
	One ISA/one ITA depart for ST training	DRSPR/TA Team
	OFR: Constraint analysis Problem clarification continues	DRSPR/TA Team
	Planning for second round of OFT's begins	DRSPR/TA Team
4th Quarter	Region V offices etc.: construction bids advertised, contractor selected and construction begins	GRM/AID-Mali
	5 long-term trainees depart for U.S. (3rd batch)	DRSPR/TA Team
	OFR: 2nd round of OFT's in progress	DRSPR/TA Team
FY 1988		
1st Quarter	Evaluation: 1st in-depth evaluation	AID/GRM
	Recruitment: GRM recruits 4 monitors, 1 ITA and 1	

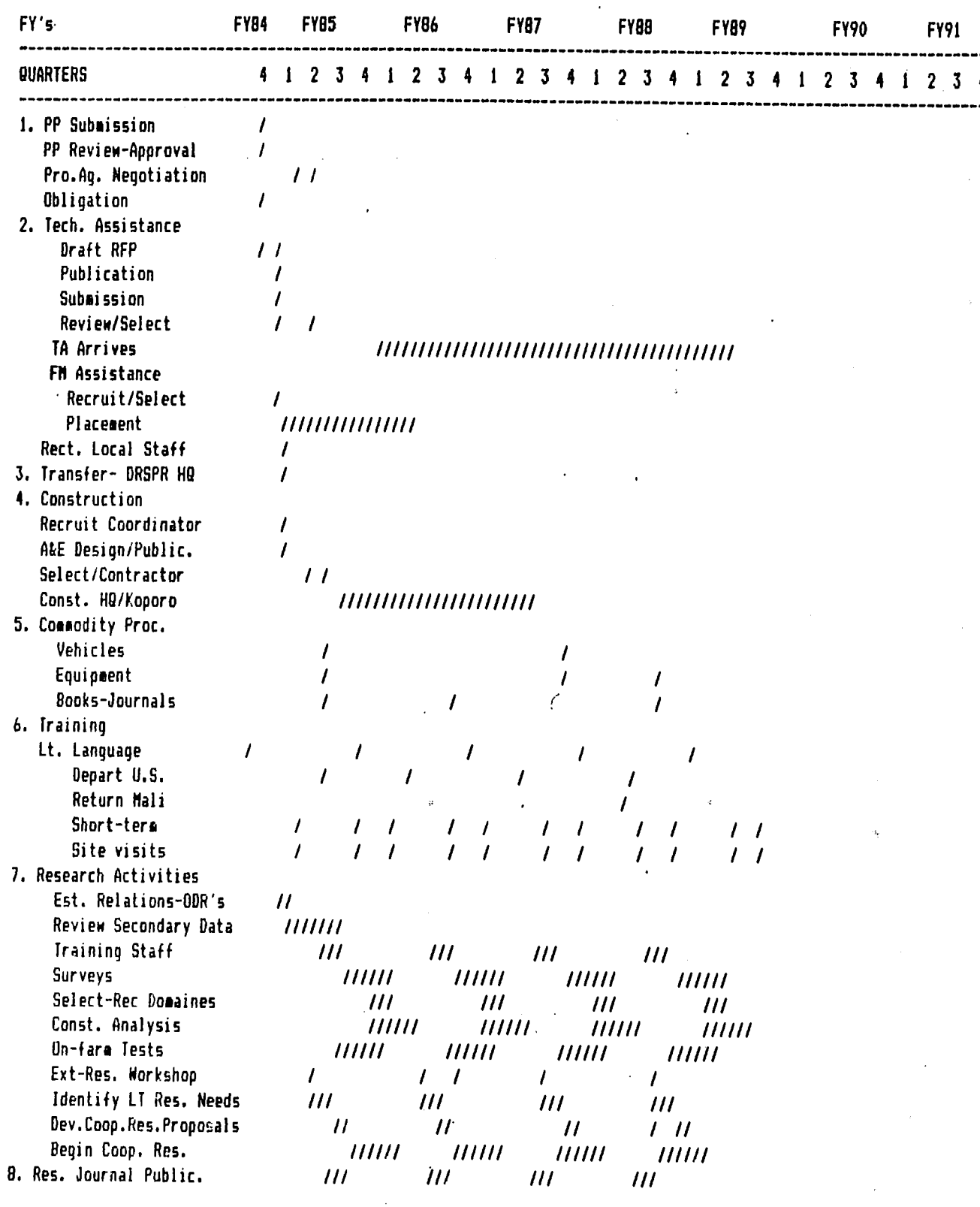
	data analyst	IER
	Training: 4 long-term trainees begin language training	IER/CAA
	OFR: Continues	IER/CAA
	Procurement: Replacement vehicles for DRSPR, Region II and DRA ordered	USAID
	Replacement equipment for DRSPR and Region II ordered	USAID
2nd Quarter	Construction: Koporo Station construction completed	AID
	TA: Data analyst end of Tours. Departs	AID/TA Team
	Extensions-Research workshop conducted	DRSPR/TA Team
	OFR: continues	DRSPR/TA Team
3rd Quarter	Training: ISA/ITA depart for ST training	DRSPR/TA Team
	OFT planning Constraint Analysis, Problem identification continues	DRSPR/TA Team
4th Quarter	Training: 4 long-term trainees depart for U.S. (4 batch)	DRSPR/TA Team
	OFR: On-farm testing in progress	DRSPR/TA Team
FY 1989		
1st Quarter	Language training begins for 3 trainees (5 batch)	DRSPR/TA Team
	Procurement: Vehicles ordered for Region V office equipment for Region V	TA Team

	Region V: GRM team constituted, support staff recruited, training begins in Region II	IER/DRSPR TA Team
	OFR: Continues in region II	TA Team
2 nd Quarter	Region V offices, housing completed	AID/Mali
	Region V T.A. Team arrives, installs	DRSPR/TA Team
	Ext Research Seminar organized	TA Team
	OFR Region II continues	TA Team
3rd Quarter	Region V team completes training, offices set up and begins work in Region V	DRSPR/TA Team
	Arrangements with extension agency in region V worked out	DRSPR/TA Team
	Two short-term trainees depart	DRSPR/TA Team
4th Quarter	Training: 3 long-term trainees depart for US (5th batch)	DRSPR/TA Team
	OFR: Constraint Analysis and problem identification begins	DRSPR/TA Team
	OFR in region II continues	DRSPR/TA Team
FY 1990		
1st Quarter	OFR: Continues in region II	DRSPR/TA Team
	Continues in region V	DRSPR/TA Team
	Training: 2 researchers depart for ST training	DRSPR/TA Team
2nd Quarter	OFR: Continues in region II	DRSPR/TA Team
	Continues in region V	DRSPR/TA Team
	Extension: Research Workshop organized	DRSPR/TA Team
3rd and 4th	OFR: Region V First round	

Quarters	of OFT's planned	DRSPR/TA Team
	Region II OFR continues	DRSPR/TA Team
FY 1991		
1st Quarter	Evaluation: Second in-depth evaluation planning	GRM/AID
	Procurement: Replacement vehicles for DRSPR, Region II and DRA	DRSPR/TA Team
	Field equipment & office equipment replaced	DRSPR/TA Team
	OFR: Continues in both regions	DRSPR/TA Team
2nd. 3rd, 4th Quarters	OFR: Continues in both regions	
	Training: In-country and short-term training continues	DRSPR/TA Team
	Extensions: Research Workshop organized (2nd Quarter)	DRSPR/TA Team
	Evaluation: Second in-depth evaluation completed (4th Quarter)	
FY 1992		
1st, 2nd, 3rd & 4th Quarters	OFR: Continues in two regions	DRSPR/TA Team
	Evaluation recommendations implemented	DRSPR/TA Team
	GRM begins to absorb support staff (1st quarter)	GRM
	Region V replacement vehicles & equipment ordered (2nd quarter)	DRSPR/TA Team

ATTACHMENT 7

FSR/E PROJECT IMPLEMENTATION CHART

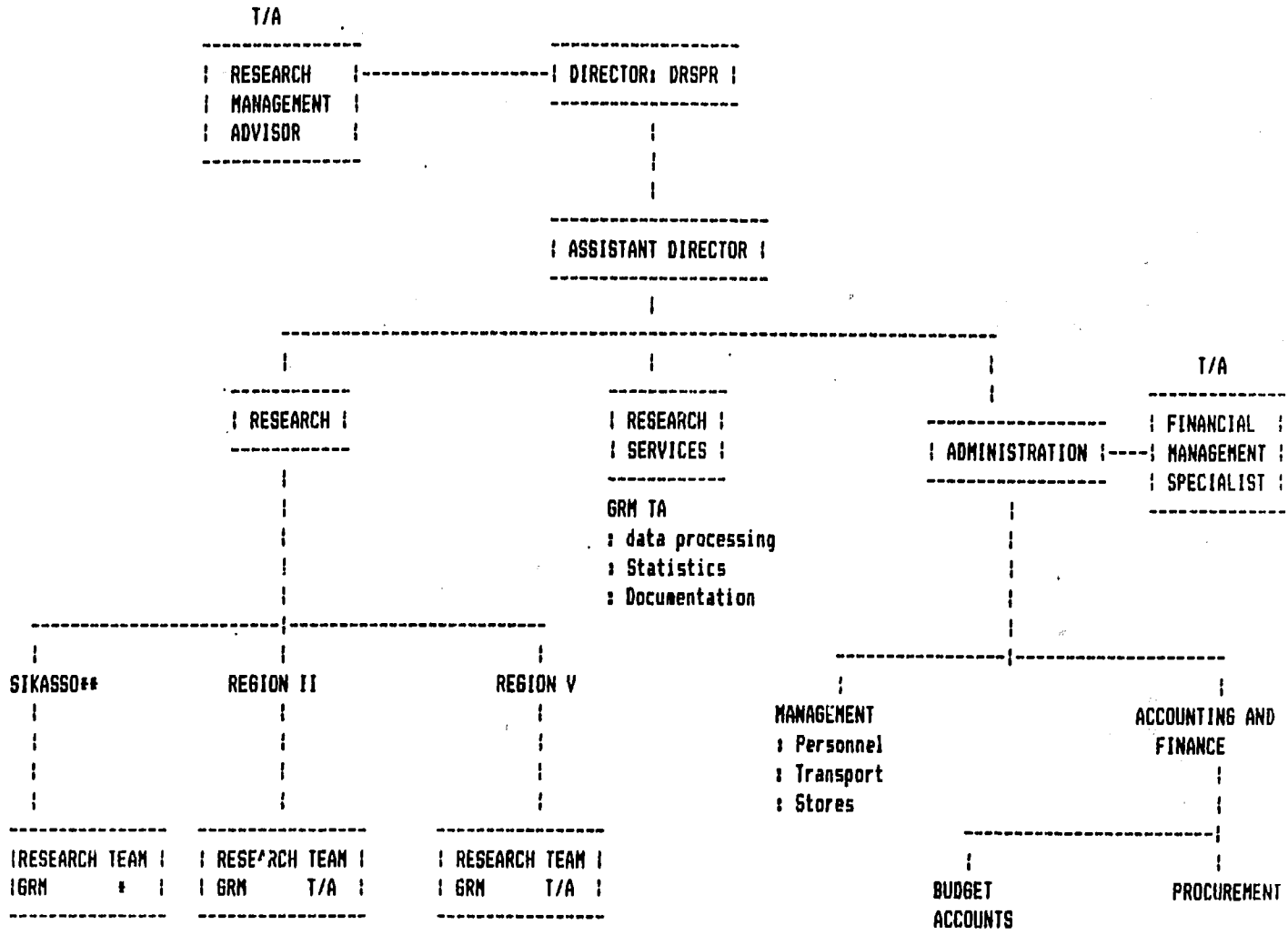


9. Evaluation
   GRM-AID Review
   1st evaluation
   2nd evaluation
   3rd evaluation
10. Region V
   T.A. recruitment
   T.A. Arrival
   Vehicles
   Equipment
   Staffing
   Construction completed
   Training
   Research underway

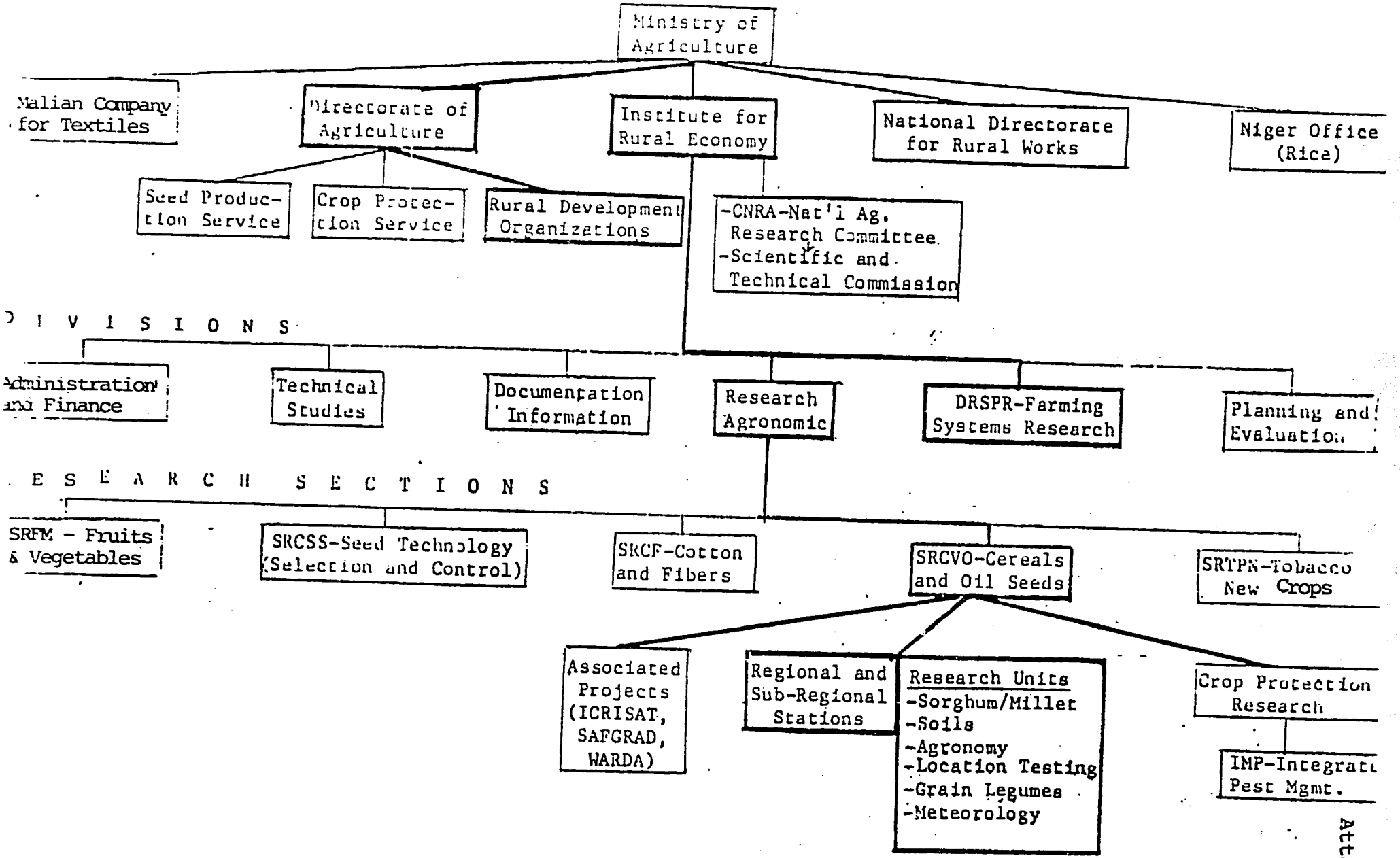
Note: Phase three 1992-94 is a consolidation phase, research, on-the-job training, etc. continued.

ATTACHMENT 8

FSRE PROJECT ORGANIZATIONAL CHART



T/A: Technical Assistance
* Technical Assistance provided by IDRC and the Dutch Government
** Existing Program



Attachment 8.1

ATTACHMENT 9

GRM PERSONNEL REQUIRED TO MEET FSR/E PROJECT NEEDS

YEAR ASSIGNMENT AND/OR RECRUITMENT

FY	85	86	87	88	89	90	91	92	93	94		
Project Year	1	2	3	4	5	6	7	8	9	10	TOTAL	
DRSPR - Director *	1										1	
Asst. Director	1										1	
Statistician	1										1	
Accountant *	1							1			2	
Typist/Secretary *	1							1			2	
Driver *	1							1			2	
Warehouseman								1			1	
Data Analyst								1			1	
Guard	1							1			2	
Janitor								1			1	14
Reg II- Agronomist *	1										1	
Economist *	1										1	
Livestock Spec.*	1										1	
Sociologist *	1										1	
I.T.A.	2										2	
Moniteur Ag.	8										8	
Data Analyst								1			1	
Accountant								1			1	
Typist								1			1	
Drivers								3			3	
Janitor								1			1	
Guard								1			1	22
Reg V - Agronomist					1						1	
Economist					1						1	
Livestock Spec.					1						1	
Sociologist					1						1	
I.T.A.					2						2	
Moniteur Ag.					8						8	
Data Analyst								2			2	
Accountant					1			1			2	
Typist					1			1			2	
Driver								3			3	
Janitor								1			1	
Guard					1			1			2	
Store Keeper								1			1	26
TOTAL												62

* Existing Staff

Support staff: Positions to be recruted/absorbed by GRM i
8 will be recruited and paid by Project i
1-7.

ATTACHMENT 10

GRM RECRUITMENT SCHEDULE TO MEET FRS/E PROJECT NEEDS

FY	85	86	87	88	89	90	91	92	93	94	
Project Year	1	2	3	4	5	6	7	8	9	10	TOTAL
I.S.A.	2	2	2								6
I.T.A.	2			2							4
Sociologists	1			1							2
Statistician	1										1
Data Analyst								4			4
Accountant					1			2			3
Typist					2			2			4
Store Keeper								2			2
Driver								7			7
Janitor								3			3
Guards	1				1			3			5
Moniteurs (MA)	8				8						16
TOTAL	14	2	2	2	12			21			57

Total Positions needed : 62
Existing Positions : 8

To be recruited 54.....Professional/Tech 24
Support 30

POSITION DESCRIPTIONS

LONG TERM TECHNICAL ASSISTANCE TEAM

POSITION # 1

A. Title: Agricultural Research Management Advisor - Chief of Party
Duration: Six (6) years
Location: Bamako, Mali
Reports to: Serves as counterpart to Director of DRSPR and USAID Project Officer.

B. Duties and Responsibilities

This is a senior research management and advisor position. The incumbent will serve as an advisor and T.A. team counterpart to the Director of Farming Systems Research Division in Mali (DRSPR).

1. Advise and assist the Director of DRSPR in developing coordination of farming systems research program, results and recommendations with relevant research units within and outside IER (DRA, DMA, INRZFH).

2. Advise and assist DRSPR in the development of cooperative agreements with research and extension organizations permitting shared use of research facilities and/or staff enabling the participation of these organizations in the FSR/E program.

3. Assist in the development of national agricultural research priorities in a form that can be used by directors of research organizations to adapt research programs to constraints and problems identified in the field.

4. To advise and assist the Director of DRSPR in developing research-extension networks in Mali to facilitate communication and coordination between research and extension agencies.

5. Advise the DRSPR Director in setting research priorities, allocation of resources, professional development of research personnel, planning and execution of research within DRSPR.

6. Will provide professional and technical leadership to the farming systems research staff.

7. Establish institutional capacity within DRSPR to communicate the problems and constraints to the appropriate research units within the GRM.

8. To assist DRSPR in developing training programs and plans. This responsibility will include:
- developing long-term training programs;
- assisting in selection of participants and training

institutions, coordinating with U.S.- based Training Coordinator;

- short-term training - third country;
- short-term training - in-country for research and extension staff;
- on-the-job training for DRSPR STAFF;
- organizing periodical workshops, seminars and conferences for sharing and communicating FSR/E information and results.

9. As Chief of Party:

a) serve as administrative and program leader of the T.A. team (short- and long-term personnel) and administrative support personnel hired under the project;

b) serve as spokesman and T.A. team representative with USAID, GRM and other appropriate organizations;

c) assist in the recruitment and placement of the contract staff including logistics required for the location of T.A. team and other facilities related to their assignment;

d) will prepare work plans and budgets for the project funded activities in consultation with DRSPR;

e) will initiate required program documentation for AID in all the areas of project activities;

f) will work closely with USAID Project Officer to ensure that project inputs are provided in a timely and efficient manner.

C. Qualifications:

1. Ph.D. in Agricultural Sciences or M.S. with highly relevant administrative experience.

2. Five years experience in case of Ph.D. or 10 years in case of M.S. in agricultural research planning and/or administration at relatively high level positions in research and/or extension organizations.

3. Three years research experience in a developing country, preferably in Africa.

4. The most critical requirement for this position is experience and proven ability in research planning management and administration. Ideal candidate would have had at least 3-5 years experience in a land grant system either as a head of the department or program leader of a major research project with interdisciplinary focus.

5. Must have demonstrated inter-personal skills and ability to work effectively with host country researchers.

D. Language:

French at S3-R3 level.

POSITION # 2

A. Title: Financial Management Specialist
Location: Bamako, Mali.
Duration: Six (6) years.
Reports to: USAID, Agricultural Development Officer/Project Officer

B. Duties and Responsibilities

1. Assist the FSR/E project (DRSPR Director) in developing standardized systems of financial planning (budgeting), accounting, reporting and inventory management. Once developed these systems would be reviewed and approved by USAID.

2. Assist in setting up internal control systems according to USAID/GRM regulations.

3. Ensure that project funds are expended and accounted according to financial management systems developed and agreed upon.

4. Initiate requests for advances/replenishments of funds; prepare financial statements periodically for submission to USAID.

5. Train DRSPR accounting staff in operating and maintaining financial management systems and inventories.

6. Assist in the procurement of project financed commodities and services.

7. Serve as the principal financial management officer responsible for project funds.

8. Assist the Chief of Party in managing project hired staff, and technical assistance team logistics (transportation, housing, etc.).

9. The incumbent will work closely with USAID Controller and the Sahel Financial Management Development Team.

C. Qualifications

1. A degree in Financial Management/Accounting with 7 years experience of which at least three years should be in managing/operating USAID related financial management systems.

2. Demonstrated experience and ability in setting up financial management and control systems (including inventory control systems) is essential.

3. Ability to train local staff in accounting systems is critical and experience in managing general support staff is desirable.

D. Language

Fluency in French language at S3-R3 level. In case of exceptional candidates, it could be waived to S2-R2.

POSITION # 3

A. Title: Data Processing Specialist/Statistician
Location: Bamako, Mali.
Duration: Three (3) years
Reports to: Chief of Party and Director of DRSPR.

B. Duties and Responsibilities

1. Assist FSR/E project in establishing data analysis and management system:
- tabulation of data;
- storing and retrieval of data.

2. Participating in the design of data collection instruments to ensure efficient data transfer to computerized systems.

3. An important function of the incumbent is to train Malian personnel in computer programming.

4. The incumbent must be able to interact with researchers on the FSR/E team and be able to take the data analysis needs of different disciplines into consideration and develop programs accordingly.

C. Qualifications

1. M.S. in computer service with at least five years experience in computer programming.

2. Experience in programming and analyzing farming systems related data is highly desirable.

3. Ability to adapt existing systems to FSR data is essential (SPSS, etc.).

4. Experience in establishing data management systems.

5. Ability to train staff in data entry, analysis and retrieval and general operation of computers and data management.

D. Language

Fluency in French language at S3-R3 level or a minimum of S2-R2 level.

POSITION # 4

A. Title: Farming Systems Economist (Region II).
Location: Bamako, Mali.
Duration: Six (6) years, approximately.
Reports to: Chief of Party.

B. Duties and Responsibilities

1. To serve as Agricultural Economist on a multi-disciplinary team. Principal responsibility will be to assist the Director of DRSPR in the development of a long-term FSR program in Mali.

2. To assist, participate in and supervise farming systems research to be conducted by the FSR team in Region II.

3. To assist and advise in:
- the development of FSR methodology;
- design and implement surveys;
- analysis of data and reporting;
- identification of problems and constraints;
- identification and screening of solutions/technologies to solve constraints identified by FSR surveys, design adaptive research activities to test the feasibility of suggested solutions to address identified constraints;
- conducting economic analysis of on-farm trials;
- training field research and extension staff in data collection activities.

4. Will assist the Director of DRSPR and the Chief of Party to follow-up on non-agronomic and non-biological constraints which have been identified.

In performing the above duties, he will work closely with the Malian Agricultural Economist and sociologist as a team.

C. Qualifications

A Ph.D. in Agricultural Economics with specialization in Production Economics or Farm Management is required. Adequate training and experience in economic anthropology or rural sociology to uderstand and analyse the social aspects of agricultural production/development problems in LDC's is desireable. A minimum of seven years experience, two of which should be in farming systems/cropping systems or experience as a multi-disciplinary team studying agricultural production problems is required. The incumbent must have a clear understanding of farming systems concepts and research methodologies and social science research analysis. A minimum of two years experience in tropical agricultural production in LDC's, preferably in Africa is essential.

Must have demonstrated inter-personal skills and ability to work effectively as a team member. Must be able to train host-country counterparts.

D. Language

French S3-R3 level.

POSITION #5

A. Title: Farming Systems Agronomist (Region II)
Location: Bamako, Mali.
Duration: Six (6) years, approximately.
Reports to: Chief of Party and Director of DRSPR.

B. Duties and Responsibilities

1. Participate as a member of farming systems research team conducting field research in order to:
- identify and describe farming systems in the area;
- identify major farm level constraints and problems;
- propose, screen and test solutions for resolving the identified constraints;
- evaluate the proposed solutions with other researchers, extension personnel and area farmers;
- assist extension service in disseminating recommended techniques.

2. Assist, supervise and analyze adaptive research activities relating to on-farm testing:
- design and execution of on-farm testing programs;
- collection and analysis of data on on-farm tests.

3. Assist in the design and/or adaptation of research methodologies in conducting cropping systems analysis.

4. Assist in training Malian research and extension personnel involved in FSR programs.

5. Assist DRSPR in developing research agenda for on-station research (based on identified constraints and problems) and communicating the same to the relevant organizations.

C. Qualifications

1. A Ph.D. in Agronomy with at least five years experience, of which minimum of two years working as an Agronomist in tropical Africa is required or an M.S. with 7 years experience, of which at least two years must be as an Agronomist in tropical Africa.

2. Sound comprehension of farming cropping systems methodology is required as evidenced by past work experience, course work or publications.

3. Experience in designing and conducting on-farm testing is essential.

4. Ability to work as a member of an interdisciplinary team is an important qualification.

D. Language
Must have fluency in French language at S3-R3 level.

POSITION # 6

A. Title: Farming System Economist (Region V)
   Location: Mopti/Sévaré, Mali
   Duration: Four years approximately
   Reports to: Chief of Party and Director of DRSPR

B. Duties and Responsiblities: Same as Position #4

C. Qualification: Same as Position #4

D. Language: Same as Position #4

POSITION # 7

A. Title: Farming System Agronomist (Region V)
   Location: Mopti/Sévaré, Mali
   Duration: Four years approximately
   Reports to: Chief of Party and Director of DRSPR

B. Duties and Responsibilities: Same as Position #5

C. Qualification: Same as Position #5

D. Language: Same as Position #5

POSITION # 8

A. Title: Training Coordinator
Location: U.S. based.
Duration: 9 years Part time.
Reports to: T.A. Contractor.

B. Duties and Responsibilities

To assist the T.A. team in coordinating project financed training in U.S.. This will include:

- identification and selection of U.S. training institutions;
- placement of candidates in the institution ensuring timely admission, etc.;
- monitoring trainee performance;
- submission of progress reports, etc. to the contract team and USAID as required;
- backstopping T.A. team in all matters relating to U.S. based training.
- arranging logistics for the trainees.

C. Qualifications

1. A degree in a related field.

2. Prior experience in coordinating graduate level training.

3. A thorough knowledge of U.S. land grant university system, especially testing, admission and graduating requirements and procedures.

SHORT-TERM FINANCIAL MANAGEMENT TEAM

POSITION # 1

A. Title: Senior Financial Management Specialist.
Location: Bamako, Mali.
Duration: 18 months
Reports to: USAID Project Officer/Director of DSRP.

B. Duties and Responsibilities

This is a senior financial management position requiring initiative and interpersonal skills. The incumbent will closely work with the USAID Controller and Projert Director of the Sahel Financial Management Project. The incumbent will serve as the principal Financial Management Officer responsible for project funds. He would be expected to:

1. Design and implement accounting, financial management, internal control and reporting systems compatible with USAID/GRM requirements (budgeting, accounting, disbursements of funds, inventory management, etc).

2. Initiate requests for advances/replenishment of funds through the USAID Project Officer. Prepare and submit financial statements to USAID as required.

3. Ensure that project funds are expended and accounted for according to financial management systems approved by USAID.

4. Provide supervision and on-the-job training to DRSPR staff in operating and maintaining financial management systems.

5. Assist in the procurement of project financed commodities and services (book-keepers, accountants, procurement, storekeeper).

6. Provide logisical support for Long-term technical assistance teams upon their arrival in country.

C. Qualifications

1. A degree in Accounting or Financial Management.

2. At least 3-5 years experience in setting up and operating financial management systems.

3. Working knowledge of USAID FM systems and accounting procedures is desirable.

4. Two years experience in West Africa preferred.

5. Ability to use or apply electronic data processing methods using micro-computers is desirable.

6. Language: French at S3-R3.

POSITION # 2

A. Title: Junior Financial Management Specialist.
Location: Bamako, Mali.
Duration: 12 months (likely to be extended up to additional 6 months).
Reports to: Senior Financial Management Specialist

B. Duties and Responsibilities

1. The incumbent will work under the supervision of Senior Financial Management Specialist and will assist: the Senior FM specialist in a wide range of financial management and accounting duties and responsibilities.

2. A major responsibility of this position is to provide on-the-job training to GRM and Project staff in accounting and financial management systems.

C. Qualifications

1. A degree in accounting or financial management.

2. At least three years experience in the field of accounting, auditing and/or financial management.

3. Knowledge of Malian accounting systems and procedures as evidenced by experience is essential.

4. Language: Fluency in English. Native French.

5. Administrative skills.

6. Training skills experience desirable.

LIST OF COMMODITIES AND PROCUREMENT PLAN (1)

ITEM	No. (2)
VEHICLES	
Station Wagon	4
4WD	20
Pick-up Trucks	10
Motorcycles	12
Mobylettes	48
OFFICE EQUIPMENT	
Typewriters-Manual with French keyboard	6+6
Typewriter-Electric with French keyboard	1+1
Typewriter-Electric with English keyboard	1+1
Copying Machine	1+1
Duplicator	3+3
Filing Cabinets	12
Book Shelves	12
Office Desks	12
Swivel chairs	12
Secretary desk	6
Secretary chair	6
Chairs-visitor	18
Chairs-folding	36
Desk Top calculators	8
Pocket calculators	60
Programmable calculators	12
Work Tables	24
Chairs	24
SCIENTIFIC EQUIPMENT	
Micro-computers with software	4
Field Equipement [weighing/ measuring equipment]	20 sets
FURNISHING FOR PROJECT* BUILT HOUSING FOR GRM STAFF	
Senior Staff houses	6
Junior Staff houses	9
Guest house	2

(1) For schedule of procurement see relevant financial tables, Annex D.
(2) Total numbers to be procured during the life of project over 10 years.
* Includes housing provided at the Koporo Station.

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

   (a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; — Through submission of annual presentation and a project notification to Congress

   (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)? — Yes

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,00, will there be

	(a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes
3.	FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	N/A
4.	FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.)	N/A
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A

DATE	TRANS MEMO NO.	AID HANDBOOK 3, App 3M
er 30, 1982	3:43	

FAA Sec. 209. Is project susceptible t execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The project directly improves technical efficiency of Agriculture and fosters increased production of food grains and livestock among private sector farmers.
FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Bids will be sought from Title XII Universities and U.S. Firms for project implementation per AID Procurement Regulations.

9.	FAA Sec. 612(b), 636(b); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The GRM will contribute local support costs upto 30% to cover salaries of research personnel and some operating costs. No U.S.-owned currency is available for support of this project.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 1982 Appropriation Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A
13.	FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does	Yes.

the project or program take into consideration the problem of the destruction of tropical forests?

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?

At the outset of the project no U.S. funds will be handled by the GRM executing agency. The project will establish a system of accounting, thru the provision of technical assistance in Financial Management. Once this is accomplished the Mission will assess the capacity of GRM implementing agency to handle project funds and make a new determination if necessary.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and

The project brings the local farmer into the Ag. development process by making him/her a part of the decision-making process which governs Ag. research and directly remits new technology through the improved extension system.

otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?

Yes.

c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

Yes, to the extent possible.

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activitiy with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

The 25% requirement is waived due to Mali's status as one of the world's least developed countries.

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character.

Yes. Satisfactory justification will be provided to Congress. The recipient is one of the relatively least developed.

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

The project will contribute to the economic development by increasing the production and productivity of rural households.

g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage

The project has been designed with full participation of the beneficiary population and Malian civil servants in each government ministry involved in Ag. production, extension and research, and provides a means for the people to express their needs and desires.

institutional development; and supports civil education and training in skills required for effective participation in governmental processes esential to self-government.	This project encourages institutional development thru training.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	N/A
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	N/A
c. ISDCA of 1981, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)?	N/A

3. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political	N/A

stability? To the extent possible, does it reflect the policy directions of FAA Section 102?

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? — N/A

c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives? — N/A

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? — N/A

WAIVER: VEHICLES

ACTION MEMORANDUM

TO: The AA/Africa Bureau/DIR

SUBJECT: Request for source/origin waiver and waiver of the requirements of section 636 (i) of the FAA for procurement of motor vehicles.

PROBLEM: Farming Systems Research and Extension Project (USAID/M-li) will require the procurement of four wheel drive vehicles, pickup trucks, motorcycles, and mobylettes. You are requested to authorize such procurement by giving your concurrence to the following:

1. A source/origin waiver from geographic Code 000 (U.S. only) to Geographic Code 899 (Free World).

2. A waiver of the provisions of Section 636 (i) of FAA.

FACTS:

a. Cooperating Country:	Republic of Mali
b. Project:	FSR/E (No. 688-0232)
c. Nature of funding:	Grant
d. Description of Goods:	Four wheel drive vehicles (24)
	Pickup trucks (10)
	Motorcycles (12)
	Mobylettes (48)
e. Approximate value	$604,000
f. Probable source:	Japan, England, France.

DISCUSSION

1. The purchase of motor vehicles identified is a vital requirement for the efficient implementation of the Project; in order to adequately provide for the transportation requirements under the Project. Non-AID funds are not available for such purchase.

2. The project is a field research project. Majority of the time, vehicles will be in the field and rural areas. American vehicle manufacturers are yet to enter the Malian market. Spare parts and

repair facilities are not locally available for U.S. menufactured vehicles. Because of the lack of spare parts and repair facilities locally U.S. manufactured vehicles, French, Japanese or U.K. menufactured vehicles will be procured for which dealerships, spare parts and repair facilities exist in Mali. 49cc display mobylettes are not manufactured in the U.S.

3. In accordance with AID Handbook 1B, procurement of commodities from Code 899 sources and origins under a grant-financed project requires a waiver. Under Handbook 1B, Chapter 5B40 (2), a source/origin waiver may be granted if "the commodity is not available from countries or areas included in the authorized Geographic Code ..."

4. "Section 636 (i) of the FAA prohibits procurement of vehicles of non-U.S. manufacture. the provisions of the section may, however, be waived when special circumstances are found to exist. Under Capter 4C2d (1) of Handbook 1, supplement B, special circumstances are deemed to exist if there is an inability of U.S. manufacturers to provide a particular type of vehicle and/or if there is a present or projected lack of adequate service facilities and supply of spare parts for U.S. manufactured vehicles."

5. As discussed above, a requirement exists that can only be met by the purchase by AID vehicles from non U.S. sources. In addition, the service facilities and supply of spare parts for Geographic Code 000 four wheel drive vehicles in Mali are non-existent. For the above two reasons, the "special circumstances" criterion set forth above is satisfied.

Primary Justification: The waiver authorizing the procurement of the above listed vehicles justified because such vehicles are not available from the authorized source and there is a present lack of adequate service facilities and supply of spare parts for U.S. manufactured vehicles.

RECOMMENDATIONS

Based on the above reasons, and the authority granted to you, it is recommended that you:

1. approve procurement source/origin waiver from AID Geographic Code 000 to Code 899 for the said vehicles.

2. conclude that special circumstances exist which merit a waiver of the provisions of Section 636 (i) of the FAA, as amended.

3. certify that exclusion of procurement from free World countries other than the cooperating country and countries included in Code 941 would seriously impede the attaitment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

Approved:

Disapproved:

AA/Africa Bureau

ATTCHMENT 15

PROJECT DESIGN SUMMARY
LOGICAL FRAME WORK

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Goal To improve the production, productivity and well-being of rural populations in two extension zones of Mali in Regions II and V	- Production increasss by 20% by 1989 and 30% by 1994 - Percentage of farmers producing marketable surplus above subsistence needs increases by 25% by 1989 and 50% by 1994	- Comparison of production data at 3 year intervals through special studies by independent agencies - Impact evaluations - Extension agency statistical reports	Purpose to goal assumptions - FSR/E genrated technologies will be adopted by farmers - GRM encourages growth of agriculture sector - Definition of farming unit remains constant through LOP to permit measurement of agricultural production - Production inputs and incentives continue to be available - Marketing system can accomodate increases in farm production
Purpose 1. To identify farmers needs for technologies help develop those technologies that improve the production and productivity of the target population, and ensuring the effective transfer of this technology to farmers.	EOPS 1. Increased capacity of DRSPR to plan, organize, implement and manage an expanded program of FSR/E in Mali. Establishment of DRSPR headquarters at Sotuba with a core staff capable of supporting field units in planning, implementing and coordinating FSR/E work in the regions. 2. DRSPR capable of systematic identification and analyses of farmers circumstances and using these analyses to select technological alternatives for experimentation. 3. Improved linkages between research and extension organizations.	- Project records - T.A. team reports - Evaluations - Physical verifications - USAID-GRM reviews - Interviews - Site visits	Output to purpose assumptions 1. Adequate financial resources will be made available by USAID to meet project operating costs 2. GRM will take timely action to move DRSPR headquarters to Bamako and establish regional teams. 3. GRM will provide adequate number of trainees in a timely manner. 4. Trainees will return, will be assigned by GRM to staff positions for which they were trained

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	4. Producing annual research recommendations designed to provide useful results to extension agents and farmers		5. Cooperative arrangements between DRSPR and research and extension agencies could be negotiated and implemented in a timely manner.
	5. Institutionalization of a process of incorporating farmers circumstances into on-station experimentation.	Organization of research-extension workshop. Review of researchs undertaken both on-station and on-farm.	6. Extension agencies are willing to participate in research and are able to nominate a research-extension coodinator.
	6. Increased number of DRSPR researchers trained at graduate level.	Number of DRSPR researchers trained.	7. FSRE developed technologies are seen by farmers as productive and farmers have access to inputs and credit where required to adopt the technologies.
	Increased numbers of researchers from other research agencies DRA, DMA, INRZFH exposed to FSR/E concepts through training.	Number of researchers from other agencies trained.	
	Increased capacity of training institutions to offer training in FSR/E concepts.	Introduction of FSR/E curriculum at IPR and CAAs. FSRE training received by the staff of training institutions.	
	7. Increased capacity of DRSPR to involve research agencies in FSR/E work.		
	Increased number of research activities in which other research agencies participate.		
	8. Increased capacity of two extension agencies to participate in FSR/E work.		
	Existence of a functioning Extension-Research Coordination Committee.		

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs			Inputs to outputs
1. DRSPR headquarters established at Sotuba	1. DRSPR headquarters moved to Sotuba and staffed by December 1984.	1. Visit to DRSPR headquarters.	1.1. GRM will take a decision issue written instructions.
	DRSPR building constructed by end of 1986.		1.2. GRM will assign necessary professional and support staff.
2. Expansion of farming systems research	2.1. Region II field unit established and working by January 1985.	2.1. On-site visits and observations	2.1. GRM will assign staff initially from existing staff and GRM will provide needed field staff - ITAs, MAs.
	2.2. Region V field unit established and working by mid-1989.	2.2. On-site visits and observations.	2.2. GRM will provide trainees for long-term training as planned.
			Training plan implemented as scheduled.
			Construction completed as scheduled.
3. Increased number of research, extension and senior research personnel trained in FSR/E approach.	3.1. Long-term participant training in U.S.: - 13 in M.S. - 6 in Ph.D.	3.1. Project implementation documents, PIO/P's, interviews with participants after their return to Mali.	3.1. Technical assistance contract negotiated and issued in a timely manner.
	3.2. Short-term training at international centers. 16 persons trained at 2 per year.	3.2. Project implementation documents, PIO/P's, interviews with participants after their return to Mali.	3.2 GRM able to identify sufficient number of trainees for long-term and short-term training and release them.
	3.3. Senior researchers/ research managers completing FSR study tours. 2 per year.	3.3. Project implementation documents, PIO/P's, interviews with participants after their return to Mali.	3.3. Trainees return and assigned to work on the FSR/E project.
	3.4. Seminars/workshops/ conferences conducted in-country to train research and extension personnel. 2 per year.	3.4. Project implementation documents, PIO/P's, interviews with participants after their return to Mali.	

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
4. Linkages established or strengthened between DRSPR and relevant research and extension agencies and training institutions.	4. Participation of relevant research agencies (DRA,DNA, INRZFH, etc.) in farming systems research: - cooperative research - participation of SRCVO in the design of on-farm trials	4. - Examination of written documents - project records - interviews	4. Capacity of research agencies to conduct research relevant to FSR/E concerns.
	4.1. Participation of extension agencies in FSR/E program: - written agreement signed between DNA and IER setting forth principles and procedures for cooperation - research/extension coordination committee established and working at extension agency level. - FSR/E activities (surveys, on-farm experiments) are developed jointly with the participation of extension agency with a provision for participation of extension agents in research activities.		4.1 Staffing capacity of research agencies.
	4.2. Training institutions participating in FSR/E field activities through internship programs.		4.2. Ability of extension organizations to assign extension staff to participate in FSR/E.
	4.3. Participation of research, extension and training institutions in the annual research-extension workshop and technical commission reviews.		

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
5. Diagnostic surveys conducted annually by inter-disciplinary FSR/E teams to assess farmers' constraints and resources: - socio-economic aspects of farming systems - productivity of cro-livestock enterprises - current level of technology	5. Surveys completed Up-to-date information available on socio-economic aspects, productivity of enterprises, level of technology	5. Annual reports	
6. On-farm tests derived from the analysis of constraints and resources identified through diagnostic surveys. Screening of technologies to focus on key system variables.	6. Approximately 50 on-farm tests per year in Region II 1985-93 and in Region V 1989-93.	6. - Annual reports - Observations - Interviews with farmers.	
7. Enhanced relevancy of on-station research.	7. On-station experiments designed and conducted annually incorporating FSR identified constraints in order to develop solutions.	7. - Annual reports - Discussion with researchers.	
Inputs: AID			
1. Technical assistance	1. 36 person years long-term T.A. and 36 person months short-term T.A.	- Project documents - Financial reports - T.A. contractor reports - PIO/P's - Obligations, disbursements - DRSPR reports - Site visits - Procurement records of T.A. contractor	1. GRM will implement the C.P.s and covenants and assign research staff and support staff as required in the staffing pattern.
2. Training	2. 19 long-term training positions funded 16 short-term training positions 16 persons complete study tours at 2 per year 21 seminars, workshops, conferences conducted - 2 per year		2. Sufficient numbers of qualified Malian candidates available with ISA, ITA and MA qualifications and GRM's budgetory capacity to employ them.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
3. Construction	3. DRSPR headquarters and offices for Region II field unit. Staff housing: 2 (senior) and 2 (junior). Region V field unit offices, staff housing constructed Koporo Station housing and office extension completed	On-site observations records/copies of contracts at DRSPR. engineering services.	Qualified A&E and construction firms are available for providing architectural and
4. Commodities	4. Field equipement, vehicles, reference books and journals procured as per schedule (see annex for details).	Procurement records of the T.A. contractor On-site examination	Waivers approved by USAID
5. Operating expenses years 1-7 100% years 8-10 70%	5. Support personnel salaries office supplies, equipment POL supplied Research expenses, in-country travel, Publication of research journal Publication of extension infomation support to RDO's	DRSPR records of payment of personnel and operating expenses	Project activities implemented as planned
6. Evaluation	6. 3 external evaluations, 1988, 91,94. 1 joint USAID-GRM review, 1987		
7. Contingencies Inflation	10% 5%		
Inputs: GRM			
1. Salaries	1. Technical and support staff at headquarters and at the two field units in years 8-10, per staffing pattern. Additional support staff salaries, 70% in years 8-10.	DRSPR Payroll Financial documents On-site visits	GRM will have the budgetary means of recruiting and assigning the staff.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
2. Operating expenses	2. During years 8-10, 30% POL, vehicle maintenance Research costs Publication of journal Water, electricity, building maintenance	2. Physical verifications site visits records	2. GRM's improved budgetary capacity to finance these activities.
3. Land for buildings at all locations	3. 100%		
4. Staff housing at DRSPR headquarters	4. 2 senior staff houses.		

Input Summary ($000s)* Project records

	AID	GRM	TOTAL
T.A.	6,040	-	6,040
Training	1,836	-	1,836
Construction	975	64	1,039
Commodities	1,433	-	1,433
Reccuring Costs	3,317	1,097	4,414
Contingencies	1,360	116	1,476
Inflation	4,137	491	4,628
TOTAL	19,098	1,768	20,866

* For details see PP, Section IV, Cost Estimation and Financial Plan.

DETAILED OUTPUTS

The following listing of detailed project outputs is included in this Project Paper to guide monitoring during implementation, as well as to provide a supplement to the Logical Framework's enumeration.

Phase One: 1985 through 1987

The outputs expected in this phase are primarily "intermediate" in the sense that they are not seen as ends in themselves but as the first essential steps towards the project objectives. Each of the outputs is associated with one of the three project components: expansion of farming systems research, improvement of coordination and linkages, and training.

EXPANSION OF FARMING SYSTEMS RESEARCH

Research Results:

- Village reconnaissance surveys will have been conducted in a sample of the 477 villages in the region of Operation Haute Vallee.

- Three to five representative villages will have been selected for more intensive collaboration in farming systems research.
- Baseline surveys, diagnostic surveys, on-farm trials, thematic surveys and other appropriate studies will have been conducted for one or two years. Baseline surveys will include estimation of levels of farm production, use of inputs, and farm household levels of technicity, among other variables. The on-farm trials will have been developed on the basis of the first-year diagnostic surveys. The thematic survey content will have evolved from discussions with the OHV personnel and from inquiries at the farm level.

- Annual reports on the DRSPR/OHV research will have been prepared by the field unit in this region. Baseline data will have been tabulated for rough analysis within one year of survey completion and used as the basis for in-depth discussions with other national agricultural research scientists and with the OHV, which will lead to the preparation of a research planning document to cover a period of at least two years.

- Farmers and OHV extension agents will have discussed results from the first year of on-farm trials with DRSPR staff. This feedback

will have been communicated either in writing in the Annual Report or in separate documents.

Production Performance:

- DRSPR/Sikasso will continue to work with farmers in the CMDT zone, testing and introducing new technologies in the on-farm trials program and monitoring the receptivity and adoption rates of the target farmers. Regular reviews of research findings will be held with farmers -- both those participating in the program and those not directly involved -- to elicit their views on the tested technologies. It is anticipated that better methods of animal traction use and animal management and a technology involving inter-cropping of maize and millet will be adopted by farmers.

- Unless findings from the DRSPR/Sikasso field unit prove to be readily transferable to the OHV setting, production performance in this area is not likely to be directly affected by project activities by the end of this phase.

  However, it is possible that research results from DRSPR/Sikasso in the areas of animal health and forage production will be applicable in higher rainfall areas of the OHV region and that a certain amount of impact will be seen on the fields of collaborating farmers producing cotton or maize with animal traction.

Organizational Outputs:

- DRSPR headquarters will have moved into a new office complex in Sotuba.

- DRSPR will have constituted the DRSPR/OHV team by assigning two experienced staff from the DRSPR/Sikasso team and assigned personnel returning with advanced degrees to both fields units (Sikasso and OHV).

- DRSPR will have fully staffed its headquarters in Sotuba.

- USAID will have provided long-term technical assistance to the DRSPR in: research management, financial management, data processing/statistics, agronomy, and

agricultural economics.

- Financial management and inventory control systems will be fully operational.

- A functional data processing system will have been set up in DRSPR for both DRSPR management and DRSPR/OHV use. One Malian staffer will have been trained and assigned full time for data processing activities.

- A library at DRSPR headquarters will have been established.

- GRM/USAID will have jointly reviewed the progress of the project at regular intervals and will have decided on the FSR/E team location and collaborating Regional Development Organization in the Fifth Region.

IMPROVED COORDINATION AND LINKAGES

Research Results:

- DRA/SRCVO scientists will have worked with DRSPR in the design and supervision of at least one season's on-farm trials.

- The SRCVO plant improvement program conducted at the Koporo Station will have been expanded upon completion of the additional facilities constructed in this phase.

- DRSPR will have prepared, on the basis of research conducted to date, a series of papers which discuss their findings in some detail with regard to improving the effectiveness of animal traction use at the farm level. These will be published in the Journal to ensure the widest possible access by the Malian research community.

- At least two issues of the IER Research Journal will have been published.

- If there has been adequate progress in identifying viable technologies, DRSPR will have developed an understanding with SRCVO/SAFGRAD for validating such technologies through trials on a large number of farms.

Production Performance:

- No production impact is expected to result from collaborative activities in this phase.

Organizational Outputs:

- DRSPR's annual reports will be discussed with representatives from other Divisions in IER in January, 1986, and January, 1987, to begin the process of joint formulation of research priorities on the basis of both on-station and on-farm research findings.

- DRSPR and OHV will have negotiated a formal agreement for collaboration.

- A formal FSR/E Research Coordination Committee will have been established by DRSPR and OHV and will be functioning.

- DRSPR will have developed cooperative research agreements with relevant research organizations (SRCVO, DMA, INRZFH) to conduct upstream research on problems identified in the field.

TRAINING

Research Results:

- DRSPR will have offered internships to IFR and CAA students; results of the special studies and analyses conducted with FSR/E staff supervision will be available.

Production Performance:

- The effective training of farmers conducting on-farm trials may be reflected in their general production performance in the following year -- assuming that the tests demonstrated useful technologies. During this phase, however, such impact is not likely to be significant.

Organizational Outputs:

- DRSPR will have organized at least two seminars on farming systems research approaches and methods to inform researchers and extension agents and to sensitize them to the possible role of this approach in the national agricultural research program.

- DRSPR will have organized at least two extension-research workshops to improve the research prioritization process on the basis of observed constraints and findings from on-farm and on-station trials.

- The effectiveness of DRSPR and OHV field staff in training and supervising farmers conducting on-farm trials will have been assessed by the Director of DRSPR and the Research Management Advisor provided by the project. The principal criterion for successful training/supervision will be minimal data loss and close to expected amounts of analysable research data.

- At least 11 long-term trainees will have departed for graduate training.

- At least six DRSPR researchers will have received short-term training in FSR/E approaches and methods.

- All DRSPR staff will have received refresher/introductory training in data collection, processing, and management as well as statistical training where needed.

- At least six senior professionals from IER or other research and training institutions will have completed study/observation tours of FSR/E projects elsewhere. Written communications and information exchanges will have been initiated.

Phase Two: 1988 through 1991

EXPANSION OF FARMING RESEARCH/ EXTENSION

Research Results:

- In the Operation Haute Vallee region, a full program of thematic surveys, on-farm trials, and other research inquiries will be implemented. The actual content of the program will be determined in two ways: (1) through the two-year research planning process at the level of IER; and (2) through the annual evaluation of research results and discussions of these results with the OHV and collaborating farmers.

- In the Fifth Region DRSPR effort, village reconnaissance surveys will have been conducted in a sample of the target region's villages. Three to five of these villages will have been selected for more intensive collaboration in farming systems research.

- Baseline surveys, diagnostic surveys, on-farm trials, thematic surveys, and other appropriate studies will have been conducted for two or three years in the Fifth Region.

Baseline surveys will include estimation of levels of farm production, use of inputs, and farm household levels of technicity, among other variables. The on-farm trials will have been developed on the basis of the first-year reconnaissance surveys. The thematic survey content will have volved from discussions with the OHV personnel and from inquiries at the farm level.

- Annual Reports on farming systems research/extension efforts in each region will be prepared by the field units.

- Other reports on particular research problems, finding, or experiences will be issued at least once a year by both regional field researchers and the DRSPR headquarters staff.

Production Performance:

- In the Operation Haute Vallee region, production performance at the farm level should reflect positive farming systems research/extension findings and the effect of closer communication between farmers and extension agents on technology issues facilitated by the FSR/E effort. Specifically, it is expected that, in the OHV region, total foodgrain output will be rising at a rate more rapid than the reported national average, that farm household productivity will be higher than in the baseline period, and that the productivity of animal traction and of soil/water resources will have been enhanced.

- It is unlikely that improvements in the production performance in the Fifth Region attributable to the project will be evident by 1992. Nevertheless, the strengthening of the commodity research at the Koporo PAR in the first phase of this project should be well on the way to demonstrating potential technologies for millet prpduciton improvement. If OMM is selected as the collaborating regional development organization, there is a possibility then for significant interventions -- and success -- at the farm level by the end of this phase.

Organizational Outputs:

- DRSPR's Fifth Region effort will have been launched: regional offices constructed and equipped, staff recruited and in place, and field activities carried out for two or three years. Two experienced Malian researchers will have been transferred from CMDT or OHV region units.

- USAID/Mali will have provided two additional long-term experts in agronomy and agricultural economics.

- DRSPR will have expanded its permanent staff by incorporating researchers returning from graduate training.

- DRSPR will have demonstrated capacity to manage a larger progam of farming systems research. Specifically, DRSPR will have: (a) defined and delineated the roles and responsibilities of headquarters and field units; (b) developed mechanisms for ensuring that research findings and experienced are regularly shared among researchers in all field units; (c) developed capacity for timely reporting of results; and (d) effectively managed logistics at both headquarters and field units and handled administrative matters expeditiously.

- The library at DRSPR headquarters will be maintained and well-utilized.

IMPROVED COORDINATION AND LINKAGES

Research Results:

- Cooperative research (involving DRSPR and SRCVO, DMA, INRZFH or others) will have continued in the OHV and CMDT areas throughout this phase. Cooperative research proposals will have been developed for the Fifth Region depending on the nature of the problems identified in the reconnaissance and initial diagnostic analyses.

- The IER Research Journal will continue to be published at regular intervals.

Production Performance:

- The production impact of the collaborative research activities will depend on the specific technologies tested and found to be valid extension themes. The specific outputs to be expected by the end of this phase will

thus be defined by activities undertaken in the first phase.

- Through annual feedback sessions, DRSPR and RDO staff will attempt to gauge the impact of their farming systems research efforts on farmers' production. Dialogues will include both participating farmers and those with only passing contact with the FSR/E program.

- The Monitoring and Evaluation Units of the RDOs charged with monitoring production performance in the areas covered by the RDOs will also be asked to evaluate the impact of FSR activity at the farm level.

Organizational Outputs:

- DRSPR will have negotiated a formal agreement of collaboration with one or more RDOs in Region V. Agreements with the OHV will have been regularly updated and renegotiated as required.

- The OHV/DRSPR Research Coordinating Committee will have continued to function throughout this period. A similar committee will have been established in the Fifth Region and will have begun to function.

- DRSPR will have held at least one workshop or seminar annually to share research findings with researchers in other parts of the national agricultural research system.

- DRSPR Annual Reports will be discussed with representatives of other IER Divisions, DMA, and INRZFH in January of each year. These discussions will continue the process of joint formulation of research priorities on the basis of both on-station and on-farm research findings.

- Further means for improving the effectiveness of linkages among various research units will have been defined and endorsed by IER management.

- Farmers and extension agents in the regional development organizations will be involved in annaul discussion of research findings, particularly those reached in the on-farm trials. Results of these "feedback sessions" will be communicated in writing, either in the

annual DRSPR report or in separate documents.

- The three DRSPR field units (CMDT, OHV, and Region V) will be meeting regularly for exchange of information, ideas, and experiences.

TRAINING

Research Results:

- DRSPR will have continued to offer internships to IPR and CAA students. Results of the special studies and analyses will be available.

Production Performance:

- The long-term relationships established with farmers in the intensive village studies in the OHV area and the Fifth Region will continue to have a training aspect. The production impact of this training will be a special concern for the second project evaluation to be conducted in 1991.

Organizational Outputs:

- DRSPR will have provided assistance to IPR and the CAAs in the development of curriculum and instructional programs in farming systems research/extension.

- At least seven persons will have departed for graduate training.

- At least 14 persons will have returned from graduate training abroad.

- At least eight DRSPR researchers will have received short-term training in FSR/E methods and approaches.

- At least two in-country refresher courses will have been conducted for DRSPR field staff and participating extension agents from OHV and the Fifth Region RDO.

- All DRSPR staff in Region V will have received in-country (on-the-job) training in data collection, processing, and management as well as in statistical methods.

- At least six senior-level researchers ffrom IER will have completed observation/study tours of FSR/E efforts in other African

countries.

- At least three DRSPR researchers will have participated in international conferences or seminars relevant to farming systems research.

Phase Three: 1992 - 1994

The accomplishments possible in this phase of activity are most readily specified at the organizational level. Outputs expected with regard to both research results and production performance will be more realistically established during the second phase of FSR/E activity, when the lines of technology development and adaptation will be clearly established. The outputs indicated here thus are relatively specific with regard to organizational impacts expected, but are more globally stated with regard production impact and research results.

EXPANSION OF FARMING SYSTEMS RESEARCH/ EXTENSION

Research Results

- In the OHV and Fith regions, DRSPR field units will have continued to report annually on results of on-farm trials, thematic adoption, and further research needs. In addition to the Annual Report, the teams will be making regular contributions to the IER Research Journal to report findings, and will be participating in international conferences and seminars to present research results.

Production Performance:

- Production and/or productivity of farm households in the three zones should be measurably improved by the DRSPR FSR/E effort. Three different means of ascertaining the nature and rate of improvement will be used:

  -- Annual feedback sessions of DRSPR and RDO staff with farmers, including both participants and non-participants in the on-farm trials programs.

  -- Periodic measurement through formal surveys of key indicators (which will be determined in the process of field research) by both the RDO Monitoring Units and DRSPR teams.

  -- Analysis of more global indicators of production and productivity available from other units in IER and the Ministry of Agriculture.

Organizational Outputs:

- All DRSPR field teams will be completely staffed by trained Malian researchers. All will have worked for at least one year with experienced technical assistance personnel.

- All DRSPR offices (headquarters and field) will be fully functional, competently managing logistics, a full-scale field research program, data processing and analysis, and long-term research planning.

IMPROVED COORDINATION AND LINKAGES

Research Results:

- Cooperative research programs will continue to produce results which will be reported both in Annual Reports and in the IER Research Jounral as well as in conference and seminar papers.

- The technology "shelf" should be continually replenished with new technologies as viable ones are tested in the farming systems research program and other pre-extension testing programs, moved into the outreach and extension programs of the regional development organizations, and adopted by farmers.

Production Performance:

- As a result of the increased dialogue among researchers, extension agents, and farmers stimulated by this project, all agricultural research should have a more visible impact at the farm level. Adoption rates of a variety of research-proposed interventions will be used to measure this production impact.

Organizational Outputs:

- A regular process of consultation about research problems and priorities will have been established and will continue to function. This process will involve research scientists in all national research organizations, RDOs, and farmers.

- The IER Research Journal will be a recognized means for intra-organizational communication of research findings.

- Malian researchers will be active participants in a variety of African and international research networks, particularly those which deal with farming systems research and extension issues.

TRAINING

Research Results:

- The IPR/CAA internship program will be a regularly established part of the DRSPR field units' work. The analyses conducted by these students will be part of the overall output of the DRSPR research.

- The quality of research will be markedly improved over the beginning-of-project status. Statistical analysis will have improved; field trial techniques will have been sharpened; overall cost-efficiency of both surveys and agronomic trials will have been enhanced.

Production Performance:

- The training aspect of the on-farm trials will be continued. Some effect should be visible; a special effort will be made in the final evaluation to suggest ways in which this training could perhaps be improved or could be adapted for other extension purposes.

Organizational Outputs:

- The national agricultural research and training institutions will have been strengthened by the long- and short-term training of more than 30 professional staff members.

- The skills of more than 100 junior- and middle-level professionals will have been increased through in-country training courses.

- More than 100 IPR and CAA students as well as 150 personnel in RDOs will be familiar with the concepts, approaches, and methods of farming systems research and extension.

TECHNICAL ANALYSIS

I. Agricultural Research in Mali

A. The agricultural production environment — A1
1. general overview — A1
2. technological level — A2
3. the relation between farm production and non-farm occupations — A3

B. The national agricultural research system — A3
1. organization and management of research — A3
2. nature and quality of experimentation — A10
commodity research/disciplinary research
farming systems research
3. strengths and weaknesses of national agricultural research system — A21

C. Agricultural production in Regions II, III, and V — A28
1. CMDT -- Region III — A29
2. OHV -- Region II — A30
3. Region V — A32
a. OMM, Operation Mil-Mopti
b. ORM, Operation Riz-Mopti
c. ODEM, the Mopti Livestock Development Organization

II. The FSR/E Project

A. Summary of problems to be addressed — A36
1. strengthening the research-extension -training system — A36
2. improving the farm-level impact — A37

B. Specific design considerations — A41
1. organizational concentration — A41
2. rate of FSR/E expansion — A42
3. technical assistance requirements — A43
4. level of funding — A45

C. Project components — A45
1. Expansion of Farming Systems Research
2. Improved Coordination and Linkages
3. Training

D. Project phasing — A46

III. Research Opportunities in Mali — A47

Attachment 1: Organisation of Agricultural Research
Attachment 2: Network of Research Stations-Mali
Attachment 3: Decision Making Structures-Mali

I. AGRICULTURAL RESEARCH IN MALI

A. The Agricultural Production Environment

A.1 General Overview

Farming in Mali is, as in most of the Sahel, a way of life for the majority of the population. Fully 85 percent of Mali's seven million people live in rural areas. They produce nearly all of the food eaten by their own households as well as the greater part of that consumed in the urban areas. In addition, agricultural exports (including livestock) account for over 70 percent of the foreign exchange earned by Mali.

In 1983, crop production was below normal, due to inadequate rainfall in many regions of the country and to poor distribution of rainfall in others. Livestock sales rose toward the end of the year as pastures were depleted and herding families sought to reduce herds to levels which could be supported on available forage. Food imports, both concessional and commercial, are expected to be higher in 1984 than in previous years --- indicating once again Mali's growing dependency on external sources to meet the daily food needs of its people.

Mali has natural resources, however, which remain underexploited and which hold out the possibility of Mali attaining and sustaining food self-sufficiency as well as generating an exportable surplus. Developing these resources has been -- and continues to be --- the long term objective of the Government of the Republic of Mali (GRM). The strategy for achieving this objective has changed over time, however. In the early days of Independence (the 1960's), the emphasis was on public investment in the irrigated sector and self-reliance and community action in the predominantly rainfed farming areas. Gradually, the public role in agricultural development was expanded into the rainfed areas, with the formation of regional development organizations (RDOs) in the early 1970's. These RDOs were charged with providing input delivery and marketing services as well as extension advice and generally "animating" the rural areas. Cooperatives were established to receive credit and organize crop purchasing. Adult education classes were held to promote literacy among farmers and increase their capacity to assume responsibility for their cooperatives, initially managed by employees of the RDOs. Public marketing monopolies (for both inputs and produce) were set up to complement the RDO structure.

The promise of government-led growth in the agricultural sector was not, however, achieved with this strategy. In the mid- to late- 1970's, the strategy began to change. The changes stemmed from many causes: continued reoccurrence of the devastating drought conditions experienced in the early 1970's; the excessive financial debts incurred by many of the state organizations through overambitious expansion or simply poor management; the recognition that the technologies which farmers had been expected

to adopt were not as well suited to their needs as had been thought; and the overall realization that the top-down approach was not working.

The marketing monopolies for agricultural inputs and for food crops have been gradually disbanded and private sector traders have been encouraged to play a greater role in these markets. The roles of the RDUs have been modified; there is a perceived need to increase the effectiveness of the services provided to the farmers while decreasing the costs of doing so. There is a growing recognition --- crystallized in the preparation of the food sector strategy --- that priorities have to be set within the capacities of the GRM to finance them and to manage them. Irrigation remains a very high priority in the agricultural sector, but the development of new technologies to further increase rainfed crop production has also received a new emphasis. The management of livestock in extensive production systems has been reallocated to those who know it best --- the herders themselves. The public livestock organizations are emphasizing support services (health, research, water point development, credit for on-farm finish feeding) rather than direct interventions in grazing and pasture management, for example.

But the challenge of increasing agricultural production --- and the food self-sufficiency of the country --- has not yet been met. Many farmers in the country are still not far beyond subsistence.

A.2 Technological Level

Malian farming systems are often analyzed in terms of their "level of technicity," that is, with reference to the level of equipment and techniques which are used in farming and herding enterprises.

The lowest level of technicity is termed "traditional." This implies use of manual labor, equipped only with a locally-manufactured hoe, for the cultivation of crops. The only source of added fertility to fields is manure or household waste or the periodic return of a cultivated field to bush fallow. The main objective of traditional crop producers is family food; surpluses are marketed only when the household granaries can hold no more or when there is an urgent need for cash and there is no other source of liquidity available. Herders are traditional if they purchase no supplemental feeds or minerals for their animals, treat animal diseases with herbs and locally-manufactured potions, and build their herds with an eye on the long term --- marketing only the minimum needed for desired herd structure and cash requirements.

A move up the technological ladder is associated with the use of purchased inputs and with a greater orientation toward production of a surplus for sale. There are, of course, intermediate steps

176

on this ladder. Rental of animal traction equipment for the production of a non-consumable crop, such as cotton, for example, is one step up -- but not as high as owning two or three pairs of oxen and complete sets of animal traction equipment, buying chemical fertilizer and producing maize as well as cotton for sale. Similarly, many herders use purchased medicines for animal maintenance but do not buy additional feed or mineral supplements. Other farmer/herders purchase animals at the end of the rainy season, often on credit, for the express purpose of feeding them up for premium sale at the end of the dry season when the traditional herds start looking thin from the declining pastures.

A.3 The Relationship between Farm and Non-farm Production

The move up the technological ladder just described is often not a smooth one. Certain investments take substantial chunks of money at one time. Some investments can be lost: due to family break-up, for example, which means that indivisible capital equipment must be assigned to one party or another; due to death -- of an animal used for traction, for example; or simply due to adverse production conditions -- poor rainfall, an attack of pests, an epidemic of a disease, etc.

One of the strategies which Malian farmers use to both acquire new agricultural technology and to hedge the risk of family starvation in the event of its loss is to pursue off-farm as well as farm enterprises. Young men are sent on migration to the urban areas or to neighboring countries to earn cash incomes which will enable the head of the household to which they belong to pay cash for purchased inputs rather than to enter into a credit relationship with another person or RDO. Off-farm employment is also pursued by family members living on the farm. They work in their spare time to earn the cash which is then plowed back into the agricultural enterprise or used to meet shortfalls in farm production.

B. The National Agricultural Research System

B.1 The Organization and Management of Research

The national agricultural research system, of course, is mandated to address many of the the problems which arise in the agricultural sector just briefly described.

Agricultural research in Mali began under the French colonial administration in 1925 with the establishment of a cotton research station at M'Pesoba. In 1932, the Office du Niger was created to promote irrigated production of cotton and rice and a program of rice research was initiated. Until Independence in 1960, all crop research was conducted at these two locations.

The Malian government (GRM) assumed administrative control of agricultural research in 1962, just two years after Independence, with the creation of the national agricultural research organization, the Institut d'Economie Rurale (IER). This Institute was placed under the responsibility of the Ministry of Agriculture. The most significant policy change made in transition from French to Malian administrative control was an increased emphasis on food crops relative to cash crops. However, until 1977, the actual conduct of crop research activities was done under contract by a number of French agricultural research institutes, most notably the Institute for Tropical Agricultural Research (IRAT). Still, French support and influence remained at a high level. In 1982, ten of the 22 expatriates in IER were technical assistance supplied by France. Moreover, IRAT advisors continue to play an important role in the dicussions and meetings in which national research priorities are reviewed and set.

Livestock research was also begun under the colonial regime, and it was turned over to direct Malian government control at Independence. It was managed by the Center for Livestock Research in IER. The National Institute for Research on Livestock, Forestry, and Hydrobiology (with the tongue-twisting acronym in French of INRZFH!) was formed in 1981, removing these areas of research from the administrative purview of the Ministry of Agriculture and placing them under the management of the Ministry of Rural Development. The Agricultural Engineering Division (DMA), which does research on farm mechanization, remains in the Ministry of Agriculture, but it is not administratively under the IER.

IER is administered by a Director-General, aided by an Assistant Director-General. The Institute has 750 staff members, including 22 expatriates. Staff are categorized as professional or support staff. There are presently 225 Malian professionals in IER, classified into three broad groups:

-- senior level (A1), that is, having graduate training or sufficient years of experience with an ISA degree (see below);

-- middle level (A1 or A2), that is, with at least four years of professional training after high school; and

-- junior level (B1 and B2), that is, with less than four years of professional training after ninth grade.

Most of the professional staff have received their basic training in agriculture in Mali. There are presently four schools which provide such training:

-- the Rural Polytechnic Institute (IPR) at Katibougou, which trains agriculturalists at two levels: (a) a degree in Applied Sciences (ISA), which involves four years of training after high school. (b) a diploma in Agriculture (ITA), which

involves four years of training after nine years of general schooling; and

-- three Agricultural Apprenticeship Training Centers (CAAs) which present graduates with certificates (the CAPA) after three years of agricultural training following nine years of general schooling. CAA graduates are called "moniteurs."

IER staff are now assigned to one of six divisions: (see Attachment 1)

-- Agronomic Research (DRA);

-- Farming Systems Research (DRSPR);

-- Technical Studies (DET);

-- Planning and Evaluation (DPE);

-- Documentation (DDI); and

-- Administration and Finance (DAF).

The Division of Agronomic Research (DRA) is by far the largest division in IER. Responsible for all on-station commodity research, its 590 employees make up 78 percent of the entire IER workforce. The majority of its staff work at the DRA headquarters in Bamako or at Sotuba, the central research station just outside of Bamako; the rest are posted to one of the regional or sub-regional research stations which are managed by the Division. DRA has 172 professional-level staff, out of which only ten have graduate level training (M. S. or PhD. equivalent). However, several others have benefitted from short-term training at institutions such as IITA, ICRISAT, IRAT, and other institutions in the U.S. and Europe. At present, ten of DRA's staff members are in long-term graduate training and are expected to return between 1985 and 1988. All scholarships have been provided by projects supported by various donors or international organizations.

The DRA is divided into six sections, four of which deal with particular groups of commodities. The fifth deals with seed multiplication and the sixth with multilocational testing of various technologies. DRA is also charged with the coordination of and liaison with international and regional research programs, as well as with management of most IER experiment stations.

The Division of Farming Systems Research is the newest division of IER and has the second largest staff. Headquartered in

Sikasso, a town about 380 kilometers from Bamako, DRSPR employs 64 people, including 13 professionals. Only one of these has had graduate level training. Five others are presently in long-term training in France, expected to return in 1984 and 1985. As

will be discussed further below, DRSPR includes two field teams and, in addition, is reponsible for the management of the Tierouala regional sub-station, the only IER experiment station not under DRA control.

The Technical Studies Division (DET) is responsible for carrying out multidisciplinary pre-project studies and other surveys and for the collection of data dealing with inputs, prices, and yields which are regularly used in Ministry policy formulation. The methodology section of the DET periodically issues reports on farmer surveys conducted by other Divisions (DPE, DRSPR) as well as by the DET itself. The DET is also responsible for the in-service training of IER staff.

The Planning and Evaluation Division (DPE) carries out feasibility, monitoring, and evaluation studies at the request of the Government.

In general, an analysis of IER's staffing pattern shows an adequate number of professional personnel at the junior and middle levels. It is these staff, supported by personnel trained at the CAA level (moniteurs), which conduct the large numbers of experiments carried out at the research stations. The analysis reveals, however, a severe shortage of qualified researchers (defined as having at least a Master's level professional degree and some field experience) in the two key divisions, DRA and DRSPR. There are only seven such persons out of the total number in these two divisions who are so qualified.

IER has a network of research stations (six in all) and sub-stations which cover all of the major agro-climatic zones of Mali (Attachment 2). The central research station at Sotuba (outside of Bamako) is the location at which most research activity is concentrated. The section of the DRA charged with research on food crops and vegetables oils (SRCVO) is headquartered there as are all of the regional or IER-associated international projects, ICRISAT, SAFGRAD, and IPM. Also near Bamako is the horticultural research station managed by the Fruit and Vegetable Research Section (SRFM) of DRA.

The three regional stations are located in:

-- Cinzana, which is in Region IV, and focusses on rainfed crops. ICRISAT has many activities here.

-- Kogoni, in the irrigated area of the Office du Niger, where the emphasis is on irrigated rice research; and

-- Dire, 200 km. north of Mopti along the Niger River, where the focus is on irrigated wheat research.

-- N'Tarala in the Region II focusses on cotton research and development.

Each of these regional stations has an on-site Director, one or two additional professional staff, three or four moniteurs, and limited support staff. Because they are located in or near population centers, staff are not always provided housing on-station, but rent it in town. Laboratory and office facilities, however, are part of the station complex.

In addition to these regional stations, IER/DRA manages sub-stations, known as PARs (Points d'Appui de Recherche) and several PEPs (Points d'Experimentation Permanente). The PAR in Tierouala is the only one managed by IER/DRPSR rather than DRA. PARs are generally stand-alone research complexes. The PEPs, on the other hand, are located in agricultural training centers and young farmers' training centers.

PARs are also headed by a Director, usually a mid-level professional with relatively little experience. One or two additional professional staff (junior level), two or three moniteurs, and guards complete the IER staff rosters at these sub-stations. The infrastructure at most PARs is generally inadequate. On-station housing is not provided, and, since the PARs are generally close to villages off the main roads, rather than in large towns. staff find it difficult to locate adequate housing. PARs thus look abandoned when the experimental season is over. It is difficult to attract, retain, and motivate staff at PARs under these conditions.

There are two other stations which are part of the research station network in Mali, but which are financed, stafffed, and managed by regional organizations with support from IER.

-- At Same Research Station, near Kayes in Region I, collaborative work with other member-states of the Senegal River Basin Commission (Mauritania and Senegal) is undertaken;

-- Mopti Research Station in Region V is under the direction of the West African Rice Development Association (WARDA) and focusses on deepwater rice improvement; and

IER researchers have access to these facilities for conducting trials at all stations and are posted at all of these stations as well as those directly managed by IER.

The decisions as to which research programs each of the IER Divisions will carry out and where experimentation will be conducted are made at two levels: (see Attachment 3)

-- the National Agricultural Research Committee; and

-- the IER Technical Commissions.

131

The National Agricultural Research Committee formulates broad research policy, identifies priority research concerns in conjunction with national needs, and determines the level of effort and resources required. The Committee meets every two years, under the chairmanship of the most senior civil servant in the Ministry of Agriculture, the Directeur du Cabinet. Participation by various research and regional development organizations (who are responsible for extension) as well as that by the international donor community is invited.

The five IER Technical Commissions are responsible for reviewing research proposals prepared by the various sections of the Agronomic Research Division, DRSPR, and associated international projects, evaluating research results, and generally coordinating the program to avoid duplication of research efforts and to assure that proposed programs are in line with the priorities established by the National Agricultural Research Committee. The IER Technical Commissions meet every year in March or April, each Commission separately, with the Director-General of IER presiding at each. The Technical Commissions are organized along the lines of Divisions and Sections within IER. Participants in the Technical Commission meetings are: researchers from within IER as well as from related research organizations (INRZFH,DMA); regional development organizations; training institutions; and donor organizations financing agricultural research in Mali. Once the Technical Commissions review previous years' research results, modify and/or approve the proposed research programs, the proposals are submitted to the National Agricultural Research Committee. The research proposals are then implemented by the concerned Divisions and Sections.

The National Institute for Livestock, Forestry and Hydrobiological Research (INRZFH) is also headquartered at Sotuba, near Bamako, although research is conducted elsewhere as well. The livestock research division has three programs, one of which is managed by personnel from the International Livestock Center (ILCA):

1. The animal production program includes 19 different sub-programs or projects, including research on animal feeding (comparing natural pastures, cultivated forage, and non-conventional forages); studies of genetic improvement in cattle; and research on improvement in pig and chicken populations.

2. The Central Veterinary Laboratory (CVL) also conducts research, including investigations in bacteriology, virology, protozoology, entomology, and toxic plant ecology as well as work related to the production of vaccines and their utilization.

3. ILCA's program includes seven elements: improved forage production from woody, leguminous shrubs; pasture development in the floodplains of the Niger Delta; cultivation of millet and cowpeas for forage; production of other leguminous forage crops;

on-farm trials and village-level studies on forage; and a feasibility study of pastoral units.

The Forestry and Hydrobiology Division of INRZFH currently pursues six general areas of research, involving:

1. a study of trees in the savanna zones, including trials with new types as well as classification and observation of local species with regard to yields, location, etc.;

2. research on the biology of indigenous species and the efficacy of various techniques for propagation;

3. irrigated forestry plantation research;

4. an investigation of artisanal paper production;

5. surveys on fishing and fish consumption, working out of the Hydrobiological Research Station in Mopti; and

6. an inventory and analysis of natural resources, (a project called PIRT, funded by AID from 1980 - 1982 was instrumental in establishing this section).

The Division for Agricultural Engineering (DMA) was created in 1970. The directorate of the DMA is located in Bamako. Actual research and development work and training takes place in Samanko (near Bamako), Sikasso, and Kayes. The DMA has a professional staff of 21 and 99 support staff (mechanics, blacksmiths, and others).

Until 1979, each regional development organization contributed to the core research and operating expenditures of the Division. By that time, many of the RDOs were having financial difficulties of their own and stopped these contributions. Since 1979, the DMA has received operating expenses only from the CMDT (approximately $62,000 per year), salaries are paid from the national budget through the Ministry of Agriculture, in which the DMA is located, and project funding is provided by a number of donors. The FAO, Swiss, and Saudi Arabia have provided both capital equipment and buildings. Both the Swiss and FAO are presently also providing technical assistance. As of 1984, CMDT will no longer supply core funding, although DMA will continue to work on special research in the CMDT region.

The DMA has played a particularly vital role in the development of agricultural mechanization in the CMDT zone. It has been responsible for the design, development, and/or modification of a wide range of tillage equipment currently in use in the zone. DMA is also responsible for the introduction of the Bouyer tractor, a tractor with small horsepower and relatively low cost. Other research and development efforts which are presently underway indicate the breadth of DMA's interests:

-- survey of traditional technologies (FAO);

-- R & D on biogas (French);

-- R & D on processing equipment (IDRC);

- karite (sheanut) oil press development (GTZ and some private voluntary organizations);

-- small tractorization (Italian support);

-- development of a multipurpose seeder and fertilizer spreader for the CMDT zone (CMDT); and

-- development of heavy equipment for animal traction in the CMDT zone (CMDT).

It should also be noted that DMA has been an active collaborator with DRSPR in the CMDT zone since 1980. The 1984 program will include farm-level work on weeding equipment, ox carts, a two-row cultivator/weeder, and improved yokes and harnesses for draft oxen.

B.2 Nature and Quality of Experimentation

The Section for Research on Food Crops and Vegetable Oils (SRCVO) within the Agronomic Research Division (DRA) and the Farming Systems Research Division (DRSPR) are responsible in large measure for the experimental crop research regularly conducted in Mali. All international research involvement is programmed as part of these research entities and thus can be discussed in conjunction with the more distinctly local research. One crop is the exception to these generalizations. Cotton research is conducted largely in cooperation with researchers from IRCT, the French cotton research institute. The discussion here will not, therefore, deal further with cotton, but will, rather, focus on those food crops in IER's mandate.

In Mali, the SRCVO is principally responsible for on-station research; DRSPR emphasises on-farm research in its program. This separation is not, however, rigidly maintained.

SRCVO: Food Crop and Vegetable Oil Research

SRCVO manages its research program by coordinating the work in each of its six sub-sections or "cells":

-- the plant improvement cell, which focusses largely on foodgrain and grain legume variety development;

-- the oil crop improvement cell;

-- the soil science cell;

-- the cultural practices cell;

-- the plant protection cell; and

-- the multilocational testing cell.

Plant Improvement:

This cell is considered to be the most important cell in the SRCVO. Until 1980, an IRAT researcher was the head of plant breeding and the breeding program in Mali was determined in consultation with the chief IRAT cereal breeder working in Bambey, Senegal. The Malian breeding program was primarily a varietal screening program, with few actual crosses being made on-station at Sotuba. This situation has substantially changed in recent years as a Malian researcher is now head of plant improvement and some Malians are in training, or have just returned, with specialities in plant breeding. The Plant Improvement Cell will continue to be in close touch with international research institutes, however, and will thus have access to a wealth of genetic material as well as information of recent advances in plant breeding elsewhere. ICRISAT has maintained a collaborative sorghum, millet, and minor millet (finger millet) breeding program since 1978. Rice variety improvement is carried out both by the Plant Improvement Cell at the station at Kogoni and at the WARDA station in Mopti.

In sum, most of the research done by the Plant Improvement Cell has been focussed on sorghum and millet, the major food staples of Mali, with some effort devoted to maize, cowpeas, rice, and minor millets.

Sorghum: The initial strategy for yield improvement followed in IER involved mass selection of superior local varieties. These improved local varieties were diffused throughout the country in the late 1960's. A more intensive breeding program was then introduced, emphasizing the introduction of exotic germplasm. This program, involving crosses of local populations with exotic material, was begun in the early 1970's. Among the crosses made at Sotuba during these years, several were retained by IRAT sorghum breeders for their yield capacity. Unfortunately, most of these populations did not hold up under farmers' conditions. The common witchweed, *Striga*, parasitized them and they showed less seedling vigor than the local varieties. With the arrival of the ICRISAT plant breeder in 1978, the Malian breeding program was again reoriented toward the national collection of local varieties of sorghum. Seedling vigor, *Striga* resistance, drought tolerance, cooking characteristics, and photosensitivity are among the criteria being applied in this breeding program -- in addition to the universal criterion of yield per hectare.

The ICRISAT effort, financed by AID/Mali, is an important component of the SRCVO plant breeding effort. At least two

sorghum varieties are expected to be released for large-scale testing (SAFGRAD) on farmers' fields in the 1985 growing season. The program has benefitted by the continuous association of an experienced plant breeder from the U.S. since 1978.

Millet: Millet varietal improvement has been slow and difficult all across West Africa. The problem of resistance to downy mildew has not been resolved and a source of resistance to *striga* has not yet been found. The IRAT policy of breeding dwarf millet varieties has been virtually abandoned, although several varieties developed from local cultivars are still being tested at the research station level. Malian researchers in the millet program are largely working of the purification of local varieties from *Chibras* outcrosses. ICRISAT s completion of a millet mildew screening facility at the Koporo station in Region V should accelerate future work on millet improvement.

The Title XII Cooperative Research Support Programs (CRSPs) in soils (TropSoils) and sorghum and millet (INTSORMIL) funded by AID joined the sorghum and millet breeding efforts in Mali in the 1984 cropping season. Understanding drought tolerance mechanisms in sorghum and millet is among possible objectives for CRSP work with SRCVO.

Maize: The maize breeding program has been limited to screening varieties available from IRAT, IITA, and CIMMYT as well as local varieties. Maize trials have been conducted mainly at Sotuba, with replicate trials sent to Kita, Sikasso, Katibougou, and Massentola. One improved local variety was identified and released for extension more than a decade ago. The purity of this variety, called Tiemantie de Zamblara, is now, however, in doubt. It seems more susceptible to *Helminthosporium* and is lower yielding than some of the varieties received from international centers. Several of these "imported" varieties are promising: among the hybrids, IRAT 81 has been identified as having potential for extension; a short-cycle, open pollinated composite, Pool 16, is now being tested by the multilocational testing cell (as part of the SAFGRAD project). Mali at the present time does not have hybrid seed production facilities so IRAT 81 has not yet moved into the outreach stage.

Cowpeas: The International Development Research Center (IDRC) is financing a cowpea improvement project in the Plant Improvement Cell. The project is being carried out entirely by Malian staff, with no external technical assistance. Drawing on the pool of IRAT grain and forage cowpea varieties screened in Mali before the IDRC support began, the project is now comparing the best of these varieties to entries originating in cowpea programe in IITA/Ibadan and Upper Volta. In 1983, the first Malian crosses were made. Cowpea agronomy trials have also been conducted: on spacing, dates of seeding, cultivation techniques, insect control, intercropping, and fertilization. In addition, "canned" varietal trials sent by IITA are carried out. Neither

the agronomy trials or the canned trials have received adequate, systematic analyses. Nevertheless, the quality of this project's work appears to be improving.

Rice: Rice research is organized according to the three major systems of rice cultivation practiced in Mali: rainfed or lowland cultivation; irrigated production under full water control; and irrigated production with semi-controlled flooding. Research on rainfed/lowland rice is focussed on the selection of varieties from the IRAT series, using the following characteristics: short duration (90 - 100 days); higher yields; and resistance to Periculariose. Eight varieties have been under observation since 1981. No conclusive results have been obtained, although an average yield of 2000 kg/ha has been found. One local improved variety identified in the program (Dourado Precose, which yields 1570 kg/ha on average), is currently being extended.

Research on irrigated rice is also focussed on varietal selection, but screening is being done for medium duration (1240-140 days) as well as short duration, and there is some development of high-yielding crosses. In both cases, control varieties (short-duration H15-23DA; medium duration D52-37) have shown higher yields than tested varieties. Another set of experiments focusses on evaluation of varieties grown under irrigated conditions elsewhere in West Africa. Varietal testing is conducted in the Office du Niger at four locations; again local controls have outyielded the introduced varieties.

Development of deepwater (floating) rice suited to the controlled flooding conditions is the principal objective of research at the WARDA station in Mopti. The program includes varietal selection, hybridization, weed control, cultural practicies, and on-farm testing. No conclusive results have yet come out of this relatively new program.

Minor Millets: Early IRAT researchers accorded little value to the minor millets, largely because they were already fully occupied in meeting the research requirements for the major food crops. More recently, however, this group of cereals has received some attention in SRCVO. A national collection of fonio (*Digitaria exilis*) has been made with the assistance of the International Board for Plant Genetic Resources (IBPGR); this is a beginning point for screening at some future date. The importance of fonio among the poorest farmers has already been noted by DRSPR/Sikasso. Finger millet (*eleusine coracana*) has also been identified, on the basis of introductory trials carried out by ICRISAT breeders, as a most promising exotic minor millet. It tolerates low fertility and may be appropriate for low-input farming systems.

Oil Crop Improvement:

Peanut and soybean improvement programs are located within a

separate cell of the SRCVO. Until 1977, the cell was under the direction of a French researcher associated with IRHO, the French research organization dealing with vegetable oils.

Peanuts: Until the late 1970's, peanut research in Mali was carried out in close coordination with that in Senegal. Breeding work was done in Senegal, with improved varieties sent to Mali for evaluation at IPR/Katibougou. This screening program identified two varieties, one long- and one short-cycle, which have been extended throughout the country. A third variety, which is drought and rosette resistant, was nearly through the experimental process in Mali when a decline in peanut research funds arrested further development in 1977.

Previously, financial support for peanut research had been received from the regional development organization charged with peanut crop development, the OACV. Funding from the RDO declined, however, as peanut prices in world markets dropped in 1977. The RDO has since been disbanded and the peanut research program now depends entirely on regular budgetary funding from SRCVO.

Since 1977, when the cell was turned over to Malian leadership, a higher-yielding long-cycle variety and several medium-cycle (120 to 135 days) varieties have been identified. Varieties 190-20GH and 28-206 are currently being extended in the west-central regions in Mali. The seed multiplication program which permitted rapid extension of the earlier varieties has, however, been dismantled and none of the new varieties have thus been released.

The Peanut CRSP, particularly the University of Georgia, has been interested in joining in the peanut improvement efforts. Administrative difficulties have delayed final negotiation of an agreement to date, however. The interest is in the area of aflatoxin control in peanuts.

Soybeans: Soybean varieties from IRAT and INTSOY have been screened in Mali since 1979. Not traditionally grown in Mali, several regional development organizations have been considering the introduction of soybeans as a cash crop, and some interest exists in Bamako in establishing a soybean milk plant. Trials have shown that soybeans can be grown, but infrastructure for rhizobium inoculation and seed storage must still be developed. In addition, the interest of rural populations in growing them must be evaluated.

Soil Science:

This cell of SRCVO is responsible for conducting most of the soil fertility work in Mali. Trials conducted at Sotuba, Sikasso, Kita, Kogoni, and Massentola stations have resulted in recommended fertilizer rates for most crops. The response of maize to nitrogen has been charted and considerable work has been done on rice response to nitrogen and phosphorus in the Office du Niger.

Some work has also been done on green manuring and the effect of incorporation of crop residues.

The most ambitious research program that the soil science cell has carried out involves a comparison of the effects of applications of natural rock phosphate, partially acidulated rock phosphate, and the soluble commercial phosphates. Begun in 1982 with the collaboration of the International Fertilizer Development Center (IFDC), this program already has demonstrated that rock phosphate, applied directly to the field, is the most cost-effective way to address Mali's well-documented phosphorus deficiencies.

A sub-section of this cell does soil surveys in selected regions of the country. The soil analysis laboratory handles up to 1,000 samples a year, but this number is far below the expressed needs of the various research organizations which rely on the lab's services. The laboratory personnel are competent, but the lab itself is chronically short of chemicals, glassware, and light instrumentation.

The TropSoils CRSP has shown some interest in collaborating with Malian soil scientists on the process of crust formation -- compactness in tropical soils. An agreement was signed in March, 1984, and work will begin in June.

Cultural Practices:

This cell carries out most of its experimentation in Samanko (the PAR just outside of Bamako) and in Koporo (the PAR in the Fifth Region). It is responsible for the "rates and dates" agronomy research. It conducts trials on optimum spacings, dates of planting, soil preparation, fertilization, herbicide use, and rotations.

Until 1980, this cell was headed by an expatriate researcher. It is now financed entirely from the SRCVO budget and lacks both the human and financial resources to carry out its research charge. It cannot address all the agronomic problems presented by other divisions of DRA or regional development organization's extension services. As a result, many of the other divisions and sections of the DRA, such as plant improvement, have undertaken much of their own agronomy work.

Plant Protection:

This cell includes entomologists, pathologists, and weed scientists. The most important contribution of this cell to date has been the preparation of a comprehensive list of pests that attack Malian food crops. Currently, the cell's researchers are assessing the economic damage caused by these pests in order to establish priorities for its research program.

An IRAT researcher headed the cell until 1979, when a Malian entomologist took charge. The CILSS Integrated Pest Management project, funded by USAID with technical assistance being supplied by FAO, is an important activity of this cell. The IPM project also provided new facilities, equipment, vehicles, and operating expenses. This IPM Project now involves two Malian entomologists, two expatriate plant pathologists, and one FAO integrated pest management specialist. Compared with other cells in SRCVO, the Plant Protection Cell is well endowed with personnel and the means to carry out good research.

There is scope for future collaboration between this unit and others in SRCVO. There is now limited interaction, for example, between the IPM researchers working on sorghum head beetle (ragnuya) in this unit and those in the Plant Improvement Cell working on the same problem pest.

Multilocational Testing:

At one time a separate section of the DRA headed by the present Director of DRSPR, the multilocational testing function is now part of the SRCVO. The cell is reponsible for the conduct of two types of trials or tests:

1. in semi-controlled conditions, at PEPs located at schools or training centers; and
2. in farmers' fields, generally conducted with the cooperation of extension agents from regional development organizations.

Lack of resources for conducting the on-farm trials led to a request to the OAU/STRC SAFGRAD project (funded by AID) and the establishment of the present on-farm trial program.

Since 1979, SAFGRAD project assistance has been used to carry out on-farm trials on the use of rock phosphate as a fertilizer, maize-cowpea intercropping, and sorghum varieties. The program has been carried out in close collaboration with the RDOs' extension agents and findings have been interesting, particularly with regard to the beneficial effects of rock phosphate on cereal production.

DRSPR: Farming Systems Research

The concept of farming systems research (FSR) was introduced relatively early into the Malian national agricultural research system. In May, 1975, the National Committee for Agricultural Research recommended that a colloquium on FSR should be organized to study ways and means of better directing existing research towards development goals. Such a colloquium was organized in November, 1976, and, as a result, IER was requested to pursue the elaboration of a farming systems research program with the appropriate institutions, including donors. In 1977, a socio-economic studies program was begin in Fonsebougou, a vil-

140

lage outside of Sikasso, with Dutch support (the Royal Institute for Tropical Research (IRRT)).

In late 1977, a team of eminent expatriate and national researchers spent several months designing a larger Farming Systems Research project for the Mali-Sud Region (in which Sikasso is located and where the CMDT is the active regional development organization). Three donor agencies agreed to finance this project, with the major funding and all technical assistance coming from Canada through the IDRC. AID and the Ford Foundation also made limited financial contributions to operating costs and training, respectively.

The Government of Mali then created the Farming Systems Research Division (DRSPR) within IER in 1979 and brought both Dutch and three-donor projects under the Division. DRSPR was given three objectives:

1. Adaptation of research to the objectives of integrated rural development by application of multidisciplinary research; improvement of existing research efficiency by taking into account real production environment constraints, and, keeping different agro-climatic zones in mind, distinguishing among farm families with different means and objectives.

2. Development of an appropriate methodology for study of the production environment.

3. Training a national staff in multidisciplinary research and farming systems research.

The new Division's headquarters was established in Sikasso and FSR field work went forward on three fronts:

1. in and around the village of Fonsebougou, with Dutch technical assistance and financing;

2. in the area between Sikasso and Bougouni -- called the Sikasso-Bougouni "axis" -- with IDRC-supplied technical assistance and financing from AID, Ford, and IDRC; and

3. on the Tierouala research station.

The Fonsebougou and Sikasso-Bougouni efforts were somewhat autonomous, with the Director of DRSPR being more directly involved in the leadership and management of the Sikasso-Bougouni work. The Tierouala station had been transferred from DRA management to DRSPR management in order to establish an "upstream" farming systems research site -- a place to work out potential trials before going to the farmers' fields. Only one middle-level professional was assigned full-time to Tierouala. Therefore, members of both the Sikasso-Bougouni and Fonsebougou teams contributed to designing and managing the on-station trials as well as conducting village-level research.

At the present time, DRSPR has 13 professional Malians and 6 expatriates on its staff. These researchers are supported by about 50 support personnel employed full-time by IER/DRSPR. All professional staff live in Sikasso and work out of offices there. The Director is, however, required to spend considerable amounts of time travelling to and from Bamako on administrative matters and in consultation with IER management. Some enumerators are resident full-time in villages participating in the FSR program. Because the heart of the farming systems research program is in the villages, the DRSPR has a greater-than-average endowment of vehicles.

DRSPR has also gradually increased the degree of collaboration with the CMDT, working with extension agents in villages and jointly managing pilot credit programs or other pilot interventions requiring outside resources beyond the budgetary capacity of DRSPR.

The methodology used by the DRSPR to conduct farming systems research has not been set in concrete. Rather, a fairly broad range of survey and experimental techniques, which are still evolving, have been applied. The Fonsebougou team has worked more with smaller groups of farmers or individual farmers in a case study approach than has the Sikasso-Bougouni team. The selection of villages for more intensive involvement has been made gradually over the years, applying different criteria at different times. The Sikasso-Bougouni effort began more conventionally and perhaps more systematically with a general descriptive survey of the entire Mali-Sud zone and the selection of four representative sectors. After several more rounds of selection, three villages, which represented three different levels of technological development in the region, were retained for more intensive studies:

1. Gladie, in which more than 90 percent of the farmers owned and used animal traction;

2. Monzonbougou, in which 50 to 60 percent of the farmers used animal traction; and

3. Sakoro, where less than ten percent of farmers were equipped with or used animal traction.

At the end of 1979, a complete enumeration of the three villages' households was made to serve as the basis for the selection of ten case-study households in each village. Intensive studies were made of these families in 1980 as the first step in establishing a farm family typology (grille). This typology was subsequently refined to include four variables: size of labor force, ownership of animal traction, success in cotton production, and degree of food self-sufficiency attained.

The case studies also led to the identification of production constraints. Possible solutions to these constraints were first tested in farmers' fields in 1981.

The 1982 and 1983 DRSPR programs illustrate the breadth of research topics addressed by the Division and indicate some of the directions which might be expected to receive more emphasis in the future.

In 1982

1. In its Sikasso-Bougouni program, DRSPR focussed on refinement and application of a typology of farming households (unites de production), on a series of farmer-managed trials, and a number of thematic inquiries (prices, farmer views on rainfed rice, use of the ox-drawn cart) as well as carrying out several training programs and technology demonstrations. The farmer-managed trials included tests on urea application to a maize-millet intercrop, herbicide on a maize-millet intercrop and on upland rice, manure on sole crop maize, plowing and seeding in rows for sorghum and millet, use of fertilizer on cowpeas for forage in association with sorghum and on cowpeas grown in pure stands.

2. In its Fonsebougou program, the team selected two new villages for future work and completed baseline description surveys, continued to apply and test the "management advice" approach developed in previous years, carried out several farm-level trials, and continued long-term monitoring of its case study households.

3. At Tierouala station, DRSPR researchers conducted six researcher-managed trials: on a four-year crop rotation system, on three kinds of intercropping patterns, on rainfed rice, and on finger millet. In addition, several observation plots were maintained for forage crops and some cowpea seed was multiplied.

In 1983

1. In its Sikasso-Bougouni program, the DRSPR examined the representativity of one of its original study villages (Sakoro) by completing a rapid survey in 14 other villages in the ZER in which Sakoro is located. They concluded that Sakoro was indeed similar to many other villages (and, therefore, representative) but noted also some significant differences -- for example, in the availability of land for irrigated rice, in incidence of onchocerciasis (which had a significant impact on the demographic composition of the villages), and with regard to the cultivation of maize. In addition, the series of on-farm trials in the three study villages (Gladie, Monzonbougou, and Sakoro) was continued, focussing on forage cultivation, on various rotations and intercrops, and on maize production. The latter test was made in collaboration with CMDT.

2. In its Fonsebougou program, DRSPR launched a program of "pre-extension" in the two new villages selected in 1982. By applying a method of "target grouping" which grew out of earlier work with farmer typologies, the DRSPR team, in collaboration with the National Agricultural Development Bank (BNDA) and CMDT, tested three separate interventions with each of three groups: (1) supplementary feeding of draft animals in order to facilitate intensification of maize or cotton production among those already equipped with animal traction and having enough household labor, but not having a particularly good record of yields; (2) a credit program for the acquisition of draft animals among those households which had some animal traction equipment but lacked oxen; and (3) the use of animal manure for intensification of maize or cotton production among those without traction equipment. The Fonsebougou team also experimented with a group-farming approach with three womens' groups in Yaban, attempted to extend the "management advice" approach to working with a group of farmers in Kaniko (all previous advice had been on an individual basis), and drew together many of the results from a multi-year analysis of five animal herds owned by sedentary farmers in the Fonsebougou area. The on-farm trials conducted in the Fonsebougou program dealt with more effective use of animal traction equipment (for transport and plowing) and with the improvement of fallow lands by the planting of forage crops.

3. The Tierouala station work continued the rotation system experiment and the work on three intercrops. An experiment with plowing on different types of animal traction equipment was carried out in collaboration with the Division of Agricultural Engineering (DMA). Observations of forage crops were continued.

Since a 1980 evaluation, which drew attention to problems of small sample sizes and the generation of an unanalyzable quantity of data, there have been successful efforts to concentrate surveys and trial interventions a bit more and to increase the numbers of farmers participating (boosting sample sizes). Staffing has continued to be thin, however, as the Malian researchers recruited for DRSPR have gone off to France for further academic training. The publication of results outside of the annual reports to the Technical Commission of IER for Farming Systems Research has been minimal.

IDRC funding is likely to expire by 1985 or 1986; Dutch funding, however, appears to be likely to be continued for several more years. CMDT collaboration has grown continuously, and, while CMDT does not directly grant research funds to DRSPR, has demonstrated a willingness to work closely with DRSPR on experiments and inquiries which touch closely on areas which concern the RDOs -- particularly the increased production of cotton and maize and the effective use of the purchased inputs which the CMDT supplies on credit.

INRZFH: The Livestock Research Program

While INRZFH manages a variety of research programs (see above), its portfolio includes one which bears a close relationship to the farming systems research of DRSPR and may, therefore, be worth mentioning in some detail. Under the Mali Livestock II Project financed by AID, a research component has been designed to address three important constraints to livestock production in Mali: lack of adequate linkages between animal research efforts and farmer/herder clients; inadequate linkages between livestock and crop production research efforts; and inadequate understanding of the role of animals in farming systems. The research approach proposed thus consists of a "production systems approach": (a) initial problem analysis; (b) formulation and testing of interventions; (c) studies of existing systems; (d) experimentation; and (e) complementary studies. ILCA is providing technical assistance (a forage agronomist and livestock economist) and will focus the work in Region IV.

B.3 Strengths and Weaknesses of the National Agricultural Research System

The strengths and weaknesses of Mali's national agricultural research system can be addressed from three vantage points:

a. Institution-building (organization, staffing, financing);
b. Scientific results; and
c. Farm-level impact.

Institution-Building

Organization: Mali has, since Independence, developed a research organization which includes a network of research stations and sub-stations covering the major agroclimatic zones and a large cadre of dedicated staff. The three organizations reponsible for agricultural research (IER, INRFZH, and DMA) are capably directed by Malian professionals and recognized to be important components of the national agricultural system. All are committed to an emphasis on applied research. The research organizations are expected to relate to the regional development organizations charged with providing extension services to farmers as well as the agricultural training institutions. There are a number of committees and commissions which ensure that such coordination and communication regularly take place.

The effectiveness of the agricultural research organizations is, however, affected by the fact that crop research (under IER) and forestry and livestock research (under INRFZH) are not located in the same Ministry. DMA's separate status complicates the organizational picture further. This makes research on agroforestry, soil and water management, and animal traction issues organizationally complex and difficult to coordinate.

Staffing: It has already been noted that Mali has succeeded in

recruiting a large number of dedicated staff. For the most part, those at middle and junior levels are well-trained and present in sufficient numbers. The real weakness in the system, however, is at the senior level. Currently, only seven senior level staff of IER have graduate level training (M.S. or more) and some of these have full or partial administrative responsibilities. Only ten staff members are now out on long-term training at the graduate level, so the possibilities for rapid expansion and improvements in research are limited. Further, most of the middle and senior level researchers are relatively young and inexperienced. Experience will, however, grow naturally as long as they stay in the system. Institutional development is, therefore, likely to be a 20-year process.

But there are few incentives for researchers to stay in the system and to excel. Salaries are extremely low. Senior professionals earn about $400 per month as base salaries, while middle and junior-level professionals average around $250 and $150, respectively. Opportunities for professional development and growth (in-service training, participation in seminars and conferences, access to the latest information) are limited. Opportunities to publish research results for an audience of peers are non-existent in Mali.

Experience with international projects (such as the ICRISAT/Mali and SAFGRAD/Mali projects) has shown that the performance of Malian researchers greatly improves when professional development opportunities are provided -- along with incentives to supplement the meagre salaries.

Financing: The Government of Mali does not now apparently have the independent resources which would enable it to increase substantially its financial committments to its agricultural research organizations. Most research stations are ill-equipped in terms of land development, offices, housing, and laboratory space. Operating expenses for purchasing research inputs and supplies are minimal and funds for field travel are nonexistent, except for Malian and expatriate researchers working on projects with external funding.

The Financial Commission of the National Agricultural Research Committee, at its meeting of March, 1984, addressed some of the funding problems encountered by DRA and DRSPR. These involved a 1.5 percent drop (in nominal terms) in total funds available between 1982 and 1983 and delays in receiving those amounts actually budgeted. The report prepared for the committee specified the numbers involved; they are summarized here in millions of francs Malien in Tables 1 and 2. Table 1 shows that DRA's budget difficulties were more severe than those faced by DRSPR. While the national DSRPR budget contribution dropped by six percent, external financing more than doubled, for a net increase in the DRSPR budget of 133 percent. The 13 percent decline in the DRA budget was the result of drops in both national and external funding.

Table 1. Summary of DRA and DRSPR Budgets by Source of Financing, 1981 - 1983

(millions of francs Maliens, MF)

Division/Source of Funds	1981	1982	1983
DRA: National budget	878.6	846.5	834.0
External funding*	708.1	975.1	742.2
DRA Total	1586.7	1821.6	1576.2
DRSPR: Nat'l budget	29.0	45.6	42.7
External funding*	136.1	114.6	337.1
DRSPR Total	165.1	162.7	379.8
DRA and DRSPR Total	1751.8	1984.3	1956.0

SOURCE: Comite National de la Recherche Agronomique, 23e Session, Bamako, 24-27 Avril, 1984, Rapport de la Commission Financiere, p. 11.

*Does not include externally-financed technical assistance.

Table 2 presents the figures for 1983 broken down according to the use made of the amounts received. It shows that roughly 60 percent of the Government of Mali's contributions go to pay salaries, while less than 12 percent of donor contributions go to this purpose. (Footnote: Although it should be noted that donors do not report in their budgets salaries paid in foreign currency accounts abroad to the technical assistance.) Donor contributions, however, provide the bulk of operating funds (more than twice as much as the national budget in DRA and over 20 times the national contribution to the DRSPR) and, for DRSPR, all of the capital investment financing. Overall, then, 40 percent of DRA and DRSPR budgets taken together goes for staff salaries, another 40 percent goes for the operating costs of research undertaken by this staff, and the annual investment in buildings and equipment is less than 20 percent of the budget.

Table 2. DRA and DRSPR Budgets by Expenditure Category and Source of Financing, 1983 only

(millions of MF)

Division/ Category of Expenditure	National Budget	External Funds	Total
DRA: Salaries			
- Permanent staff	402.2	--	402.2
- Temporary staff	84.0	212.2	296.1
Operating Costs	172.0	426.1	598.1
Equipment, Buildings	175.0	104.0	278.9
DRA Total	834.0	742.2	1576.2
DRSPR: Salaries	37.7	36.6	74.3
Operating Costs	5.0	107.7	112.7
Equipment, Buildings	--	75.8	75.8
Unclassified expenses	--	117.0	117.0
DRSPR Total	42.7	337.1	779.8
DRA and DRSPR TOTAL	876.9	1079.3	1956.0

SOURCE: Comite National de la Recherche Agronomique, 23e Session, Bamako, 24 - 27 Avril 1984, Rapport de la Commission Financiere, pp. 7 and 9.

One small item has been left out of this budget discussion. Some small amounts of money are earned by IER from the sale of commodities produced under experimental conditions. The amount is, however, negligible, accounting for less than one percent of total system funding in 1982, for example.

Scientific Results

A major strength of the Malian agricultural research system lies in its ability to design and carry out a large number of experiments on a number of stations with its limited budget. Designs are generally sound and the quality of management of on-station trials is good. Further, in spite of the hierarchical

nature of research organization and the split of research efforts under different Ministries, there is evidence of useful interaction and experimental collaboration between research units within and outside of IER. Despite the long distance between Sotuba and Sikasso, DRSPR has also managed to develop and sustain collaborative research efforts with researchers from DRA and other units. Some examples of this coooperation are:

-- DRSPR/SRCVO collaboration on NPK trials in villages in the Sikasso-Bougouni area;

-- DMA/DSRPR work on the design and introduction of ox-carts and animal traction equipment which can be drawn by one ox rather than the more usual pair;

-- INRZFH/DRSPR design and conduct of on-farm livestock management interventions; and

-- DRSPR/Central Veterinary Lab cooperation on animal disease treatment experiments.

A number of both on- and off-station experiments are also proposed by regional and international institutions, such as CILSS, OAU/SAFGRAD, IITA, and ICRISAT, and are executed and supervised by the national research staff. Protocols and the types of data to be collected are specified by the proposing institutions. Partly because these experimental proposals are also accompanied by funding to carry them out, up to one-third of all trials conducted are from these sources.

The weaknesses of the Malian experimental programs for developing and testing new agricultural technologies are concerned with:

a. the analysis and evaluation of experimental data;

b. the validity of results for all of Mali's many agro-climatic zones; and

c. the relationship of the experimental conditions and objectives to farmers' conditions and objectives.

<u>The analysis and evaluation of experimental results</u> suffers from time constraints, the nature of the international agreements, and a lack of sufficient in-country analytical capability. Harvest data are generally not in hand until the end of the calendar year, but results must be tabulated, summarized, and printed for presentation at the IER Technical Commissions by March. While the Technical Commissions are important mechanisms for review and communication of research results and for programming of the next year's research, time is a real constraint to detailed analysis, especially given the low level of data handling equipment available in IER. On the international experiments, data collection requirements are often very high -- as many as 15 variables per trial. Frequently, however, only the biological yield data are analyzed in Mali, unless the international organization has an in-country team (which is the case with ICRISAT, for example).

While the other data are sent back to the proposing institution for further analysis, these results may not be published until some time later -- and then often only in publications with limited circulation. The analytical capability constraint stems from the paucity of senior staff with graduate level training already discussed above. While middle and junior level staff have been shown to be competent managers of experimental trials, not all of them have the training to be as competent analysts of the results. Most experiments carried out at regional stations have been designed by researchers at the central station and are replications of trials conducted elsewhere. Results thus must be examined by a small number of senior researchers -- many of whom have had limited opportunities for field observation during the growing season (due to the travel budget constraints already noted) and who also face the time constraints already noted.

The validity of experimental results in agro-climatic zones or on soil conditions other than those which are found on the research station is another problem encountered in the experimental program. Mali has a wide range of climate and soil types and, while the network of regional stations and sub-stations is fairly widely dispersed, not all of the possible soil, temperature, and rain combinations are found on these sites. Recommendations based on station trials thus need verification work off-station to establish their validity. To increase the quality of experiemental results and to ensure their validity elsewhere, efforts to more carefully control for agro-climatic conditions in all experimental design and analysis are needed.

This is especially true if the third weakness of the scientific research efforts -- the relationship of the experimental conditions and objectives to farmers' conditions and objectives -- is to be overcome. With a few exceptions, the scientific experiments conducted now are not based on a systematic analysis of farmers' problems or goals. The classic example of monocropping vs. multiple cropping can be given. Researchers' trials have, until recently, virtually all been conducted under conditions of sole cropping. Yet the majority of farmers in many areas practice intercropping and little advice as to which crops do better in this situation is available.

DRSPR, of course, has been most directly involved in trying to overcome this gap between on-station experimentation and on-farm requirements. Indeed, the Division's efforts to date have highlighted both the nature and the extent of this gap.

To date, the methodology developed by the DRSPR to delineate appropriate groups of farmers (recommendation domains) needs to be refined. The household typology developed in the Sikasso-Bougouni work has been interesting in a descriptive sense, but has not proven to be as analytically or programmatically useful as intended. The gradual evolution of the management advice approach and the more rough-and-ready articulation of a "target group" approach in the Fonsebougou work seem more promising as

methods leading to action-research. Some thought could be given perhaps to modifying or merging the good points of the two techniques. There may also be a need to reflect again on the issue of village selection. While the initial selection of villages was essential to providing the DRSPR teams a grounding in the farming life of the area, it has been suggested that working too long with farmers in one villages reduces significantly the replicability of results achieved in that village.

The on-farm trials program conducted under the SAFGRAD/Mali project has been another mechanism which has begun to address this problem. This multilocational trials program does take farmers' soil and rainfall conditions into account as all the trials are conducted on their fields, with their labor and animal traction inputs. The trials actually laid out (over 280 in the 1983 growing season) are based on technologies which have seemed useful to station-based researchers: promising seed varieties, fertility- increasing inputs, and cultural practices. While this approach provides valuable feedback to on-station researchers about the performance of technologies under variable soil and water conditions encountered off-station, they may or may not be responsive to most farmers' constraints.

Farm-Level Impact

The farm-level impact of the national agricultural research effort can be seen in: the use of improved varieties, the use of improved cultural practices, and farm-level incomes. It is difficult, however, to attribute such effects to research alone. Input supply mechanisms, extension advisory services, and the general price structure also have significant effects on farm production and productivity.

It is the general consensus that the crop and livestock research efforts in Mali to date have succeeded in developing technologies which are suited to farmer adoption in:

-- cotton production: varieties, fertilizer recommendations, and animal traction cultivation methods;

-- groundnuts: varieties for the higher-rainfall zones;

-- maize: an improved variety, Tiemantie;

-- rainfed rice: an improved variety, Dourado Precoce;

-- a rotation (cotton followed by maize or sorghum, which, in higher rainfall zones, enables the grain to benefit from residual fertilizer applied during cotton production);

-- supplemental nutrition recommendations which enable herders to increase herd productivity; and

-- drugs for trypanosomiasis prophylaxis.

No comprehensive quantitative assessment has been done to determine the rate of adoption of each of these technologies, but some indicative figures are available.

The most striking of these figures come from the cotton and maize interventions in the CMDT zone. In the past, CMDT has contributed about 70 percent of the total operating costs of the N'Tarla station; as of 1984, CMDT will take responsibility for all operational expenses. Technical assistance from the IRCT as well as staff from IER will continue to conduct trials on cotton -- selecting for yield and disease resistance -- as well as maize (mostly varietal selection). The presently recommended cotton variety, B-163, was released in 1976 and total production in Mali increased in the following years. Hectarage planted in 1976 was over 100,000 hectares for the first time and average yields have stayed over a ton per hectare ever since. N'Tarla researchers have also used this variety as a parent to the two other improved varieties which have been released to maintain the relatively good yields achieved in the zone.

By placing emphasis on planting maize as a sole crop after cotton, and by providing good seed stocks of the improved local variety, Tiemantie, the CMDT program has also had an impact on production of this grain. Hectarage planted to this improved maize has grown from 10,000 ha. in 1977 to 27,000 ha. in 1982. Over half of this area is grown with intensive cultivation methods (i.e.,planted sole with chemical fertilizer). Yields of up to three tons/ha have been reported by farmers using intensive cultivation methods and animal traction.

Under the Second Mali-Sud Development project (1984-1990), 13.3 percent of project resources have been targeted for agricultural research.

C. Agricultural Production in Regions II, III, and V

Because this project will focus on expansion of farming systems research in these three regions, a slightly more detailed description of each of these zones is given to establish the agricultural context within which this project will work. The information on the CMDT (Region III) is taken from both CMDT and DRSPR research reports, as well as the 1983 World Bank appraisal report for the Mali-Sud Rural Development project. The information about the area covered by the Operation Haute Vallee (OHV) is largely drawn from an analysis done by BECIS, a private Malian consulting firm which carried out extensive and intensive surveys of farming households in Region II in 1981 and 1982 under a contract with AID. Information on Region V is from various appraisal reports prepared by the World Bank.

CMDT, the Malian Textile Development Company, Region III

Generally recognized to be the most agriculturally-productive region in Mali, the CMDT zone includes about 1.5 million people, working in an estimated 100,000 farming households (or about 20 percent of the total in Mali). There are four ethnic groups in the area: Bambaras and Bobos in the north, and Senufos and Miniankas in the south. Rural outmigration is fairly high, with households, on average, reporting 20 percent of their members living elsewhere.

The climate in the zone is characterized by a distinct rainy season, May through October, with average rainfall about 800 mm in the north and 1500 mm in the extreme south. Temperatures vary between 26 and 31 degrees Celsius. Arable lands consist of light sandy loams and loamy sands, suitable for rainfed cotton, coarse grains, cowpeas, and groundnuts. Hydromorphic clays are found on a limited scale in bottomlands (bas fonds) making them suitable for rice cultivation. An average family of twelve members, with 3 to 4 adult men, cultivates approximately 4.6 hectares, of which 1.5 hectares are planted to cotton and the rest are devoted to sorghum, millet, maize, and cowpeas.

The area in cotton has grown steadily since the early 1960's, with a dip during the Sahelian drought years (1972-73). The maximum hectarage was 119,000 ha. in 1979. While yields have been stable over the last seven years at an average of 1.1 tons/hectare, both the hectarage planted and the number of farmers growing cotton have declined since 1979. Part of this decrease was due to low rainfall in 1980 and a late onset of the rains in 1981. Also having an effect, however, were economic factors. In 1980, fertilizer subsidies were reduced and the farmgate price for seed cotton remained the same. Farmers' net revenues per hectare were thus reduced by 30 percent. In 1981, prices were increased by 13 percent, but only after a further reduction in input price subsidies had been announced. Between 1979 and 1981, therefore, farmers found the amount of cash they were expected to invest in each hectare of cotton rising by 45 percent and net revenues declining to the level experienced in the worst drought year, 1972. The second Mali-Sud development project involves measures intended to turn this situation around and get production back up.

CMDT is responsible for the development of cereal crops as well as for cotton. Maize, sorghum, and millet production have been promoted as part of a rotation with cotton, to take advantage of the residual fertility resulting from fertilizing cotton in the previous growing season. In six years, 1975 - 1980, the area under improved cereals (that is, using improved seeds distributed by CMDT, often on land previously cultivated in cotton) quadrupled. Maize production increased tenfold and maize yields now average over two tons per hectare on farms using CDMT recommendations. CMDT itself develops and multiplies improved cotton seed on the N'Tarla station and operates two maize seed

153

production centers at Sougoula and Dalabani. In the second phase of the Mali Sud project, improved sorghum, millet, and cowpea seed are also expected to be produced by the CMDT.

Out of the 100,000 farms in the zone, it is estimated that 86 percent are reached by CMDT's extension service. In the 1979 peak production year, 20,000 tons of cotton fertilizer (14-23-14), 3,500 tons of urea, and 1,100,000 liters of insecticides were distributed to the farmers. This volume represents over two-thirds of total fertilizer and chemical use in Mali. Credit for animal traction has also been a major part of the CMDT program. More than 50 percent of the farming households are equipped for oxen traction, in part due to cash purchases made with remittances from family members working elsewhere, but also in part due to the credit extended by the CMDT. The CMDT credit program has one of the most enviable credit repayment records; the reimbursement rate for short-term credit has never been below 95 percent and medium term credit repayment rates are about 92 percent. Cotton marketing, however, is a monopoly controlled by CMDT and repayment is ensured by deductions from marketed amounts.

The CMDT has also helped to establish and maintain a 3,000 km. network of rural feeder roads in the zone in order to facilitate its marketing operations. Although many of these roads have not always been well-maintained, in general, this has meant that farmers in this zone are among the better-served by transportation services.

OHV, Operation Haute Vallee, Region II

Perhaps the second most productive region in Mali, the area covered by OHV includes an estimated 477,000 rural dwellers, living in about 940 villages and hamlets and working in about 30,000 household production units. The average household includes about 15 people, with about half of them considered economically active. Ethnic groups represented are: Malinke in the southern and western portions, Bambara everywhere else. In addition, there are some Sarakolle as well as Bambara farmers in the northernmost sector. Migration to neighboring countries and to Bamako for work is common. Just over ten percent of the family members were reported to be away on "exode." Most of these were young men.

The climate in the zone is similar to that of Region III, with average annual rainfall ranging from about 700 mm in the north to about 1100 mm in the south -- with a good deal of inter-annual variation. Arable lands are generally sandy loams or loamy sands with several areas of hydromorphic clays suited to rice cultivation along the courses of rivers or streams. In addition, there are wide bands of allivial soils along either side of the Niger River, the most dominant natural feature in the zone. 320 km of the river's length pass through the center of the region, and a third of the total cultivable area is estimated to include alluvial soils.

An average household cultivates almost six hectares, planting about 60 percent of the area to sorghum, millet, and maize, 22 percent to groundnuts, and about 7 percent each to cotton and rice. The averages are somewhat misleading, however. Cotton production is concentrated in the southern part of the zone, with higher rainfall and formerly part of the CMDT region. Sorghum is also more common in the south, while millet becomes more important in the north and west areas. Overall, farmers in the region cultivate over 131,000 hectares of rainfed crops and about 4,000 hectares of irrigated rice. Use of animal traction is variable. Very few farmers in the northern and western zones have animal traction equipment; the majority in the southern and central portions of the region do.

The diversity of natural conditions in the OHV zone is considerable and there is evidence of significant production potential -- an on-farm trial conducted by the SAFGRAD team in 1980, for example, yielded 7.8 tons of sorghum per hectare. But recent production history has not been so positive. Cotton production has fallen in recent years, due to rises in the costs of inputs which were not matched by increases in farmgate prices. Groundnut production has declined -- again, due to declining profitability associated with a fall in the world market price and loss of export opportunities. It is estimated that 1982 yields of sorghum and millet were only two-thirds of the previous year's level, largely due to shortfalls in rain, and are expected to be even lower in 1983.

The 1983 decrease is attributed to a number of factors. Again, there was drought in the north and a late start to the rain in the south; a short cessation of rain during August caught most of the zone's maize in full flower and reduced yields dramatically; there was also a shortage of inputs, compounded by a shortage of credit. A slight increase in the official cotton price was announced in May, 1983, and created a strong demand for cotton seed, fertilizer, and insecticide which the Operation management was unable to meet -- due to a shortage of credit. CMDT, which has in the past assisted its sister regional development organization to meet its requirements, would not, in 1983, do so and, in addition, claimed payment for previous debts.

All of these elements led to a critical financial situation for the OHV management. Existing fertilizer stocks were quickly claimed by the region's farmers. Additional cotton fertilizer arrived too late to be as economically useful as it should have been. OHV, which derives the majority of its operating expenses from handling cotton sales, is thus facing a situation of low cotton yields, continuing debts, and a growth in uncovered operating costs. It also indicates that the farmers in the OHV area will likely realize considerably lower incomes from 1983 production than they expected -- and needed.

OHV has, however, begun to make some changes which have promise for the future. Staff improvement has continued with the return

of four young managers from graduate training in the U.S. During 1983, there have been some good experiments with the use of a different, more farmer-oriented approach to extension. The expatriate credit advisor, part of the five-person technical assistance team provided under the 1979 - 1984 AID assistance project, has succeeded in obtaining over 90 percent repayment on old input loans --- thus increasing the debt capacity of both agency and farmers again. These improvements in OHV management make the proposed farming systems research/extension activities in the zone both feasible and potentially productive.

Region V

The Fifth Region is an agroecologically diverse zone, including the seasonally-inundated inland delta of the Niger River, the world-famous Bandiagara plateau, and the broad Seno-Gondo plain which stretches from the Bandiagara cliffs to the border of Upper Volta. It spreads over 29,000 square kilometers and includes a population of 1.27 million people. Average annual rainfall ranges from 500 mm to 700 mmm, and the rainy season occurs from June to September. Soils vary from light sandy soils to sandy-loams, and there are pockets of heavier clay soils throughout the region.

Two distinct crop production systems, each of which is integrated with a livestock production system, are practiced. In the Seno-Gondo and Bandiagara plateau areas, farmers put their principal efforts into millet production. In the Delta, the emphasis is on rice and livestock. There is also an important fishing industry -- involving an ethnic group called the Bozo-- in and around the Mopti area.

According to various estimates, the Fifth Region ranks first in millet production, accounting for 30 percent of the amount grown in Mali. In 1981, millet was planted on 243,000 hectares and yielded 143,000 tons. Of the 200,000 hectares of rice cultivated in Mali, about half is grown in this region. It is cultivated under semi-controlled flooding conditions and yields remain low (about 700 kg/ha on average) in spite of efforts to improve both flood control and yields. Gross paddy production has in fact declined from the 237,000 ton level of 1976 to about 122,000 tons in 1983, partly because of recent rainfall deficits in the Niger River's watershed and consequent low levels of flooding. In livestock production, the Fifth Region ranks first in terms of cattle production (27 percent of Mali's 6.7 million-head cattle herd) and second in terms of small ruminants (20 percent of the country's goat and sheep population of 12.4 million).

In recognition of the vital role the region plays in Mali's food production, the Government of Mali has located three regional development organizations in Region V: OMM -- Operation Mil-Mopti charged with millet development and extension activities in the Seno-Gondo and Bandiagara area; ORM -- Operation Riz-Mopti, which works with rice production systems in the Delta area; and

156

ODEM -- the Mopti Livestock Development Operation, emphasizing animal and pasture improvement throughout the region.

Operation Mil-Mopti (OMM) was created in May, 1972, to promote millet production in the region. The area covered by OMM included 1422 villages with a population of 947,000 of which about 60 percent were classified as economically active. Activities of the OMM were financed by AID in two phases. Phase I (1976-79) emphasized agricultural production and rural infrastructure (wells and rural roads). Phase II (1979-83) was cast in the integrated rural development model and included: agricultural production; applied research; rural roads; training of village blacksmiths; functional literacy; and training of extension personnel.

OMM was successful in distributing substantial quantities of animal traction equipment, seed treatment packets, and fertilizer. Yields on average rose by 15 percent, from 502 kg/ha in 1979 to 586 kg/ha in 1981. Available data, though spotty, indicates the existence of significant potential for further increases in millet yields in the region. Pilot farmers with animal traction, who also used small amounts of fertilizer, recorded maximum yields of 1392 kg/ha. Similarly, households only equipped with tillage equipment showed higher average yields per hectare, increased rates of return to labor, and increases in cropped area. Much remains to be done to realize these kinds of results on a broader basis, however. The slow rate of adoption of mechanical seeders and cultivators may indicate that the equipment needs to be modified to better fit local conditions. Low consumption of fertilizer may indicate problems in the economics of use and/or in availability. Other means of improving soil fertility have not yet been examined in comparison to fertilizer application (e.g., better integration of cropping and livestock activities). Soil erosion due to wind is also a serious problem which affects the survival of newly-emerged seedlings.

While Operation Mil-Mopti has had support from AID in the past, this support was recently terminated for reasons of management in the Operation headquarters. OMM has since made attempts to re-establish itself as a viable organization, however, and has cut back on both activities and staff. It still has significant numbers of extension staff on its payroll, charged with providing extension services to the farming households in the zone. OMM has, over the years, also participated in the on-farm trials carried out by the SAFGRAD project in the region. It has designated a research coordinator who works closely with the Koporo Research Station and the SAFGRAD team.

Operation Riz-Mopti (ORM) has, since 1971, been responsible for the development of the traditional rice cultivation in the region. ORM has received -- and continues to receive -- project support from the World Bank. The first phase involved investments of $9.5 million (from 1971-75); the second phase, from 1978 -84 is estimated to cost $32 million, of which $15 million

is a World Bank loan. The projects were intended to increase paddy production by 34,000 tons per year through the extension or improvement of polders (by construction of dikes and irrigation channels to increase water control), training and extension, input supply and agricultural credit.

Among the key reasons advanced for the projects' not achieving their stated objectives are: lack of rice varieties suited to the varying inundation and rainfall conditions; low yield potential of local varieties (less than a ton/hectare); lack of control measures against insect, rodent, and disease attacks; poor seedbed preparation and sowing techniques; lack of draft oxen and limited equipment for timely preparation of soil and planting; inappropriate and expensive agricultural equipment; low official producer prices and high credit terms; inadequate infrastructure (intermediate dikes and secondary channels) to control the flood level.

ODEM, the Operation pour le Developpement d'Elevage à Mopti, has been responsible for the development of livestock in the region since July, 1975. ODEM is to cover an area of 89,000 square kilometers, about 100,000 herding families, and 1.6 million cattle and 2.3 million small ruminants. ODEM activities have also been supported by the World Bank; the first phase of the ODEM project (1975-1984) is expected to cost about $17.3 million, of which the Bank has provided about 77 percent ($13.3 million). Project activities carried out during the first phase included: establishment of 27 veterinary outposts and 75 vaccination centers; vaccination of about 75 percent of the livestock in the region; sales of veterinary medicines (which grew from an annual level of 6 million MF in 1975 to a level of 45 million MF in 1983); 70 wells (of which 50 percent were successful); development of 50 water holes, of which 20 were along transhumance routes; construction of a slaughter house and hide-drying plant; establishment of 5 livestock marketing centers, one of which, at Fatoma, handled 60,000 animals last year; reseeding of the traditional pastures in the inner delta area; sales of feed concentrates, salt slabs, and paddy straw; training of livestock extension personnel; establishment of a research station (on fodder crops, livestock feed); and functional literacy for herders.

In focussing primarily on livestock production, the project overlooked the possibility of farm-level integration of livetock and cropping activities. The increased size of herds due to improved veterinary services accompanied by a reduction in available grazing land and fodder (due to the development of rice polders under the second phase of the ORM project) contributed to the ecological destabilization of the inner delta. A new project has thus been proposed to correct the problems noted.

The Mopti Area Development Project is scheduled to be implemented from 1985 to 1991, with financing provided largely by the World Bank ($18 million). Drawing on the lessons learned in the two earlier projects with ORM and ODEM, this project will seek to develop the production potential of the inner delta through a range of mutually supportive activities in crop and animal production. The national agricultural development bank (BNDA) and the seed production organization (OPSS) will also be involved with ORM and ODEM. The proposed range of activities will include: hydraulic works to improve flood control; credit for inputs and equipment; support for training and extension activities; livestock water development; animal health; range and pasture management; rehabilitation of the seed farm and rice research; functional literacy; and a broader line of credit from BNDA.

In sum, each of these regional development organizations would provide a collaborative basis for DRSPR work in the Fifth Region. The selection of the RDO with which the expanded DRSPR program will work in the 1989 - 1994 period can probably best be done by the project staff in about 1987-88. A proposal should then be drawn up for IER and AID consideration in mid-1988. This proposal will address the issues of cooperating RDO, location of DRSPR/Region V headquarters, staff requirements and assignments (expatriate staff requirements will need to be met through recruitment), preliminary scope of research for first and second project years in the region, and detailed budget for the regional effort.

II. THE FSR/E PROJECT

A. Summary of Problems to be Addressed

In the previous sections, a number of problems encountered by the farmers, the research system, and the regional development organizations in Mali have been presented and briefly discussed. Farming systems face uncertain weather conditions, a changing market situation for both inputs and products, differing endowments of resources --- land, labor, and capital, and varying access to information about new technologies which might increase productivity. Extension systems --- regional development organizations --- have to come up with ways to provide information and services to a wide range of farmers, cost-efficiently and on time. The national agricultural research system must cope with even greater variability at the farm level in the search for improved technologies --- addressing the problem of mildew on millet for farmers producing it the sandy soils of the Seno Plain in Region V with less than 600 mm of rainfall as well as the problem of increasing the efficiency of animal traction use in areas with heavy soils and over a 1000 mm of rainfall each year, for example.

In addition, the national agricultural research system must address this range of problems with a constrained budget, an undertrained senior staff, and a relatively "late start."

This FSR/E project will not, of course, be able to address all of the relevant problems at all three levels. It will, therefore, focus on two closely-related sets of problems:

1. those which are organizational and involve research, extension, and training organizations; and

2. those which have to do with increasing the impact on production at the farm level.

Strengthening the Research-Extension-Training System

First, all Malian research organizations have constrained budgets. Commodity researchers in IER/DRA are, in principle, responsible for the scientific tasks associated with, for example, the development of new seed varieties, with evaluation of soil fertility requirements, and with the development of cultural techniques which can improve water infiltration, soil aeration, and biological activity. These are all important technologies which should be "on the shelf" as potential elements in a farming systems research program. In fact, however, the "shelf" is somewhat bare and the availability of resources limits inquiry to a selected number of areas. If DRSPR researchers were to suggest that DRA researchers conduct on-station trials or laboratory research on some particular problem, this might force a shift of priorities within the DRA work programs. If DRSPR were to

request DRA assistance in designing and conducting a controlled trial on farmers' fields, this would probably involve not only a shift in priorities, but some means to facilitate regular supervisory trips to the field.

Second, the research system as a whole has insufficient numbers of highly-qualified staff. Building up one link in a chain does not strengthen the whole chain.

Third, there are barriers to communication among researchers, extension personnel, and farmers which even a strengthened DRSPR will not be able to overcome. There are no publications beyond the annual research reports to transfer knowledge from researcher to extension agent, for example, without personal contact. There are few written materials available at the farmers' level, in the farmers' languages, to present new agricultural ideas and advice. There are no curricula and no training programs on what the farming systems approach to research is all about. There have been few contacts with FSR projects elsewhere to keep up to date with what's going on. Another type of communication barrier also exists, one which has to do with the direction of communication. Traditionally, communication in the research-extension system is top - down. Part of the farming systems research emphasis is on bottom-up communication. This may take some training in listening as well as a change in attitude.

Fourth, there has to be joint agreement on objectives and approaches if two or more organizations are to work together. The CMDT-DRSPR agreement in Sikasso has demonstrated the positive value of such an agreement. It clarifies responsibilities. establishes targets for achievement, and promotes a better environment for continuous communication.

Improving the Farm-Level Impact

Improving the organizational context in which research is conducted and results are communicated is one way to raise the probability that research will lead to the development of technologies which will, in fact, increase production. An organizational innovation, however, has been suggested as another way to further raise the probability of positive farm-level impacts. This innovation, the farming systems approach to research and extension, involves farmers and their houserholds directly in the process of research. Thus, farmers' problems are the starting point for the research process and the solution of the farmers' problems is the endpoint.

A by now fairly standard four-step process facilitates identification of farm-level problems and systematically tests alternatives for alleviating them. The four steps are:

--- identify those constraints which are most important at the farm level;

*161

-- propose solutions, drawing on the stock of technological information already available;

-- test these solutions in the selected zones, working with the farmers concerned; and

-- provide the information on those which "work" to the extension services in the form of "extension theme" and feedback information on those which need further research attention to the relevant researchers.

As has already been described at some length above, the Government of Mali has already adopted such an approach to agricultural research and implemented it in one area of the country. The GRM and the national agricultural research institution expect this effort to be effective in improving the overall impact of agricultural research at the farm level. Such an expectation seems justified, on the basis of current experience. An annex to this Technical Analysis also suggests that there are many more production problems which require on-farm as well as on-station research.

Three major limitations have, however, also emerged from experience to date:

1. that of geographical coverage. While important, the CMDT zone still includes only 20 percent of farming households in the country;

2. the quality and organization of the DRSPR/Sikasso efforts has not been as effective as desired; and

3. the relationships between the on-station research and the farming systems research have not been as close or as sustained as desired.

The geographical limitation can obviously be overcome by expanding the staff and increasing the resources of DRSPR. The rate at which this can be done, however, is largely a function of the rate at which trained Malian staff can be employed. The project design implications of this are discussed in more detail below.

Improving the quality and the organization of the DRSPR research effort would seem to require some fairly specific problem-solving. Three areas seem particularly amenable to improvement:

First, <u>field data collection and analysis techniques</u> could be improved to increase both timeliness and quality of results. Data collection, analysis, and reporting have been problemmatic for the DRSPR since the Division's early days. As has been the case in many other farming systems research efforts, too much data was collected at first. It could not be processed in time

and therefore could not be used to define recommendation domains, to indicate priority constraints, or to accomplish any of the other analytical objectives for which it was collected in the first place. The research and survey plans at the annual meetings, therefore, tended to represent the collective impressions -- rather than the statistical analysis -- of the group. The data was stored in the hopes that time would be found later to complete the analyses but this -- again, as in so many cases elsewhere -- proved impossible. Yet without a clear idea of the analyses which should be performed, it was also difficult to better define the types of data which should be collected. Subsequent surveys which also covered too much ground were also conducted.

The prevalent misconception -- that the purchase of a microcomputer would solve all the data problems -- further exacerbated the tendency to continue to collect too much data. In addition to being time-consuming and expensive, the data collection process diverted researchers' attention at times from straightforward observation of what farmers were doing on their own.

The arrival of an Apple computer at DRSPR, financed by IDRC, thus did not solve the problem. Technical and personnel problems persist and the equipment is under-used. No Malian staff have yet been trained to process and analyze the data with the Apple.

Statistical techniques are also in need of improvement. Some of the problems noted to date are: not reporting agronomic trials where the coefficient of variation of yields exceeded 15 percent; conducting too few replications of any one theme where variability is known to be large and differences likely to be small; not maintaining adequate controls; and, as already noted, simply too little analysis.

Further, there seems to be a need to reflect upon -- and possibly to revise -- some of the more general methodological approaches used thus far. As already discussed, there may be a need to rethink both the household typology applications and the criteria for working in villages. Because of the amount of effort which is invested in village level work, the criteria for selecting "new" villages are critically important. They should be based on a clear idea of what objectives are to be achieved and on thorough analysis of initial experiences.

Second, <u>further definition of research and extension responsibilities</u> is required. DRSPR was put in charge of the Tierouala station management with the idea that DRSPR could conduct both upstream and downstream farming systems research. The Tierouala effort has failed to fulfill the expectations. It has consumed an enormous amount of DRSPR administrative time and the time of the expatriate (Dutch and Canandian) agronomists. There has been a tendency to conduct standard agronomy trials of the type

normally conducted by commodity researchers, but which have little relationship to the on-farm testing program or the survey-identified farmer constraints. These Tierouala efforts have, it is felt, detracted from achieving greater effectiveness of other DRSPR efforts and the benefits to date have been negligible.

Another aspect of the responsibility-definition problem is that of drawing the line between the research and extension organizations. When do extension personnel assist in research and when do they carry out their extension duties? Similarly, when are on-farm trials "demonstrations" and thus closer to extension and when are they research trials? These issues have not been clearly resolved by the DRSPR to date although it is clear that a modus vivendi has evolved between DRSPR and CMDT. The definition of respective responsibilities of research and extension will, however, require further attention as farming systems research is extended to other zones, and other collaborative relationships are formed with regional development organizations and with the DRA.

Third, a <u>longer-term research planning process</u> is needed to ensure that annual research activities move consistently toward defined objectives. Several observers have reported that DRSPR is presently weak in the logical process that should characterize the farming systems approach to research (that is, the four step process summarized above-- identification or diagnostic; proposal of solutions; testing of solutions; transfer of solutions to extension services). There has been a lack of hypothesis formulation before diagnostic data collection, followed by superficial data analysis which has led to subjective identification of production constraints. On-farm and on-station research themes have often been based on what is practically possible and bureaucratically acceptable, rather than being based on the analysis of production variation and constraints.

The time element has also been mentioned several times above. There is a need to report on one season's findings and to propose the next season's activities to the Specialized Technical Commission before there has been time to digest the data generated and the observations made. Solving the data processing and analysis constraints will help somewhat; tighter focussing of the farming systems research efforts will also aid in making such a rapid turnaround feasible. But it could be suggested that explicit development of a multi-year research program would also improve the quality of the research effort. It would be possible to prioritize activities better, to smooth out the workflow, and to ensure that the manpower (either Malian or outside expert) for specific research activities is lined up well in advance. DRSPR could also contract out for key "upstream" work and program the on-farm phases accordingly.

This latter point leads directly to the solution of the third limitation to the present farming systems research effort noted

above. By establishing a mutually-interdependent work program, DRSPR, commodity researchers, and other professionals in the national agricultural research system would not only find their knowledge and understanding of each others' research findings improved, but they should also be able to focus their research tasks more tightly around the solution of farmers' problems.

B. Specific Design Considerations

Given this analysis of the complex of problems to be addressed, the project design team faced four major design issues:

-- Concentration of project activities within DRSPR;

-- Rate of farming systems research/extension expansion;

-- Technical assistance requirements; and

-- Appropriate level of funding.

-- Complementarity of on-station and on-farm research efforts.

Each alternative was informally assessed according to four criteria:

-- effect on project's purpose and goal;

-- timing;

-- manageability both by the GRM and AID; and

-- sustainability of action initiated under the project by the GRM.

The Organizational Concentration

Farming systems research/extension is, by its nature, an activity which involves more than one organization. While DRSPR was created as a separate division within the national agricultural research system, it has never been the intent of the Government of Mali that it should operate in isolation from other Divisions in the system. Indeed, the experience to date demonstrates clearly that, while DRSPR has a unique role to play in the research-extension continuum, it can play this role effectively only with the support and collaboration of other researchers in IER, INRZFH, and with the regional development organizations carrying out extension.

By expanding the DRSPR's capability to carry out field research in more agro-climatic zones and with more groups of farmers, the project will place DRSPR in a position to facilitate linkages

between the research and extension systems and to contribute to the effectiveness of commodity research in enhancing production and productivity at the farm level. But a strictly-DRSPR focus will be insufficient because it is the sectoral objective of this project to enhance the ability of the research-extension system to contribute to a real increase in production, productivity, and incomes at the farm level.

It follows that project resources need not -- should not -- be restricted simply to DRSPR. The criterion of effectiveness at the farm level thus dictates that measures should be taken to make farming systems research an effective part of the broader research -extension system.

For these reasons, the following elements were suggested for inclusion in the project:

-- construction of an office complex for DRSPR at the main research station at Sotuba, to make DRSPR more administratively effective, but also to enhance the potential for interaction with fellow researchers;

-- construction of facilities for DRA at the PAR in Koporo to enable on-station research in Region V to be established on a sound footing;

-- training of research, training, and extension personnel outside of as well as in DRSPR; and

-- publication of a research journal and extension materials to facilitate intra- and interorganizational communication of research findings.

The application of timing and management criteria are discussed in some detail in the implementation plans. In general terms, consideration of these criteria suggested that DRSPR should be programmed to grow at a fairly moderate rate and that the regional expansion should be limited. The management criterion also supported the relocation of the DRSPR headquarters to Sotuba. The criterion of sustainability is addressed in the economic analysis, as it primarily involves the issues of recurrent cost and projected economic returns.

The Rate of FSR/E Expansion

In the PID, the possibility of expanding to either two or three new zones was left open. More detailed examination of the Malian staff availabilities, however, showed that these would be a major factor in limiting expansion to two zones (See Instutional Analysis). In addition, closer examination of the DRSPR experience to date confirmed the complexity and the depth of effort required to conduct effective farming systems research.

The preliminary choice of the Operation Haute Vallee region as the first expansion zone was confirmed when the management criterion was applied. For organizational reasons already discussed, it makes sense for DRSPR to relocate its headquarters to Sotuba. Requiring the DRSPR management also to establish a new regional office in the first few years of the project would have taxed personnel and institutional capabilities further. Since the OHV region lies around Bamako, this additional management burden will be avoided. The relatively good agricultural prospects of the OHV region and the ongoing AID project supporting the extension efforts of OHV, discussed above in Part I, also promise a more effective project at the farm level. Given the similarity of many OHV villages and farmers with those in the CMDT zone, it is also likely that an FSR/E effort in the OHV zone will be able to move more rapidly toward a farm-level impact than might be likely in other zones.

The choice of the second expansion zone has been narrowed down somewhat although the choice of collaborating regional development organization has been left open. Region V has been a surplus producer of grain and livestock for many years. The productivity of this area has, however, been seriously affected by the continuing drought conditions and population growth. The challenge for the farming systems research team in that region will be to work with a new set of variables in a more climatically risky environment. Funding the improvement of the Kopero station, it is hoped, will enhance the ability of the station to address FSR/E identified constraints and will contribute meaningful FSR/E effort by providing a flow of potential technologies for on-farm testing.

Technical Assistance Requirements

One way to compensate for the relatively few numbers of highly-trained and experienced Malians available for expanding the agricultural research and extension efforts is simply to substitute expatriate technical assistance for Malians off on training. Additional expatriate expertise could also be brought in to fill in for missing specialties in the present staffing pattern or to provide critical skills needed for only a short time period (statistical analysis, training in rapid reconnaissance survey techniques, sociology or anthropology, extension, traction equipment design, etc.).

Technical assistance requirements for the FSR/E project were assessed taking into account the following factors:

1. Manpower analysis of DRSPR: There are presently only 13 researchers in DRSPR out of which five are presently on long-term training. Only one of the 13 has had graduate-level training. The disciplines in which those in training now are specializing are: livestock (one staff member); sociology (two); agronomy (one) and economics (one).

2. Availability of Malians outside of DRSPR: There are very few trained Malian agronomists and agricultural economists available outside of DRSPR who are not already employed by IER or other governmental institutions. Sociologists are, however, available and could be employed on a contract basis by the GRM until the DRSPR sociologist presently in training returns.

3. Research-Extension Coordination at the RDO: While research-extension coordination will be an important activity in the FSR/E project, several factors argued for assigning this function to Malian personnel. First, each potential collaborating RDO has a Malian staff member assigned to research coordination. Second, in the specific case of Operation Haute Vallee, this person has a Master's degree in extension (from the University of Missouri); he also has a counterpart extension on the assistance team working with OHV under the AID OHV project. Third, short-term technical assistance funds will be used to assist in precise assessment and analysis of extension-research coordination activity needs.

4. GRM Sensitivities to the Level and Nature of Technical Assistance: USAID/Mali experience shows that, while the GRM is receptive to technical assistance in general, there is a concern with the overall proportion of funds allocated to technical assistance. IER, during the project design, expressed its view that Malian sociologists and extension specialists will be more effective in the socio-cultural context of the Malian rural milieu and will be better able to work in the range of local languages and dialects which will be encountered in the expansion zones (Bambara, Peul, Malinke, etc.). These disciplines have thus not been represented in the long-term technical assistance teams; short-term technical assistance will be used to fill any specific analytical or skill requirements which come up. Those identified include, anthropology, extension, fruit and vegetables, data processing and management, curriculum development and organizational communication.

In sum, the long-term technical assistance positions that have been identified as critical ones for expatriates to fill in this project are those for which Malians are presently out of the country in training programs and are not due back for a few years and those for which experienced personnel not now available in Mali are needed --- to conduct on-the-job training for people presently in the system or to get a particular activity underway in the short term. Short-term technical assistance are primarily concentrated in support areas. (as above)

To assist USAID/Mali as well as DRSPR to manage the project, a financial manager will be provide as part of the technical assistance team.

Level of Funding

The appropriate level of funding has been determined to be $20.8 million for a ten-year life of project. This level is 18 percent higher than that estimated in the PID. It implies an increase in the DRSPR budget proportional to the expansion of present activities. The financial and economic analyses presnet the details of the funding questions. It is concluded that the effort proposed will be appropriate to both the problems discussed above and the capability of the GRM (IER) to address them in the next ten years.

C. Project Components

In summary, it appears as though AID can usefully assist the Government and farmers of Mali to achieve their production objectives by providing support for a project with three sets of activities or components, involving:

-- expansion of farming systems research/extension efforts into two new zones of Mali;

-- fostering improved coordination and better linkages among researchers in the national agricultural research system, between researchers and extension personnel, between researchers and farmers, between research and training institutions; and between Malian agricultural researchers and their colleagues in other Sahelian and African countries.; and

-- directly improving the capabilities of research and extension personnel, that is, training.

To support these activities, AID will provide three types of resources to specific organizations:

Financial resources will be provided to assist the Insitut d'Economie Rurale (IER) to expand its Farming Systems Research Division (DRSPR) activities into two new regions (Operation Haute Vallee and Region V) and to relocate the administrative headquarters from Sikasso (in the CMDT area where activities are presently localized) to Sotuba, the central agricultural research station near Bamako. The DRSPR activities in the CMDT area will be continued, principally with continuing external assistance (both financial and technical) from the Dutch Royal Institute for Tropical Agriculture. Funds will also facilitate a variety of collaborative research efforts and an overall improvement in communication among researchers, extension agents, agricultural education specialists, and farmers.

On-the-job, short-term and long-term training oppportunities will be provided to national agricultural research, extension, and training personnel in order to develop skills in agricultural research, with special emphasis on skills needed to carry out farming systems research and extension.

Technical assistance will be provided to strengthen the short-term capability of IER and DRSPR to conduct farming systems research and extension activities, to assist in the development of a long-term FSR/E program, and to provide specific expertise not now available in Mali.

D. Project Phasing

While the proposed ten-year life span of this project is long for an AID project, it is largely dictated by the need to ensure that advanced training in disciplinary skills is adequately supplemented by on-the-job farming systems research experience before technical assistance personnel and project funds are no longer guaranteed. In fact, a 20 year or more effort is likely to be required to allow further expansion to other zones, more farm-level research, and the full institutionalization of the research approach.

Training schedules also largely determine that the project will have three internal phases. The first, from 1985 - 1987, will be an initiating phase. The DRSPR Headquarters will be relocated and the DRSPR/OHV program will be launched with technical assistance, brand-new graduates and borrowed DRSPR/Sikasso staff. The second phase, from 1988 - 1991, will see the consolidation of the DRSPR/OHV research program and the establishment of the second expansion zone research program. More newly-trained staff will be incorporated into the field teams and gain an important grounding in interdisciplinary research at the village level. In the third phase, 1992 - 1994, all field units will be completely staffed with trained Malians and both expansion zone programs will be fully operational.

III. Research Opportunities in Mali

While a major aspect of the farming systems research effort to be carried out under this project will be the delineation of production problems at the farm level and the search for technologies which can resolve these problems, previous experience in the project "expansion zones" -- the OHV region and Region V -- indicates that three broad classes of problems are likely to be important. These are:

1. Soil fertility and soil/water management;

2. Varietal improvement; and

3. Effective use of animal traction.

In this section the status of research on each of these problem areas is briefly reviewed and some of the opportunities for future on-farm research are suggested.

Soil Fertility and Soil/Water Management

Because rock phosphate is locally-produced, application of the commercially-available Tilemsi phosphate has long been suggested as the obvious means for overcoming the constraint posed by the phosphorus-deficient soils common in Mali. It has, therefore, been tested both on-station and on-farm in the Operation Haute Vallee and Operation Mil-Mopti regions. These tests have shown that farmers' use of about 300 kg of rock phosphate per hectare on millet and sorghum could increase annual cereal production by 30 percent. Research on-station is now being carried out by the International Fertilizer Development Center to assess the potential benefits of partial acidulation of rock phosphate.

Further research opportunities:

-- Economic analysis of on-farm test results and presentation to regional development organizations' extension services;

-- Survey of farmers who have participated in rock phosphate tests for three years;

-- Development of recommendations for rock phosphate credit programs (because benefits are derived over several years rather than a single, growing season);

-- On-station research into the possible positive interaction between rock phosphate and manure when applied simultaneously as well as on possible interaction between rock phosphates and soluble fertilizers;

-- On-station research into microbiological acidulation of rock phosphate;

-- Research to chart differential yield responses to rock phosphate applications in different soils;

-- Response rate analysis for different crops and different rates of rock phosphate application.

Soil management is a particularly serious problem in the Fifth Region where wind erosion poses a serious threat to newly-emerged seedlings. In general, however, intensification of agricultural production has increased soil erosion from wind and water and methods have to be developed to cope with the changing situation. DRSPR has already begun some studies on water erosion control, which lend themselves to a multidisciplinary approach. Tied ridges and crop residue incorporation have been shown to be useful in conserving available soil moisture.

Further Research Opportunities:

-- "Basic" research to quantify soil losses due to wind and water erosion under farmers' conditions;

-- Further testing of CMDT zone findings on soil management on slopes in high rainfall areas and improvement on these findings;

-- Further testing of tied ridges on different soils, different crops;

-- Identification of optimum crop residue use within the farming system;

-- Manure management and handling equipment;

-- Development of "domains" for eventual soil management recommendations based upon local names and classifications of soils; and

-- Tailoring of recommendations to identified domains.

Varietal Improvement

Maize improvement seems to be an area in which furthr research could lead to significant increases in production. Acceptable as a food, new varieties already tested have demonstrated high yield potential. Farming systems research work in CMDT has demonstrated the feasibility of increased maize production following cotton in the rotation -- a practice which makes good use of residual fertilizer. Open-pollinated varieties from IRAT, CIMMYT, and IITA have been tested on stations all over Mali. Several have also been tested on farmers' fields. The hybrid IRAT 81 (both with and without high fertilization) seems most promising, although an open-pollinated variety, Pool 16, also has shown good results. Maize response to nitrogen has been good -- linear up

to about 110 kg/N per hectare -- and several good maize herbicides have been screened on research stations. Intercropping of maize and cowpeas has been shown to have agronomic advantages. Both streak virus and striga, however, remain serious problems when maize is introduced as a major crop.

Research in other Sahelian countries on maize also indicates the potential for further improvement work on this crop. In Upper Volta, research has indicated some farmer acceptance of short-season maize even though yield potential is low. Research on tied ridges in Upper Volta shows that this might be a potentially useful technique to address the problem of maize's sensitivity to water stress. Food technology research in Senegal indicates increased demand for maize when processed into a rice-like product. High-lysine varieties of maize have apparently gained acceptance in Nigeria.

Further research opportunities:

-- Seed production economics for hybrid maize IRAT 81;

-- More testing of Pool 16 on various sites;

-- Survey and analysis to determine relative importance of and consumer preferences for yellow and white grain color and desired product characteristics (especially of milled maize);

-- Further exploration of streak virus research from IITA;

-- Economic importance of striga on maize; striga resistance and other measures to combat striga need to be developed;

-- Assess potential for short duration maize in dry zones and as a means of providing yield security in higher rainfall zones (surveys, on-farm trials); asses potential for fresh corn production around population centers;

-- Development of feasible systems for providing inputs (fertilizers and herbicides) required for maize production;

-- On-farm tests to measure effects of maize herbicides under farmers' conditions and to determine economic combinations of mechanical weeding/herbicide use on maize;

-- On-farm trials to determine utility of tied ridges, controlling for soil type and rainfall regime;

-- Examine economics of maize-cowpeas intercropping at farm level.

Probably the single biggest crop "pest" in Mali, striga resistance is likely to be a major characteristic for any varietal improvement program. Interestingly enough, however,

striga is not found on Malian research stations and no experimentation has thus been done on striga. The biology of this parasitic plant has been worked out in India and the U.S., however, and there seems to be a vast amount of empirical knowledge among Malian farmers which remains to be tapped. Striga infestation is commonly thought to be related to low soil fertility. One species attacks cereals in Mali; another attacks cowpeas. ICRISAT and SRCVO researchers in Mali have made striga tolerance a criterion in the sorghum breeding program. New crop species needed to be screened for tolerance or resistance to striga.

Further research opportunities:

-- Systematic collection and assessment of local knowledge and practices relating to occurrence and control of striga;

-- On-farm research to screen local and exotic varieties for resistance/tolerance to striga;

-- Herbicide screening for effectiveness of striga control;

-- On-farm studies to determine the relationships between striga infestation and other factors, such as rainfall distribution, soil water holding capacity, soil types and characteristics, date of planting.

-- Research on host and parasite interaction in Malian subspecies of striga;

Another aspect of varietal development which may be worthy of attention is that of new crops. Present DRA work on new crops for Malian farmers has focussed almost exclusively on tea. ICRISAT/Mali researchers, during the last three years, however, have been experimenting with finger millet (weleusine coracana). Results have been encouraging. ICRISAT scientists are also developing processing techniques to adapt finger millet and pigeon pea to Malian food preparation practices. Pigeon pea, mung beans, and soybean varieties have been screened on several research stations.

OHV has demonstrated some interest in crop diversification and have begun promoting sesame and soybeans as well as tobacco. A constraint identified is that soybeans must be innoculated with Rhizobium japonica, not found in Malian soils.

Possibilities also exist for the improvement of traditional Malian crops which have, up to now, received little attention. In this category are crops such as fonio (Digitaria exilis), Bambara groundnuts, African eggplant, sheanuts, etc.

Further research opportunities:

-- Continue tests already begun; extend on to the farm level (finger millet, pigeon pea);

-- Examine crops with forage and firewood as well as food potential;

-- Explore local production of Rhizobia needed for soybean production;

-- Investigate soybean storage and off-season seed multiplication possibilities;

Effectiveness of Animal Traction

More than 40 percent of OHV farming households own or use animal traction. Animal traction is widely hypothesized to be positively correlated with both higher yields per hectare (due to the benefits of better tillage, increased water infiltration, more timely plowing and weeding operations) and with greater sizes of farms (as animal traction "spares" labor). Yet farm surveys have been unable to find significant differences between OHV farmers who use animal traction and those who don't. Thus, there would appear to be a need not only to find out what prevents more people from adopting animal traction, but also to find out why those who do have it do not achieve expected levels of productivity.

In the CMDT zone, the DRSPR researchers have begun to address the complex of animal traction related problems and have identified high animal mortality (as high as 40 percent per year!) and poor animal condition in the plowing season as major causes for ineffective use of animal traction. These, in turn, are related to the problems of weeding with poorly-trained animals (those which are newly-purchased to replace one which died) and to relatively low quantities of work performed each day.

Further research opportunities:

-- Increase understanding of effects of animal traction simply by systematic observation in the field, to learn how farmers (both efficient and inefficient) are using their animals and equipment;

-- Measurement of effectiveness of single-oxen compared to pairs of oxen for plowing and other operations;

-- Further work on corralling animals and making better use of animal manure;

-- Animal nutrition studies for determing economically-efficient, balanced rations using local crop residues most efficiently;

-- Investigation of animal mortality;

-- Examination of off-season animal traction revenue-generating possibilities (e.g., in irrigation, transport);

-- Evaluation of animal supply and credit systems;

-- Develop a system for supplying spare parts for animal traction equipment; assess potential for local manufacture by village blacksmiths;

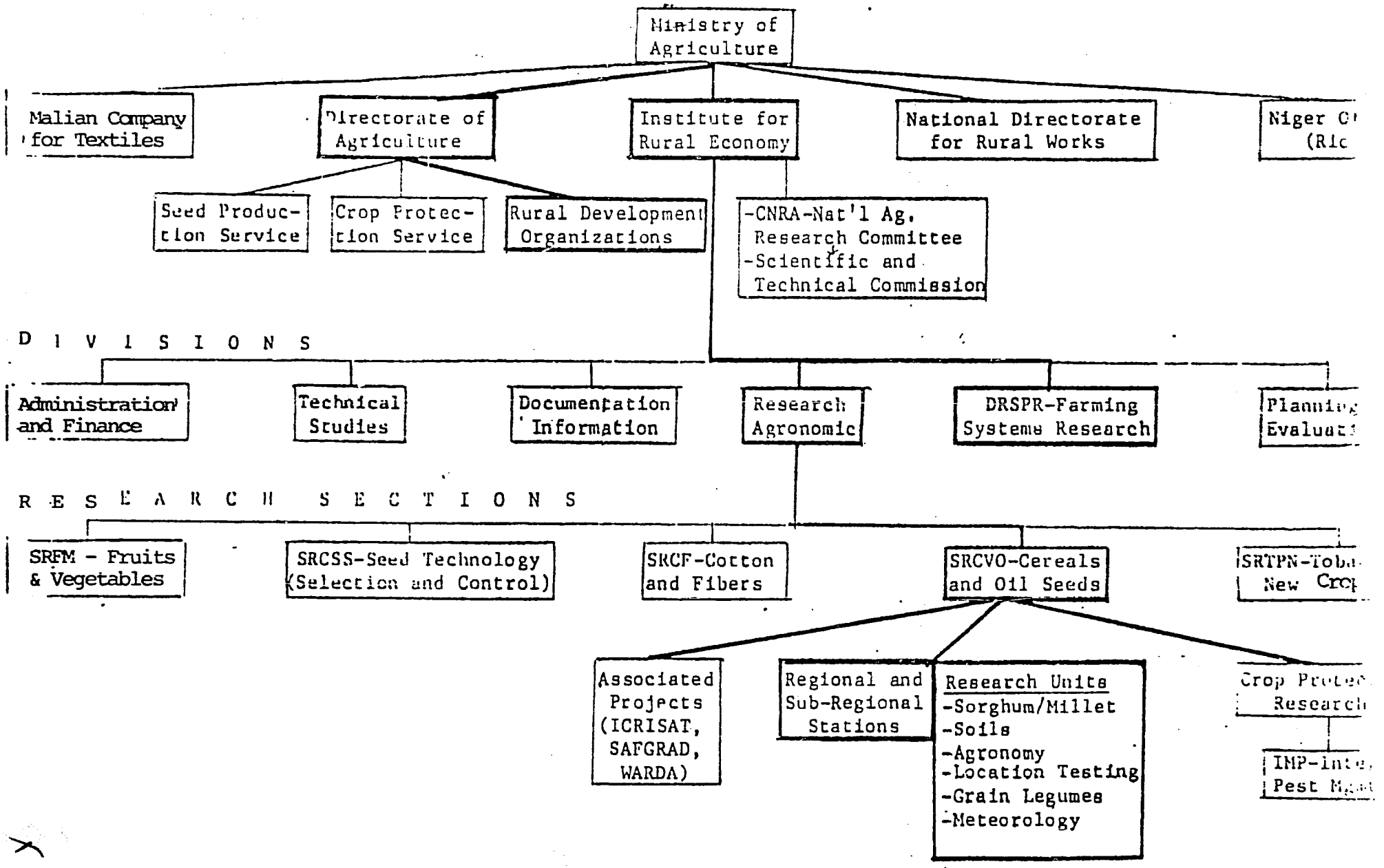
-- Examine economic feasibility of breeding cattle more appropriate for animal traction: conformity, disease resistance;

-- Design and test animal traction equipment for constructio and maintenance of erosion control structures; for seeding, fertilizer application and weeding in multiple rows.

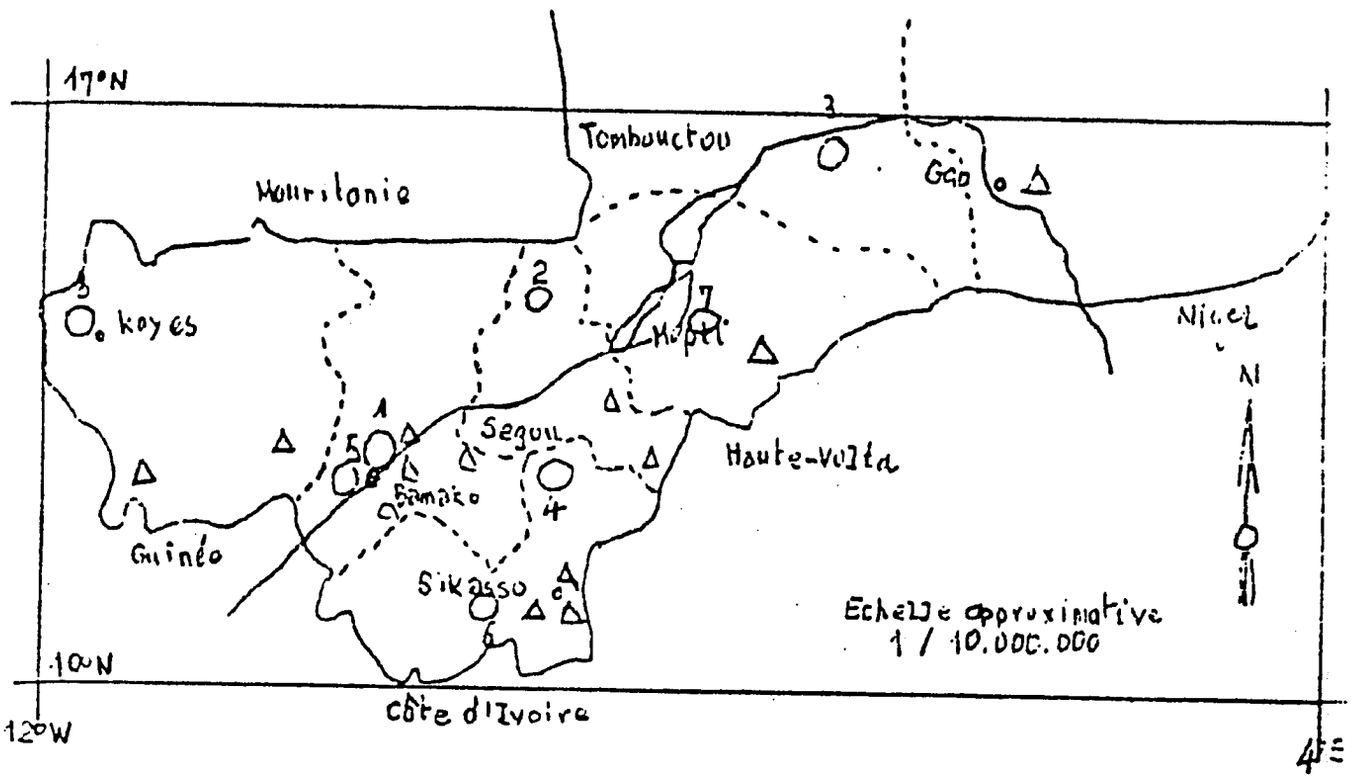
It should be noted that economic feasibility is an important aspect of virtually all suggested research topics. Lack of capital is often identified, in fact, to be the single most important constraint to increased production. While farm management studies are routinely done by IER in Mali, largely to determine the costs of production of various crops, these studies are most often focussed on finding average values of various statistics, rather than on assessing the profitability of technological change. DRSPR work in the CMDT region has begun to do some economic evaluation of both traditional and introduced agricultural technologies, but little analysis of this work is available at this time.

Farm management analysis, using detailed farm records, needs to be done for Bambara and Malinke farming households to obtain some reliable data for groups with traditions and practices different from those used in the CMDT zone. Land ownership and use patterns need to be quantified and the extent to which they constrain production decisions should be determined. Market price information needs to be improved in order to better assess farmers' incentives to invest and to expand production. The capacity of farmers' to use and repay credit must be assessed. At the present time, land is assumed to be "free", credit is assumed to be needed only for cash crop production (or perhaps only recoverable from cash crop production), and, under the new liberalized grain market policies, prices are assumed to be at the "incentive" level. It is important that these assumptions be verified and more carefully delineated.

ORGANIZATION OF AGRICULTURAL RESEARCH IN MALI



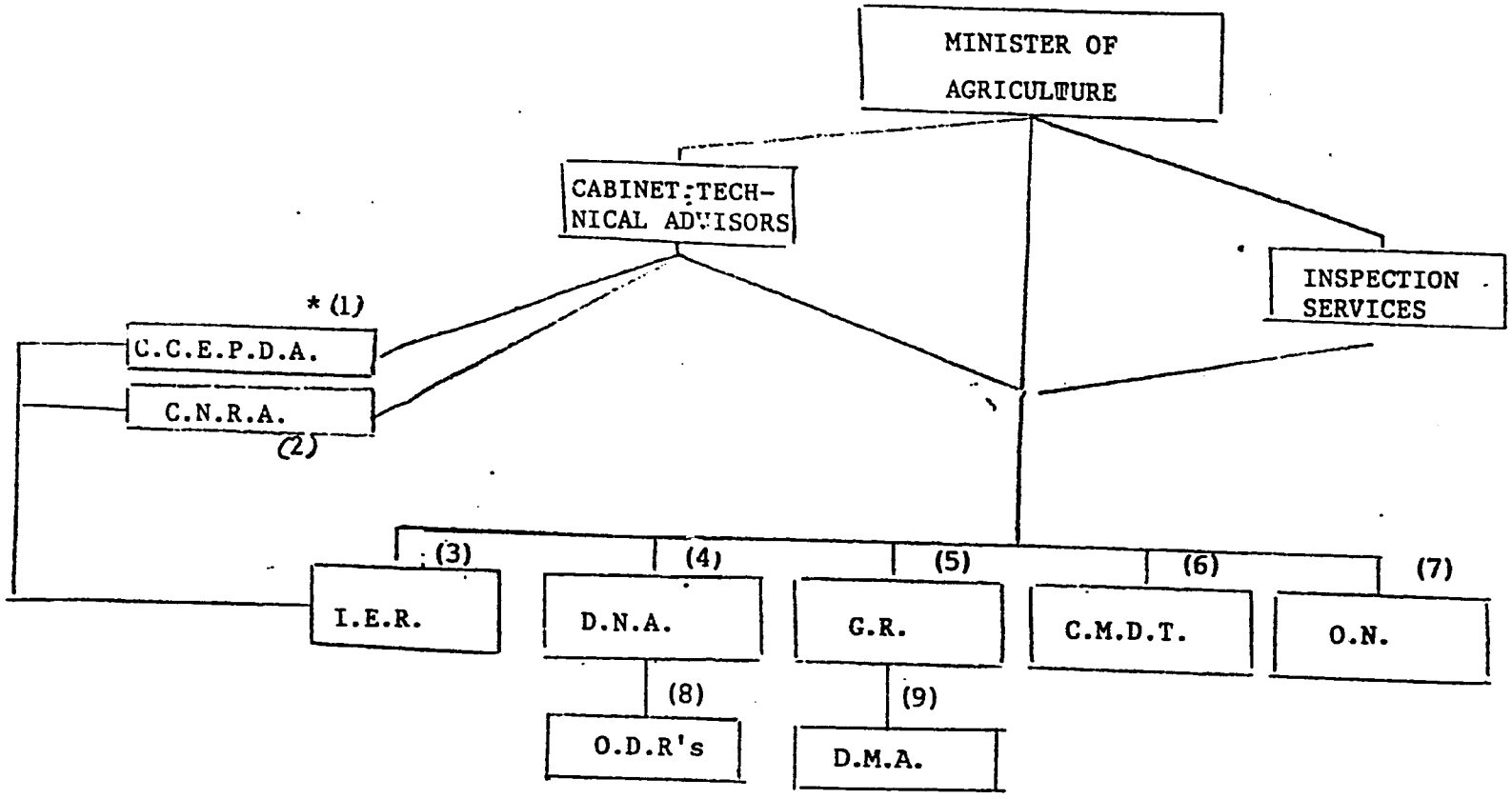
RESEARCH STATION NETWORK : MALI



Stations de Recherche Agronomique..... ○

(1)	SCTUBA	Céréales-Oléagineux-Techniques culturales
(2)	KOGONI	Riz, autres Céréales et Coton irrigués
(3)	DIRE	Blé irrigué
(4)	N'TARLA	Coton et Fibres jutières
(5)	BAMAKO	Fruits et Maraîchage
(6)	TIERCUALA	Recherches sur les Systèmes de Production
(7)	MOPTI	Projet Associé ADRAO-Riziculture flottante
(8)	SAME	Projet Associé CILSS - Céréales et légumineuses

Annexes, Sous-Stations et Points d'Appui de la Recherche.. △



1. Coordination Committee for Agricultural Development Programmes and Studies
2. National Committee for Agricultural Research.
3. Institute of Rural Economy.
4. Directorate of Agriculture.
5. Directorate of Rural Works
6. Cotton and Textile Development
7. Niger Office (Rice Development Agency).
8. Rural Development Organizations.
9. Agricultural Engineering Division

* Shown in the organigram are the two Committes directly intervening in the functioning of IER.

Source: IER Annual Report 1982

ANNEX B

SOCIAL SOUNDNESS ANALYSIS

I. Introduction 1

II. Socio-cultural Feasibility 1

A. General Description of Population and Beneficiaries 1

1. Rural Populations 1

2. DROs and Extension Personnel 2

3. Research Institutions and Researchers 3

B. Social Organization 3

1. Farmers 4

2. Village Association 7

3. Research and RDOs 7

4. RDOs and Extension Service 8

5. Research Institutions 9

6. Implications for FSR 12

C. Goals and Motivations 14

1. Farmers 14

2. Research Institutions 15

III. Spread Effects 16

A. Participation 17

1. Farmers 17

2. Extension 18

3. Researchers 19

B. Social Consequences and Benefits 20

1. Researchers 20

2. RDOs 21

3. Farmers 21

SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

FSR/E is an institution-building project to develop and expand the capacity for farming systems research in Mali. Researchers and research institutions will directly benefit from the project. Thus this social soundness analysis will concentrate on institutional behavior patterns in Mali, and the constraints and opportunities these patterns provide for project success.

Close linkages between research institutions and rural development organizations (DROs, "operations") and farmers are an integral part of the project design. Project benefits will accrue directly to participating extension agencies and farmers and , in the longer term, to rural populations. This analysis will therefore also discuss the socioeconomic and sociocultural factors related to ROOs and to rural populations in Mali that may affect their cooperation with research institutions. In each section of the analysis, these categories of participants and beneficiaries in the FSR/E effort will be discussed.

II. SOCIOCULTURAL FEASIBILITY

A. General Description of Participants and Beneficiaries

1. Rural Populations

The majority of the Malian rural population comprises farmers who live in the southern and central portions of the country. In the southern savanna zone, full-time sedentary cultivators predominate. A numerically smaller populace lives in the Sahelian zone, where farming is usually combined with livestock raising. Further to the north, as soils become poorer and rainfall is more scarce and uncertain, herding becomes the dominant means of making a living. In the desert, only pastoral nomadism is possible. Herdsmen are sparsely scattered along the southern fringe of the Sahara. The interior desert is almost unpopulated.

The Mande-speaking peoples, all of whom are sedentary cultivators, make up Mali's largest single ethnic group. The Bambara, speakers of the Mande language Bamanan kan, are numerically the most important. They number 2 million and live throughout south-central Mali, from the border with the Ivory Coast in the south almost to Nioro in the northwest, to Mopti in the northeast, and to San and Koutiala in the east. Next in population size are the closely related 1 million Malinke (or Maninka), who lives to the west of the Bambara along the border with Senegal and Guinea, from Bafoulabe in the north to Yanfolila in the South.

To the northwest, along the Mauritania frontier from Kayes to Nara, lives a smaller population of Sarakolle (or Soninke). They number about 50,000. To the east and north are the Dogon (or Hamber), a Voltaic people numbering about 250,000, and the east, from Goundam and Tombouctou to Gao and the border with Niger. A fishing people, the Bobo, live along the Bani and Niger rivers. There are also smaller populations of Senoufo, Diawara, Bozo, and Khassonke.

The herding peoples of southern and central Mali are mostly Peul (Fulani). To the northeast, along the edges of the desert are smaller populations of Maure and Taureq, linguistically related pastoral nomadic peoples having strong affinities with Mauritanian herding peoples of Berber origin.

The Mande-speaking people of Mali, the majority of whom are Bambara, are shifting cultivators of millet and sorghum. Living along them for at least part of the year are nomadic Peul, who care for a portion of the farmers' livestock in exchange for access to pasturage and watering places during the dry season. When the rains begin and the farmers must prepare their fields for planting, the Peul move with their animals to the north. Since the drought, a growing number of Peul have abandoned pastoralism for farming. Some Maure, actually the descendants of the Maure's former slaves, are also sedentary. Most, however, remain fully nomadic.

The initial populations directly involved in the FSR/E effort will be farmers in selected zones of the Haute Vallee of south-central Mali. This area is one of the country's best endowed agricultural regions and comprises ethnically homogeneous farm communities of Bambara or Malinke origin. Farmins sustems units may later be established in the northwest (Soninke) or the Mopti area (Dogon, Peul)

2. RDOs and Extension Personnel

Over the last 15 years, a number of DROs have been established in Mali. They are under the Ministry of Agriculture (MOA) and must follow national policy directions, but they also enjoy a fair amount of autonomy in their day-to-day activities. Host RDO responsibilities include providing extension services to farmers, delivering inputs and credit, overseeing marketing, and managing agricultural development projects. Most RDO activities are carried out by the extension agents. These field agents provide a principal linkage between research institutions and the farming populations.

The initial RDO to be directly involved in FSR/E efforts will be Operation Haute Vallee (OHV). OHV began as an integrated de lopment project with programs in livestock development, feeder road maintenance into a more specialized operation. first concentrating on cotton. In recent years OHV has started

diversifying its crop production efforts to include tobaco, corn and sesame. This transformation is the result of the difficulty experienced in obtaining financing for the large investments required by integrated rural development projects.

The original objectives of OHV were to increase cereal production, particularly irrigated rice, and to intensify production of cotton, peanuts, and tobaco. Currently, OHV's major source of revenue is cotton. Although substantial quantities of cereals and food crops are grown, these are most often consumed by the producer or sold directly by farmers.

3. Research Institutions and Researchers

Under colonial rule and for about the first 15 years of independence, agricultural research in Mali was directed primarily toward the export cash crop sector of cotton and peanuts. During the last five years, food crop research has received increased attention.

The Institute of Rural Economy (IER) of MOA is the primary agricultural research institutions in Mali, and will be the principal implementing agency for the FSR/E project. At present, there are six divisions in IER. The two most directly related to this project are the Agronomic Research Division (DRA) and the Farming Systems Research Division (DRSPR). DRA is the largest division in IER, and includes 80 percent of all IER researchers. It is involved with basic agronomic research on food and cash crops. DRSPR is a small interdisciplinary unit located in south-eastern Mali that has focused its research in the area known as CMDT Zone.

Until recently, IER concentrated almost exclusively on the biological aspects of agricultural research. With the creation of DRSPR, the sociological aspects of agricultural research have assumed more importance. However, of the 135 researchers in IER, only 12 are social scientists. The assignments of the five sociologists and seven economists are as follows:

	DRSPR	Division of Technical Studies	Division of Planning and Evaluation
Sociologists	2	3	0
Economists	1	4	2

Because a successful FSR approach must be interdisciplinary, it should include strong social science as well as natural science components. The current imbalance in the staffing pattern of IER should be addressed by strengthening its social science capacity in terms of both number and level of training. (1)

B. Social Organization

Malian social organizations is oriented toward strongly hierarchical structures with centralized authority patterns. Status differences are clearly marked and taken seriously in social relationships.

1. Farmers

The basic structure of rural society throughout Mali manifests a significant number of similarities. Among rural Malian people, property is held and work is organized on the basis of kinship. The representative unit of production is a group, comprising a core of adult men descended through the male line from a common male ancestror. This unit may be composed of the separate dwellings for a man and his wife or wives, his married sons and their wives and children, and his own unmarried daughters. The senior male is the head of the production unit and is responsible for managing its common production activities. As this unit grows, individual households may break off to form separate production units. This may also occur as a result of conflicts, a breakdown in the authority structure, or a lack of sufficient resources within the original unit.

Land is assigned to each lineage by village elders, with usufruct rights inherited from father to son. Holding size may be adjusted by short-term assignment of land-use rights between lineages. Family land may be divided into communal and individual parcels. Communal fields are worked collectively by members of the farm unit, under the direction of its head, who also manages the distribution of their produce. Each individual parcel is cultivated by the individual to whom it is allocated and owns what is produced on it.

Typically, each patrilocal extended family is located near others, to which core members are related by a bond of shared agnatic descent. Because of lineages are to some extent exogamous most are necessarily related to neighboring domestic groups through marriage. The resulting network of alliances based on affinity provides for the allocation of most productive goods, farmland, tools, food-processing equipment, for the organization of work; and for the distribution of most of what is produced. Reciprocity is important within the family. Among almost all farmers a portion of the harvest is held in the granaries of the extended family head and allocated to family members in need. The family herds of Malian pastoral nomads serve similarly as a source of material security for the entire localized membership of the kin group.

During the rainy season, all able-bodied members of the sedentary population are engaged in food production. The fields are cleared for planting in early spring; planting and cultivation keep men, women, and young people steadily on the land until the fall harvest, which lasts from September to December. In addition to their work in the fields, women are responsible for gathering

firewood and water, processing food and preparing meals, washing and cleaning, and child care. With the possible exception of the favored wives of a few high-status men, the Malian woman's workload is heavier that that of her male counterpart.

In the off season, which lasts from late fall to late spring, labor is less intensive, For those who remain at home, this time is devoted to the repair of tools, weapons, and other household goods, and to craft production. In accordance with a practice that is more than 50 years old, many young men leave home after the harvest to seek employment in urban areas and on plantations, especially in the Ivory COast. Young men from the northwest, especially along the Sarakolle, go to Senegal and France. Money earned from migrant labor constitutes an important source of cash income for the entire family. A part of the cash is also used to buy the presents needed by a young man to acquire a wife and establih his own household. The value of money earned from this migratory labor must be balanced against the loss to the migrants' home communities, and to Mali as a whole, of the output of this part of the labor force.

The societies of Malian farmers and herders are stratified. Persons of free ancestry (horon in Bambara) generally monpolize positions at the apex of the status hierarchy, the richest and "noblest" among them having the highest standing. To the side of this category are casted groups of artisans (nyamakala in Bambara), whose social position is more separate than inferior. At the bottom of the status hierarchy are the slaves (dyon in Bambara) and , in the north, people whose economic dependency upon their former masters perpetuates their chattle-like status.

Associations are widespread in rural Mali. The ton of the Bambara is representative. Comprising male and female sectors, it includes all young persons of the same generation. Organized to work together collectively, association members pool the money they earn in the fields to hold dances or buy clothing and medicine. They also function as rotating credit associations. Other associations take the form of joking alliances (senenkounia in Bambara) between linkages or ethnic groups. All these grouping cut accross kinship ties and class and caste barriers to form a community-wide network of receiprocal relations that greatly extend socioeconomic security and add flexibility to the social system.

The indigeneous authority systems typical of rural Mali derive their structure from the lineage organization. The eldest male members of the local lineages of free descent hold the right to political power. Generally, the senior members of the lineages that make up a local farming community or group of herders serve as counselors to the eldest responsible male member of the founding lineage of the local community. He is the chief and passes his decision-making power on to his younger brother or eldest son.

At each level of the social structure, the right to exercise power over subordinates is reinforced by the control over their access to productive goods, land. and pasturages, and by the belief in the ancestoral spirits of the kin group. Those who disobey the edicts of the elders, who are their ancestors' closest descendents, risk supernatural punishment. The threatened withdrawal of vital economic support is a control of equal weight.

This belief in the potent spirits of the ancestors, and in sources of supernatural power derived from nature--the sky, the earth, and the rains--is complemented by the widespread espousal of Isalm. The Moslem religion provides a valuable basis for organizing people across ethnic lines and is a powerful source of economic, social, and political conservatism throughout Mali. Through religious leaders known as marabouts, Islam can also influence agricultural decisions (growing of tobacco, for example).

Within these generally shared patterns, there are significant variations between regions and ethnic groups. Areas in which the project may be implemented differ economically and in culture, social organization, climate, and physical resources, resulting in differences in production systems.

For example, a major ethnic group in Region I is the Soninke. whose household income is derived mainly from off-farm wage labor. Only of secondary important are the crop or livestock revenues produced essentially by women through a combination of rainfed, flow recession, and irrigated cultivation. The lack of a road transport infrastructure further limits markets in this previously neglected area. Although the Senegal River and its tributaries offer much potential for future agricultural production. achievement of this potential may require a major reorientation of family labor patterns and interests.

In contrast, the Upper Niger Valley has access to the Bamako market. It endowed with an adequate and fairly dependable rainfall, and is populated with Malinke farmers who produce cash crops of cotton, tobacco, and peanuts in addition to food crops, and who have had relatively more experience with animal traction methods.

The vast sandy plains of Region V present yet another physical and cultural setting. Limited rainfall, inadequate roads, the traditional conservatism of the Dogon, a social structure with little class distinction, competition for crop and pasture land between sedentary farmers and transhumant herders, and relatively greater poverty are some of the variables the farmer must confront and manipulate to achieve his desired ends, while minimizing associated risks.

The families of the main ethnic groups who inhabit these areas descend from ancestors who experienced war, empire, expansion of

commerce and trade, abundance, famine, and political rivalties. These families have known the whims of religious and secular colonial and independent governments. Thus many different factors have contributed to the development of different systems of production.

2. Village Associations in OHV Zone (1)

There are three types of village associations in Mali: (1) Tons Villageois: "The tons are defined as village associations for economic, social and cultural development founded upon solidarity and volunteerism. The 1981-1985 five year economic and social development plan of GRM places considerable emphasis on the role of local organizations at the base level in the rural development process. The tons are to serve to mobilize local resources to improve the quality of life, and are essentially to become multipurpose productions, consumer and monetary cooperatives. Activities may include village infrastructure improvement... and group purchases of agricultural inputs such as seeds, fertilizers, insecticides and agricultural equipment for animal traction." (2) Groupement Villageois": "The groupements appear to pre-cooperatives of the kind that are common throughout Africa. They are multipurpose consumption and marketing groups which are supposed to generate a number of community development activities from the profits of their retail activities as well as from additional contributions of villagers' financial and labor resources. However, in most instances there were either insufficient funds to complete all projects or projects were poorly prioritized." (3) Comitéde Vulgarisation: (Extension Committees) "These committees (sometimes called extension operatives) are supposed to be made of farmer leaders who are selected on the basis of common ecological situation or cropping system. Officially, there are 100 in the OHV zone alone. The intention there is to facilitate maximum coverage by the extension agent who will work with these groups rather than with individual farmers. The groups will then pass along information from the agent to other farmers in their communities who have similar situations and cropping systems. Unfortunately, this relatively new system was put in too fast, too many groups were started and there was a general confusion on the part of extension of extension agents and farmers about what they were designed to do. For example, groups apparently constituted themselves to get access to credit, not to extension services, as credit was available to individuals who were members of the group. While extension agents do some demonstration for the groups as a whole, they are primarily involved in working with individual farmers."

---

* For further details refer to the evaluation report: Operation Haute Vallee, August 1984. The quotations in this section are drawn from the "Local Organization Capacity" section of that report.

187

3. Research and RDOs

The research and rural development systems in Mali have been shaped by its colonial history and a situation in which small scale farmers have been marginal to the political process. The mandate for both the research organizations and RDOs, theoretically aimed at small-scale farmers, has to a great extent come from outsiders or donors concerned with the macro problems of crop production. Both types of organizations have also been influenced by the French. Differences in education and, frequently, in urban versus rural background create social distance between small farmers and those working in research and rural development systems. The latter group's place in an urban bureaucratic setting further removes its members from the rural context. They view academic training as a means for upward mobility, in terms of status, responsibility, and access to additional opportunity. Those professionals from rural backgrounds place value on this mobility, and few wish to work in rural areas. For example, the Agricultural Apprenticeship Training Centers (CAAs), which train extension agents, enroll a large number of students who may no wish to work in rural areas. Due to the absence of an alternative academic path, many attend the CAAs in the hope that this will lead further educational possibilities and employment in the capital, preferably in an office seeting.

The majority of researchers and employees of extension agencies are civil servants. They have a high degree of job security and are eligible for promotions based on education and seniority. There are, however, negligible differences in salary within Malian system. This situation intensifies the importance of other sorts of status markers within and between these organizations.

One market is a person's place on the information chain. In most research projects in Mali, information passes from top to bottom. Therefore, those who receive information have lower status than those who give it.

4. RDOs and Extension Service

Malian Extension activities in Mali are the responsibility of semi-autonomous parastatal RDOs. Within each RDO, the extension service is centralized and hierarchically organized. The system is designed to respond more to RDO production goals that to the problems of farmers. Although RDO and farmer interests should coincide in many ways, at present they are different. While the primary goal of the RDO is increased production of cash crop, the farmer must balance his participation in such crop production with other factors including rising input costs, relative prices for crops, and family food needs.

Key decisions within an RDO are made at RDO headquarters, whose

personnel are farthest removed from farmers in terms of social status and physical environment. RDOs are headquartered in major centers. Information generally flows downward from headquarters, to sector chiefs, to zonal chiefs, and to village level extension agents. This forms a pyramidal authority structure, in which the number of subordinates increase in relation to the descending order of the bureacratic structure. Information also flows selectively. For example, although OHV s annual plan for the 1982-83 agricultural season was to allow for input from sector chiefs and their subordinates, headquarters did not inform the sector chiefs about the design process or provide guidelines. As a result, data provided by the sectors were not in usable or consistent form. Predictably, headquarters ignored the sector inputs and instead used data from the government's Five Year Plan.

The only connection between the extension service and farmers is at the lowest level. In practice, the extension agent monitors the established system, decides which farmers are given loans and inputs, ensures input delivery, makes sure that crops are harvested and that the marketed portion of the harvest proceeds through the designated channels, and collects on production loans. The extension agents' role has been as the last in a line of RDO information receivers. Of course, even if the extension agent were to take information from farmers, there is no easy mechanism to channel it to superiors.

The lack of two-way communications between extension agents and farmers is exacerbated because most agents are not from the area in which they work. Moreover, they are transferred frequently. Extension agents are often viewed by farmers as outsiders and representatives of the government, making a reliable information flow from farmers to agents difficult.

There is an understandable tendency for extension agents to focus on larger, more successfull farmers, who are the means to the RDO goal of economic self-sufficiently. In addition, the majority of extension agents are men who aork with male farmers, This is significant, given the segregation of the sexes in rural Mali and the demonstrated importance of women in Malian farming systems.

5. Research Institutions

The organizational characteristics of research institutions is similar to that of RDOs--hierarchical, with strong centralized authority. The director of the IER maintains control over research activities reserving decision-making powers on such issues as budget, personnel, and research agenda. In direct contact with him are the directors of IER's six division, who are responsible for overseeing the activities of the researchers under them, and answering for them to the director. Below the researchers and supervised by them are the enumerators and monitors responsible for such activities as administering

socioeconomic surveys and monitoring agronomic trials (frequently on a contractual basis).

As in the RDOs, directives are handed down from the IER director, to division directors, to researchers, to their support staff. Superior status is based partly on control of the information on which decisions are made; those in superior positions are therefore unlikely to accept such information from inferiors, nor are they likely to pass down all of the information they have. One example is the researcher-enumerator relationship. Enumarators may be given a survey to administer by a researcher and instructed on filling it out, but are not necessarily informed about the purpose of the survey or how the sample of respondents was chosen. (The same appears to be true of the monitors employed for agronomic testing.) Partly as a result, the individuals charged to deliver any data other than those specifically requested by researchers. This is not perceived as a particular problem, because as a lower status category, enumerators are not expected to be information givers in relation to researchers. Nevertheless, a potentially valuable source of information for researchers is thus bypassed and, indeed, the quality of the data delivered by enumerators amy be limited by their lack of information about the purpose for which the data are needed.

A partial by somewhat troubling departure from this relationship accured during the second year of farmer surveys by DRSPR. For that year, enumerators were asked to select farmers for the sample on the basis of those who would be most cooperative. Although this move in the direction of drawing upon the knowledge of enumerators was positive, the request itself demonstrates a lack of regard for sampling methodology, since the selection of only cooperative farmers was likely to be unrepresentative of farmer population.

While information filters down from top to bottom, individuals at each level of the hierarchy are responsible only to their immediate superior. For example, a researcher must provide his division director with reports of his activities, but ordinarily has little reason to inform his colleagues of his work. When asked if researchers would be interested in publishing articles in a proposed IER journal, several replied that they would do so if told to by their division director: "Then it would just be another part of the job." Since researchers are answerable only to superiors, they have little incentive to built individual reputations among themselves. Communication among individuals of equivalent status is limited because one's frame of reference is apt to be vertical, rather than horizontal.

This feature may more actively contribute to blockage of horizontal communication. Seeking information from an equal necessarily puts one in the lower-status information receiver position, and it apt to be avoided. For example, the director of one IER division said that he would welcome visits from other

190

divisions interested in the research activities he directs and was disappointed that such visits rarely occur. He was considerably less interested in visiting the research sites of other divisions. None of the divisions wishes to take the position of information receiver in relation to any of the others, with the result that communication between them is limited.

Actually, the hierarchical organization of the research institution is somewhat truncated. Social relationships are ordinarily perceived in hierarchical terms, individuals and groups are highly status conscious, and in the absence of significant salary differences among civil servants, such elements as educational levels, titles, number of subordinates, and access to information assume great importance as markers or expression of status differences.

The status of researchers, however, remains a relatively undifferentiated one below the multilayered administrative hierarchy and above the less-educated support staff. Although researchers have varying levels of education (from Bachelor's to French 3eme Cycle) and differing amounts of seniority, there are no ranks for them to pass through: they are all researchers. This is perceived as abnormal and problematic by Malian researchers: they frequently complain that there is no career to be made in research, that is, there is no succession of statuses such as attache, charge, and maitre de recherche, as in the French system. The result is likely to be a relatively young and inexperienced corps of researchers, and a high turnover rate. Individuals are apparently drawn to research because it gives them access to higher education (that is, opportunities to be sent abroad for graduate training). However, no vehicle exists for turning this higher education into higher-status position within the research establishment. Having acquired these credentials, individuals are likely to be drawn to other sectors, where appropriate status rewards exist, and a recognized career ladder can be mounted.

The lack of status differentiation among researchers increases the perceived importance of maintaining and expressing status differences between researchers and support staff and rural populations. Researchers are thus inclined to distance themselves from lower-status farmers, preferring, for example, on-station testing to on-farm testing, and formal surveys, which can be administered by enumerators, to informal surveys. This use of enumerators or monitors as intermediaries buffers contact between researchers and diminishes the possibility that researchers will be placed in the role of information receivers in relation to farmers.

Enumerators are subordinated to researchers by several mechanisms. Because the Malian research establishment is not connected to the system of higher education, enumerators are not, as is frequently the case in United States, researchers-in-

training. Enumerators, therefore, having no possibility of advancing to the status of researcher, and are not perceived by them as potential colleagues. Similarly, researchers prefer to use enumerators hired by the research establishment as data collectors rather than using extension agents are part of a different hierarchy and would not be as unambiguously answerable to researchers. The status of researchers, already perceived by them as inadequate, would be further undermined if their control over subordinates were diminished by the replacement of enumerators with extension agents as data collectors.

The links between the research establishment and the RDOs are weak. To a certain extent, they are subject to the kind of blockage limiting communications between equals. Each has its own jurisdiction, and closer ties between the two would carry the risk of one side's finding itself (inappropriately in its view) in the low status of information receiver. Because no one wishes to become the subordinate of the other, the safest solution has been to keep contacts to a minimum.

Nevertheless, some ties do exist between the research establishment and the highest and lowest levels of the RDOs. RDO representatives attend the IER's annnual Technical Commission meetings, at which research results are reported and research priorities established. The information exchanged tends to be general, however, and the input from the RDOs and from the research establishment to the RDOs appears to be pro-forma. The RDOs recognize the need for good research as a basis of their programs, but some are inclined to establish their own quasi-research division, rather than to accord credibility to the research establishment or to place themselves in a dependent position in relation to it.

The extension agents at the lower echelons of the RDOs also have contact with researchers. The agents are often used to obtain initial information and contacts in rural areas in which researchers wish to undertake a project. However, the involvement of the agents in research projects is ususally limited, and after initial contacts are made, researchers prefer to work with their own enumerators.

It should be noted that barriers to bottom-up and horizontal communication flows are permented to a certain extent by the large number of personal ties cross cutting formal statuses and official hierarchies, just a large kinship network, involving extensive rights and duties, In addition, special relationships tie any individuals sharing the same last name, and all of those bearing a certain last name may have special rights or duties in relation to those with a certain other name (for example, Traore and Diarra). This is not an insignificant integrating mechanism, because there are relatively few last names in Mali, and a large barriers to horizontal communication between an RDO and a research group may be lessened because the heads of each are brothers. Or bottom-up communication between a farmer and a

researcher may be facilited by the relationship expected because of their two last names.

6. Implications for FSR

These patterns of social organization have important implications for the type of FSR program likely to be most successful in the Malian context.

The existence of a centralized and effective authority structure in each of the relevant institutions allows a large number of individuals to be mobilized quickly and efficiently around a focused effort. For example, if the higher administrative levels of IER decide to make a full-scale commitment to the FSR approach, then much of the research establishment will be reoriented in that direction. Similarly, if a high-level decision is made in the RDOs to collaborate in the FSR effort, then this collaboration can be accomplished, whether it involves directorate-level participation in the identification of problem domains, or field agent participation in data collection. Finally, village leaders are readily identifiable, and can mobilize farmer cooperation and support.

The top-down flow of information characteristic of Malian social structure has further implications for the FSR/E project design. FSR is based to some extent on information flowing from farmers and those working closest with them to researchers. However, Malian social structure is organized around information flows in the opposite direction. This means that those in a status position permitting them to be information givers are unlikely to accept the position of information receivers. It also means that those in the lowest-status positions--farmers, enumerators, and extension agents--might not be given enough information on the goals and purposes of particular FSR activities to feed back much useful information. Either appropriate mechanisms for increasing their involvement in the process will need to be found, or dependence on their input must limited. Overemphasis on bottom-up information flow can be expected to be socially disruptive and to meet with considerable resistance. Design of FSR in Mali must take a realistic stance on the amount of multidirectional communication that can be reasonable be achieved.

The strong orientation toward top-down communication also renders delicate communication between parallel institutions or groups. FSR requires effective communication betweem basic researchers and FSR researchers, and between researchers and extension agencies. Mechanism for promoting communication without establishing a hierarchical order between, for example, DRA and DRSPR or IER and OHV will have to be carefully and explicitly worked out. Otherwise, effective communication will remain blocked out or, at best, be only sporadic.

It should be noted that women play an important role in Mali as agricultural producers. In many areas and among many ethnic

groups, they provide a substantial amount of labor. They produce food crops that provide a "safety net" for the farm family, significantly influencing the amount of risk male farmers can take. A complete understanding of Malian farming systems, their constraints, and the impact of proposed innovations, therefore, must include attention to women's roles in the system. To date, these have received little attention by either the research establishment or the RDOs. This is partly because a high level of gender segregation exists in rural Mali, causing Malian extension workers, enumerators, and researchers to have little contact with women producers. Although some women have been trained as researchers, none has been included in the DRSPR group. There are few women extension agents and none employed as DRSPR enumerators. Until this situation is rectified, incomplete view of farming systems will results.

Lastly, it is certain that village associations, especially extension cooperatives, could contribute significantly to the FSR/E activities such as identification of production constraints and problems, delineation of recommendation domains, evaluating proposed solutions, selection of cooperating farmers for on-farm testing and providing feedback to FSR/E workers on the observations of on-farm tests. Working with these groups should greatly facilitate upward flow of communication from farmers to researchers. Moreover, in designing interventions requiring group concensus, effort, and participation (e.g., soil conservation practices, agro-forestry and control of migratory pests such as army worm, striga, seed-borne diseases and bird-locust attacks) the village groups/associations will be important.

C. Goals and Motivations

Farmers, extension services (RDOs), and researchers share many goals. All are concerned with increased agricultural production and farmer income levels. Despite these shared goals, groups have different priorities and time frames for achieving these goals. Individuals further define these priorities in terms of their particular situation.

1. Farmers

Small-scale farmers in Mali are interested in optimizing the opportunities and well-being of the household and production unit. This includes a wide variety of on- and off-farm activities. The first priorities of small farmers are risk minimization and a constant food supply for their families, Maximizing production and producing cash crops are secondary to these goals. Like those elsewhere, Malian farmers are price-responsive and will move in and out of agricultural activities depending on their terms of trade. For example, in the cotton-producing Mali Sud region, low resource farmers have found it uneconomical to produce cotton. Large capital outlays required for inputs and equipment have been unaffordable, since the returns to their investments may take several years to cover

these costs. These farmers do not have a margin that enables them to wait for these returns. They require more immediate results and have in many cases abandoned cotton for other income-generating activities.

Both men and women assign higher priority to food than to cash crops. Both men and women are responsible for food crop production, with men usually also taking responsibility for cash crop production. Women are responsible for producing "safety" crops that serve as the family's food supply during shortage periods. The condiments women produce represent an important contribution to the family's diet. Women are likely to be more risk-averse because of their responsibility for this safety mechanism.

Frequently cash needs are met by non-agricultural activities. Younger people and some not so young see advantages of moving off the farm. Their motivation may be to escape from the central authority structure of the village and family. They may want to make their own decisions and realize profits that accrue to them as individuals. One example, is the many young men who migrate to the Ivory Coast to work as farm laborers. Although they still do farm work, their salary is personal income and the distribution decision is theirs. Employment resulting from migration is an important addition to family income in many areas. For example, among the Soninke in Region I of Mali, family income is derived mainly from off-farm wage labor. Crop or livestock revenues, produced primarily by women, are of secondary importance. haute Vallee, seasonal migration to mine gold has important family income-generating implications.

The farmer must confront many variables and manipulate them to achieve his desired ends while minimizing associated risks. The factors considered to ensure the farmer's primary goal of family well-being may not conform to those considered by the larger economy and organizations operating within it.

2. Research Institutions

There are distinctions between the goals of the action-oriented RDOs and those of the research-oriented IER. The latter is not expected to be financially self-supporting and therefore need not place a high priority on obtaining results having an immediate application.

Within this context, the individual motives of research workers are often similar to those working within the DROs. For example, one major incentive for working in research is that it is salaried and most often associated with urban setting, with the social status that implies for Malians. However, along with a salary comes considerable obligation to provide support to a wide circle of relatives and dependents. Official salaries are uniformly low and generally insufficient to meet such

obligations. An important attraction of salaried jobs, therefore, is the opportunities they offer for other income-producing activities. These are apt to be greatest when one's main job is in a major population center, and involved office work with fixed and relatively short hours.

This means that research workers are unlikely to be attracted to activities requiring long hours in rural settings (researcher-conducted informal interviewing or participant observation, for example,), unless the workers are compensated with monetary or status rewards commensurate with that potentially obtainable with an urban office job. Because the rural setting has little to offer in terms of prestige or supplementary income, these rewards must be attached to the job itself (such as perdiem or access to a vehicle).

Besides the immediate status and material rewards motivating individuals to engage in research work, an important incentive is access to further eduction. Because educational levels are an important marker of social status and a means of obtaining high-status employment, individuals are highly motivated to seek further education. A research job is an excellent way to gain access to opportunities for post-graduate training abroad. However, the current lack of a career ladder in research means that once higher education is obtained, the individual has little incentive to remain in research. The additional education is frequently used to obtain higher-status positions. The result is relatively young, inexperienced researchers who have little reason to make much long-term investment in their research activities.

There is little incentive to build up individual reputations as researchers or to seek approval. Because the system is hierarchically organized with strong centralized authority, peers have no decision-making power over one's professional life (including hiring decision, choice of research agendas, funding, and publications), and nothing is to be gained by distinguishing oneself as original. Research activities are closely supervised from above, and these decisions are made by one's administrative superiors. Success as a researcher comes from following directions from above and gaining approval of superiors.

One possible advantage for FSR is that this system may remove a source of blockage to interdisciplinary research. In the U.S. research system, peer approval plays an important role in one's career advancement, and relevean: peers are most likely to be in one's own discipline; there is therefore little incentive--and there are frequently disincentives--for crossing disciplinary lines. In a system in which peer approval is less important, there are no outright disincentives to interdisciplinary integration, as long as it is mandated from above.

III. SPREAD EFFECTS

The FSR/E project is directed mainly at the researchers. The project's thrust is to increase Malian capacity for FSR/E by providing appropriate expertise and skills and by developing the necessary support institutions.

It is expected that the effects of this efforts will spread to other parts of the research establishment, leading to a better understanding of the FSR/E approach and for more effective fundamental research. A spread effect will also be felt in the RDOs through an understanding of the FSR approach, closer collaboration with the research establishment, and well-adapted technological innovations to deliver to farmer clients. Finally, farmers will be able to make known their perceptions of constraints and problems, and will receive new technologies permitting them to increase their well-being.

A. Participation

Most observers agree that participation of farmers, extension workers, and researchers in an FSR/E project is a key to project success. This is however, little consensus on the exact operational meaning of participation.

1. Farmers

The degree of farmer participation in an FSR effort will be determined in large part by the broad problem area being treated, the type of target population (such as low or high resource farmers, men or women), and the particular stage in the FSR research cycle.

In the diagnostic stage, farmer participation can range from a small sample of farmers responding to formal survey questionnaires to a more active role in which participation is elicited through informal interviews or participant-observation by the researchers. The choice is at least partly a function of the emphasis placed on farmer-perceived constraints and strategies. At the most formal end of the spectrum, farmers provide the information considered significant by researchers (response to survey questions), while increasing amounts of farmer initiated input can occur as the diagnostic tool becomes less formal.

In the elaboration stage, participation of farmers may vary from no involvement at all, to the eliciting feedback on solutions proposed by researchers, to the use of farmer-elaborated solutions as a basis to design.

FSR also includes farmer participation at the testing stage, in the form of on-farm trials. There is wide latitude here for the degrees of researcher supervision and the extent to which farmer

suggestions and reactions are taken into account. At one end of the spectrum, farmers provide only land and some labor for researcher-managed trials, while at the other end, farmers provide all inputs including most of the management.

More farmers will be involved in the extension stage than in any of the others. In this stage, farmer participation is equal to adoption, and is a measure of successful research and extension.

The degree of farmer participation desired determines way in which farmers are selected. As the degrees of participation increases, random selection of farms becomes less feasible, and such factors as articulateness, interest in the project, and willingness to spend time take on greater weight. In more general terms, the more active the farmer participation, the less control researchers will have over variables. This is the case not only in terms of the choice of farmer participants (researcher-determined random sample versus self-selection on the basis of personal attributes and interest), but also in regard to such variables as the testing environment and choice of test fields.

Because farmers are interested in improving their well-being, it is likely that they will be motivated to participate. This incentive will be enhenced if they believe that they have a role in the process. They are usually willing to talk about their ideas, problems, and constraints is someone is interested. It may, however, take special effects to develop sufficient rapport to convince farmers of the usefulness of particpation in FSR/E interventions.

The question of risk and allowing for an insurance program to provide incentives to take risks does not seem to be an issue. Current IER policy does not allow on-farm testing unless there is full assurance of virtually no risk. This translates into small, best-bet tests that have minimal risk factors.

2. Extension

To obtain the full cooperation and commitment from the RDOs, the RDOs should provide support from the beginning. A selected group of field agents will have to be involved in the FSR/E activity. Their selection will most likely be determined by the geographic location of the target group chosen. Field agents, at a minimum, should understand the objective of the research undertaken, since they will be ultimately responsible at the extension stage. They would be the logical source of information regarding the choice collaborating farmers. The relationship between extension agents and farmers is affected by the agents' responsibilities for delivering inputs, marketing produce, and monitoring debt repayment. This relationship can be expected to affect the kinds of information farmers will be willing to give to extension agents.

At the diagnostic stage, participation of the RDO could vary from no involvement, to the setting of initial broad problem areas, to more active participation as part of an interdisciplinary diagnostic survey team. Involvement of field agents could range from no participation to use of key informants for the initial definition of recommendation domains, to active involvement in data collection for survey.

RDOs should be willing to participate in an FSR/E activity to the extent that their problems are addressed. If the cooperation of the directorate is elicited from the beginning. those taks determined appropriate for extension agents in the FSR/E process will becomes a part of their overall job. Some extension agents will have further personal motivation since their position in relation to that of farmers will be enhance due to the availability of useful technical innovations for extension.

3. Researchers

An FSR/E team will normally be composed of sociologists, economists, agronomists, and livestock specialists from DRSPR. Specialists from other IER divisions will be called upon as required by specific settings and problems encountered. The involvement of this interdisciplinary team in the different steps of FSR/E is treated in the Technical Analysis.

There are few incentives for researchers from other divisions within IER to participate in and FSR/E effort. At the same time, there are not outright disincentives to this divisional collaboration if it is mandated from above. To the extent that high-level MOA and IER officials remain convinced thet FSR/E is an effective tool in agricultural research, they will direct research personnel to cooperate with the farming systems unit. This commitment of high-level officials will in turn depend on FSR/E performance. At present, MOA and IER officials appear to have accepted the FSR/E approach on paper, but disenchantment could soon set if useful results are not forthcoming.

One major incentive to participate as a member of the FSR/E team is the access to further training and material benefits provided by the project. Due to the absence of other incentives, the project might devise some special awards to recognize individual researchers.

B. Social Consequences and Benefits

1. Researchers

The most direct beneficiaries o this project will be those researchers who receive post-graduate training in the United States. Once training is completed, these individuals will have much higher level of education and stronger credentials than the average Malian researcher. However, the lack of a career ladder

for researchers means that some may choose to use their credentials to obtain higher-status jobs elsewhere. In this event, the individuals concerned would benefit, but the spread effects to the research establishment, RDOs, and farm population would be aborted.

Alternatively, returning trainees may be placed in administrative positions in the research establishment. In this case, these individiduals would be expected to have considerable influence over subsequent research. However, it is unlikely that they would be directly involved in conducting research, so that some of their acquired research skills would no benefit the system.

If a career ladder for researchers were created, returning trainees could be expected to be placed near its top. In this case, they could be expected to have considerable influence over the research done by others, while continuing to carry out their own.

Related to this issue is the effect of the proposed project on the relative position of various disciplines. The project is in a strong position to reinforce th interdisciplinary nature of FSR/E through the training of more social scientists and their integration into FSR/E units would demonstrate a serious commitment to the input of social scientists and increase the chances of conducting socially sound research. It would also enhance the prestige and attractiveness of becoming a professional social scientist in Mali.

V. RDOs

RDOs will indirectly benefit from this project. Insofar as FSR/E results in the development of technologies to meet the perceived needs of farmers, the DRO concerned will have an acceptable and worthwhile technology to extent. Because farmers will have been involved in the development of the technology from inception, and because care will have been taken to adapt the technology to local concerns, the extension taks should be considerably easier an adoption rates higher than would otherwise be the case.

The DRO will also benefit insofar as successful innovations increase its economic viability. This would occur directly when new technologies are aimed instead at food crops for home consumption, they would increase the food security of farmers and therefore make them willing and able to engage in cash crop production as well.

FSR/E will be situated in the more agricultural productive area of Mali: Regions II, III and V. This means that those regions and RDOs that are already relatively well off will benefit the most. It is possible that if significant strides are made in these regions, particularly if accompanied by further deterioration in other regions (due to continued drought, for example), movements

200

of population into the more favored regions will occur. This could result in a whole new set of problems and constraints.

The disadvantages of favoring relatively more prosperous regions and RDUs and potientially exacerating regional disparities are, however, more than offset by the need to establish FSR credibility through initial sucessess. To maximize the long-run spread effects of FSR research, it should be conducted initially in areas and with RDOs in which the chances of immediate successes are greatest.

3. Farmers

The ultimated beneficiaries of the innovations to be developed by an effective FSR program will be farmers. In principle, the FSR effort will be directed primarily at low-resource farmers and will result in the development of innovations responding to their perceived needs. If this happens, income disparities within the farming community will be decreased, while the overall well-being of the rural population is increased. If, however, participation in the FSR effort is limited primarily to relatively prosperous farmers, then increases in agricultural productivity will be achieved at the cost of further increasing rural income disparities.

It will be necessary to make a special effort to include women in the project. Failure to consider them may result in mi ed opportunities for developing highly useful innovations. Moreo , focus on male agricultural activities could result in a deterioration of women's relative status in the farm community and household.

Large numbers of rural Malians migrate seasonable or over the long term in search of incomes to augment or replace farming incomes. Some of these individuals would prefer to remain in their communities to farm if they could expect an adequate income. If the FSR effort is successful in developing innovations that significantly enhance farmer incomes, one set of beneficiaries would be migrants who gain the possibility of returning home to farm as a feasible option.

ECONOMIC ANALYSIS

I. Introduction: The Policy Context

Mali is one of the six poorest countries in the world, with an annual per capita income averaging about $200. The economy is based almost entirely on agriculture. The sector accounts for up to 75 percent of foreign exchange receipts from exports, employment for about 85 percent of the active population, and about 40 percent of the gross Domestic Product (GDP). The approximately 900,000 tons of foodgrain produced on an annual basis account for approximately 70 to 75 percent of the country's food requirements.

Following independence in 1960, the Government of Mali pursued a set of policies intended to lead to the socialist transformation of the economy. The state assumed control of most of the country's banking activities, foreign trade, and large industrial concerns. In the agricultural sector, grain prices were fixed at low levels, internal grain marketing was ceded to public monopolies, and an attempt was made to collectivize agricultural production. Industrial and infrastructural development were given greater emphasis than agricultural production. The policies were not successful in attaining the objectives. Agricultural producers did not respond to the political incentives and supply stagnated (Table 1). The rate of urban migration picked up.

Drought conditions in the late 1960's and early 1970's also had a negative effect on the productivity of the agricultural sector. Crop production in Mali is largely dependent on the highly variable rainfall which characterizes the Sahel, and millet and sorghum production levels were lower in 1971-73 than they had been at independence. While substantial external resources flowed into Mali after 1974, and many of them were directed to increasing agricultural production, food supply has continued to be problematic. First, drought years have reoccured since 1974. Second, many of the "old" policies on prices and state control of input and product markets continued to discourage farmers from increasing their production. Third, many of the technological innovations introduced with the external resources turned out to be less well-suited to Malian conditions than has been anticipated.

By 1980, however, the Malian government began to formulate plans for broad economic reform and initiated important policy changes in public finance, management of public enterprises, and agriculture. Public marketing monopolies were reconsidered. The markets for coarse grains were liberalized and the official prices for these commodities were substantially increased. Measures were taken to curtail public expenditures, many of which involved disbanding or restructuring of indebted parastatal enterprises. The government also restrained public sector wage

increases and improved its collection of taxes. In 1982, Mali obtained a one-year stand-by loan from the IMF to help pull the economy out of its financial difficulties. The agreement included further reform of public finances.

By late 1983, it was generally agreed that the reform had produced positive results in terms of overall fiscal health. The government deficit had been reduced from about 17 billion MF in 1980 to about 10 billion MF in 1982. Internal arrears were reduced by 25 percent and external arrears, by 80 percent. In December, 1983, Mali entered into another agreement with the IMF and is expected to further consolidate recent achievements. The government has also successfully completed the negotiations to rejoin the West African Monetary union. The balance of payments deficit and internal and external arrears remain at high levels. However, if the improvement made during the 1980-82 period continues, Mali will reach a balance of payments equilibrium and come close to eliminating its arrears by 1986.

This continued progress assumes, first, that the program of grain marketing liberalization which the Government has embarked upon has the expected effect of stimulating local production and, second, that the restructuring of public enterprises (which involves, among other things, considerable reductions in public sector employment) can be accomplished in such a way that political stability is maintained while economic efficiency is increased. Poor weather cannot be ruled out as a possibility which might have a significant retarding effect on such reforms. Nevertheless, there is a definite sense that an efficiently functioning open market system, with the Government of Mali is striving to establish, will help to ensure that, at the farm level, production incentives are enhanced as farmgate price levels rise and farm level taxes are reduced. Implicity, such price incentives should also have the effect of increasing farmers' capacity to use, and their demand for, new technologies which will help them to increase production and/or productivity in their farming operations.

II. The Role of Agricultural Research

The purpose of agricultural research is to supply technologies which meet this demand. Perhaps the major contribution of the farming systems approach to agricultural research lies in its focus on defining "technology demand" at the farm level and in communicating this demand to the scientist-"suppliers".

One measure of agricultural research effectiveness, then, is the rate at which the technologies developed are in fact "bought" by farmers. Another measure is the gains which farmers realize when they use these technologies. Still another is the net benefit which society as a whole (consumers as well as producers) realize from the utilization of these new technologies.

203

Estimation of the magnitude of benefits which can be attributed to agricultural research conducted to date in Mali is difficult. Statistics are poor--both on the costs of doing the research and on the value of benefits realized--and do not permit even ex post calculation of an internal rate of return or other quantitative indicators of benefits. There is even a strong possibility that, given the relatively low rates of adoption of new technologies and the stagnant or declining crop yields (Table 1), agricultural research in Mali has not had a production effects are apparent and could, with better data, be measured (Table 2). From the CMDT region; for example, there are indications that cotton research has had a significant effect on both farm-level output and on national incomes.

The design of the Second Mali-Sud Development project (which will be implemented largely by the CMDT) explicitly recognizes such benefits derived from earlier research. Just over 13 percent of the project's 1984-1990 funding--about a million dollars a year--will be used to continue such research. The development of improved cotton varieties continues to be an important component of the research program, but the project design also emphasizes the development of cost-effective input packages (particularly focussing on the possibilities of substituting rock phosphates for imported fertilizers).

Varietal development clearly builds on earlier research success in the area. In 1975-76, the researchers at the N'Tarla Station released an improved variety, B-163, for planting in the CMDT zone. Since then, average yields have consistently exceeded one ton/hectare. In the few years just after the release of this variety, overall production grew steadily. Both yield and gross production increases were sustained by concomitant increases in official farmgate prices for cotton. However, in the 1977-81 period, input prices increased nearly four times as much as product prices and farmers' exposure to cash risks increased so considerably that, as the Mali-Sud project Appraisal Report says, it caused "a drop in both the number of farmers growing cotton and the average acreage of cotton per farm" (p.9). The realization that input prices were so critical has in part, therefore, led to the emphasis on research into increasing the efficiency of input use as well as on varietal development. One investigative approach being used is the farming systems research work being done by the DRSPR in the Sikasso-Bougouni region. (See Annex A Technical Analysis for more detailed discussion of this research effort.) It is equally important for the researchers to be able to offer farmers complementary technologies which will increase their economic returns per hectare as well as to provide them high-yielding seeds.

Assessment of the benefits of agricultural research outsides of Mali support the more qualitative conclusions on the efficacy of research in the CMDT zone just described. Those assessments which actually attempt to measure quantitatively the benefits of agricultural research are generally those done in an ex post

204

fashion. Looking back permits the evaluator to take into account the lag between the time the research is initiated and the time the results are visible on farmers' fields--estimated in the U.S. to be about six to seven years. It also permits the evaluator to use actual numbers rather than projections and to allow for the effects of other intervening factors, such as the price changes noted above in the CMDT case, in calculating the internal rate of return associated with a specific research expenditure.

While the internal rates of return to agricultural research investments calculated by such ex post examinations differ considerably, the general conclusion of virtually all of them is that agricultural research pays (Norton and Davis, 1979). Economic returns to particular agricultural research activities typically exceed 26 percent per year and frequently are greater than 40 percent (World Bank, 1980; Evenson et al., 1979). These high levels have been used as powerful arguments for significantly greater investments in agricultural research in general (Wise, n.d.). Accepting this general conclusion as well as the evidence of experience with a cash export crop in Mali, can it then be accepted that the proposed FSR/E project will realize a similar rate of return?

III. THE ECONOMIC BENEFIT OF THE FSR/E PROJECT

The economic pay-off of this Farming Systems Research/Extension project will be derived in two ways:

1. Through the development of technologies which will lead to increases in the production and productivity of the agricultural sector; and

2. Through the better specification of research problems and priorities which will lead to increased efficiency in the overall use of agricultural research resources.

As the mechanisms by which these benefits are generated are different, the relevant behavorial assumptions and their possible effects on the direction and magnitude of the two types of project-related benefits are considered separately. The levels of tangible benefits which are required to cover the costs of the project are shown to relatively easily attainable at the farm level. The efficiency gains from better specification of research problems cannot be quantified, however. They are, therefore, posited here to be an "extra" intangible benefit which will offset the costs of undertaking this project.

The Technology-Production Benefit.

The specific agricultural production/productivity problems to be addressed by the DRSPR researchers with the resources provided by this project will be determined in the research process itself. As is more fully discussed in the Technical Analysis, however, it is likely that, given current knowledge of the two zones into

which farming systems research will be expanded under this project, the following types of technology are likely to receive considerable emphasis:

a. technologies which increase or maintain soil fertility;

b. development and adaptation of seed varieties (which are both drought tolerant and pest resistant as well as high-yielding and have acceptable cooking qualities) and related agronomic practices; and

c. technologies which support the more effective use of animal traction both as a substitute for labor and as a complement to other inputs (fertilizer, water) and the better integration of crop and livestock activities.

The benefits of improvements in these types of technologies will be measured in increased yield levels or in maintenance of present yield levels. In each case, the benefit stream will only be sustained if other conditions hold: extension services deliver the information about the technologies to an adequate number of farmers; inputs are available and the terms of trade (inputs - products) are favorable; and product markets are not completely inelastic or shrinking. Assuming that these conditions do hold, one can then project yield or adoption levels which will be sufficient to cover the costs of the project, appropriately discounted.

If all the costs of the FSR/E project were to be covered by the gains brought about by the introduction of new technologies which increased yield, for example, it can be estimated that, in the Operation Haute Vallée area, an annual increase of two percent per year after year five on about 60 percent of the land planted to sorghum, millet, and maize would amply cover the costs of the OHV FSR/E research and one-third of the DRSPR headquarters establishment and operating costs. In the OMM area, yield increases would have to be around 2 percent per year on about 25 percent of the cultivated millet land from project year eight to year 20, in order to provide a net benefit in excess of project costs, discounting the net benefit at 10 percent.

Alternatively, if one projects that, without such new technologies, yield levels will decline at, say, one-half percent year, then the costs of the FSR/E project in the OHV area for example, would be more than amply compensated by the losses avoided were the project to introduce new technologies which simply permit farmers to maintain yields at present levels. Tables 3 and 4 present the details on these and other scenarios. The conclusion of these prospective analyses is that project costs could readily be covered by very reasonable rates of adoption of technologies which provide significant, although far from spectacular, increases in productivity.

Benefits could also be measured in terms of lowered costs of production either for the same or greater volumes of output. This would probably be a logical measure for many types of animal traction-related technologies, for example. Decreasing input costs per unit of output is particularly critical in land- or labor-short situations. If in Mali, for instance, the same levels of sorghum production could be obtained with half the labor input (which accounts for a significant portion of variable production costs), by increasing the efficiency of animal power used, changes total sorghum supply would be an inadequate measure of benefit to the labor-saving technology. The "excess" labor released by applying the technology to sorghum production could, however, be devoted to other enterprises--both on and off-farm--and it would be the return to this labor which would be the relevant measure of benefit.

Realization of either of these benefit streams as the result of FSR/E project activity assumes that not only researchers have demonstrated in a controlled environment (on-station) that the technologies developed can result in hypothesized levels of increases but, further, that they will have demonstrated that similar increases can be obtained under farmers' conditions. It further assumes that consumers will continue to demand the products being grown and price signals will be both transmitted and received in such a way that rational economic behavior at the farm level results.

In general, it is likely that the benefits of most agricultural technology improvements in Mali will be differentially distributed among four different groups in society:

a. Those producers who adopt the new technology;

b. Those producers whose do not adopt the new technology but are high cost producers. They will not be able to compete with those adopting the new technology and therefore likely to leave farming;

c. Those producers who are low cost producers and continue to produce under traditional conditions, without adopting the new technology; and

d. Consumers.

It is hypothesized that this FSR/E project will result in disproportionate benefits to the first group--the adopting farmers. These are essentially the kinds of benefits already discussed--due to yield-increasing, yield-maintaining, or cost-lowering technological innovations. However, it is also anticipated that, by careful specification of recommendation domains and experimentatl efforts to identify and adapt technologies appropriate to each, the FSR/E project will, to a greater extent than other agricultural research efforts, attempt

to ensure that a majority of farmers are adopters or potential adopters. Indeed, this is the essence of the farming systems approach to research.

In the long run, consumers should also be able to benefit by the incremental surplus generated by the use of yield-increasing and/or cost-lowering technologies. Both types of technologies will have the effect of pushing consumer prices down unless demand is perfectly elastic (which is not likely to be the case).

Farmers who are presently low-cost producers and do not adopt any of the new technologies might suffer some absolute loss if prices decline significantly due to greater supplies being available from adopting-producers. Given the possibilities for enterprise diversification and for export of production in Mali, however, it is unlikely that such a situation would occur. It is more likely that the impact of research on this group of farmers would be fairly neutral.

It is more difficult to predict the potential benefits or losses which will accrue to the farmers presently producing at high cost levels who, for some reason, are unable to adopt the new technologies developed and tested at the farm-level under this project. On the one hand, the freeze on public sector employment and the job cutbacks associated with the restructuring of public enterprises might indicate that alternative employment opportunities for farmers who could not produce at competitive levels would be limited. Their unemployment would then be a cost--or negative benefit--to the project. On the other hand, the encouragement of private sector expansion might indicate that opportunities in Mali could be expected to grow as private entrepreneurs begin to invest in productive ways. In this case, the displaced farmers (and their family labor forces) could be expected to find employment elsewhere. Overall efficiency in the agricultural sector would be improved as they left it; the net economic effect, it is still too early to say which of these is the more likely scenario.

The benefits of Increased Efficiency of Research.

A footnote to the World Bank's Sector Policy Paper on Agricultural Research Systems suggests that the estimated rates of return to research just presented in the body of the text (and quoted above) may have been biased upward for several reasons. One which appears to be particularly relevant in West Africa is that "cost of research failures--'dry holes'--may not have been properly calculated". As Eicher and Baker note, "Although research on plant breeding, agronomic practices and mechanization has been extensive, African agriculture is less mechanized and has been less affected by new technologies than other areas of the world. There has been a long history of research recommendations being rejected by farmers and endless debates

208

about the need to reorganize national research systems" (Eicher and Baker, 1982, p. 113).

There have apparently been many "dry holes" to date. Is there any reason to expect that this FSR/E project can help to avoid some of these in the future--thus generating a benefit by increasing overall efficiency of agricultural research expenditures in Mali? There are several reasons to believe that it can:

1. One of the oft-mentioned reasons for farmers' rejection (or non-adoption) of agricultural research recommendations is that they do not respond to farmers' real problems.

Weeding labor, for example, is a critical constraint to increased yields in much of the Sahel. Each day of delay in weeding is related to a decline in yields; ICRISAT analysis in Niger estimates that millet yields are depressed by as much as nine kg per day weeding is delayed. It is, therefore in farmers' interests to maximize the return to this scarce input. Many do so by intercropping--planting two or three crops on the same field. Average returns per day of labor expended in the weeding, "labor bottleneck", period are higher using this practice that they are on fields planted in only one crop (Norman et al..., 1982,p.54).

Yet, until quite recently, virtually no improved technologies were recommended for the intercropping situation. Instead, new technologies were developed which assumed sole cropped field and he y fertilizer use, Both of these practices, when adopted, can have the effect of exacerbating the present labor bottleneck which occurs at weeding time even more.

Interestingly, through farming systems research conducted elsewhere (at the Institute for Agricultural Research in Zaria, Nigeria), the total yield of improved intercropping systems has also been repeatedly demonstrated to be equal to or greater than those of improved sole cropping. More productive use of land, it would seem, is more understandable to many agricultural scientists than farmers' labor shortages. The potential yields gains per hectare have thus brought intercropping into the research agenda. There is a good chance that the recommendations which will flow from this research are likely to be considerably more attractive to farmers than recommendations strictly limited to sole crop situations. Among other things, they have lead to higher returns to and a more efficient allocation of peak season (weeding) labor.

2. Another oft-mentioned reason for low rates of recommended technology adoption is that such recommendations do not take adequate account of farmers' risks.

The farming systems research carried out by the SAFGRAD/FSU team in Upper Volta, for example, demonstrated that, under farmers'

production conditions, use of the relatively high recommended doses of rock phosphate and urea (200 and 50 kg/ha, respectively) would involve a probability of cash loss to 78 percent of farmers in one village and a 100 percent chance of cash loss in another. This was so even though yields were, on average, substantially higher under fertilized than under non-fertilized conditions (FSU, 1983, p. 74,75).

3. Still another reason frequently cited for low rates of farmer adoption of recommended technologies is the difference in physical resources (soil, water) available to the researchers on-station as compared to those available to farmers in their own fields.

A "yield gap" has come to expected when station-based results are compared to those on-farm, but the actual size of the gap is often unknown. Further, the reasons for it are often poorly-understood. The on-farm trials carried out in farming systems research efforts are one way, however, to come to quantitative grips with the gap--and to suggest, in concrete terms, ways in which it can be narrowed. In some cases, the recommendations simply need further specification of soil and/or water requirements to reach projected yield potential.

An evaluation of groundnut production in Mali from the early 1970's to 1982, for example, showed (after the project had collapsed) that certain improved 120 day varieties were being introduced in areas where the probability of the crop receiving less than its water requirements were 50 percent or better (Amselle et al, 1982). A few on-farm trials accompanied by discussions with producers might have detected and avoided this situation--which resulted in reports of farm families eating the "improved" seed (or selling it) and continuing to grow lower-yielding, but more reliable, local varieties.

The state of the art for quantifying the benefits of such efficiency gains, however, is considerably less developped than it is for measuring technology-production benefits (Klein and Kehrberg, 1981)... It is expected that the AID/S&T/AGR Farming Systems Support project will be looking into this in future. Nevertheless, given the Sahel's poor record of agricultural research impact to date, its many small agroecological zones, and the substantial social and economic differences among farming systems research, such as that proposed to be conducted in this FSR/E project, can only be positive.

IV Conclusion

The analyses above support the potential returns to proposed expenditures on agricultural research efforts in Mali. However, it is important to note again that increased research expenditures alone will not result in increased agricultural

210

productivity. The results of research investments to date have been mixed, illustrating both the promise of well-designed and targeted agricultural research for the long run and the difficulties of achieving anticipated results. On the one hand, cotton research has led to impressive results. Malian cotton farmers obtain among the highest yields in Sub-Saharan Africa, and rank among the most techologically advanced in production of this crop. In contrast, the record for food crops, on which research has begun more recently, has continued to deteriorate in most regions, with declining yields and relatively slow or no overall growth in production. Although improved technical packages for food crops are promoted by virtually all regional development organizations, most farmers have not adopted them.

Farming systems research was recognized in the Government of Mali's Five-Year Plan as having an important role in improving the cost-effectiveness of investments in agricultural research. In this approach to research, the diagnostic stage is specifically focussed on identifying farmers' problems and learning farmers' priorities. Technologies selected for testing are those that offer the best chance for increasing benefits to farmers, and these technologies are usually tested under farmers' conditions. In short, this project, by emphasizing the expansion of the farming systems research effort in Mali, has the potential:

-- to develop the recommendations and extension themes on new technologies which can make farming systems more profitable and productive; and

-- to make an agricultural research system more cost effective by helping to focus that research on farmers' priority concerns.

REFERENCES FOR THE ECONOMIC ANALYSIS

Amselle, Jean-Loup et al. Evaluation de la Filière Arachide au Mali: Mission d'Evaluation. Ministere des Relations Extérieures, Coopération et Développement, October, 1982.

Development Alternatives, Inc. Contribution to a Project Paper entitled Mali Farming Systems Research and Extension, Dec. 1983.

Eicher, Carl and Doyle C. Baker. Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey. MSU International Development Survey Development Paper No. 1, 1982.

Evenson, R.E., Waggoner, P.E. and V.W. Ruttan "Economic Benefits from Research: An example from Agriculture", Science, 205, pp. 741-799, 1979.

FSU (Farming Systems Unit) 1982 Annual Report: Farming Systems Research Unit in Upper Volta, Purdue/SAFGRAD, May 1983.

ICRISAT/Economics Unit Report on 1982 Research. Niamey, 1983. (mimeo)

Klein, K.K. and E.W. Kehrberg. "The Use of an Information Possibility Frontier to Evaluate an Applied Animal Breeding Research Project," Canadian Journal of Agricultural Economics, 29 July, 1981, pp. 141-158.

Ministère de l'Agriculture. Rapport Annuel, Campagne Agricole. 1982-1983.

Norman, D.W., Simmons, E.B. and H.M. Hays. Farming Systems in the Nigerian Savanna: Research and Strategies for Development. Westview Press, 1982.

Norton, George and Jeff Davis. "Review of Methods used to Evaluate Returns to Agricultural Research," Staff Paper Series P79-16, University of Minnesota, Dept. of Agricultural and Applied Economics, May 1979.

Wise, W.S. "The Theory of Agricultural Research Benefits." (unknown journal tearsheet, n.d.)

World Bank. Agricultural Research Systems - Sector Policy Paper, Report No. 2966, Washington, D.C.: April 18, 1980.

World Bank. Staff Appraisal Report: Second Mali-Sud Rural Development Project, Report No. 4064-MLI, September, 1983.

212

Table 1. Production of Major Cereal Grains in Mali, 1960 - 1983
Total Output in '000 Metric Tons

Year	Millet and Sorghum	Maize	Rice (Paddy)	Total Foodgrain
1960	833	65	160	997
1961	828	70	145	988
1962	867	88	200	1079
1963	863	100	189	1080
1964	946	107	192	1172
1965	880	88	162	1068
1966	809	101	162	1010
1967	830	98	160	1027
1968	757	91	94	906
1969	913	73	119	1060
1970	756	84	168	944
1971	691	87	171	884
1972	624	44	116	740
1973	660	63	130	804
1974	800	100	250	1055
1975	800	70	218	1005
1976	900	80	237	1127
1977	800	50	199	973
1978	1000	55	251	1211
1979	943	64	165	1109
1980	654	73	165	829
1981	871	70	175	1050
1982	793	95	129	968
1983				
Annual average	784	76	165	962

Table 2. Cotton Production, 1960 - 83, Mali-Sud Region Only

Year	Total Output ('000 mt)	Yields (mt/ha)	Average cost per ha ('000 MF)	Net revenues per ha ('000)
1960	9	.28	n.a.	n.a.
1961	10	.26	n.a.	n.a.
1962	18	.32	n.a.	n.a.
1963	24	.32	n.a.	n.a.
1964	31	.36	n.a.	n.a.
1965	21	.36	n.a.	n.a.
1966	28	.50	n.a.	n.a.
1967	41	.53	n.a.	n.a.
1968	48	.59	n.a.	n.a.
1969	54	.76	n.a.	n.a.
1970	57	.79	n.a.	n.a.
1971	70	.85	9.4	30
1972	72	.82	10.1	32.7
1973	55	.75	11.5	24.5
1974	71	.89	n.a.	n.a.
1975	105	1.15	21.2	65.7
1976	133	1.09	18.5	63
1977	114	1.11	30.4	70.2
1978	133	1.12	33.3	70.2
1979	151	1.23	34	103.7
1980	110	.99	41.1	72.9
1981	98	1.15	52.6	90.4
1982	129	1.23	n.a.	n.a.

Sources: Ministere de l'Agriculture, Rapport Annuel, Campagne Agricole, 1982 - 1983. and World Bank. Staff Appraisal Report, Mali-Sud Rural Development Project, 1983.

*214

Table 3. Summary of Cost-Benefit Indicators
Various Assumptions regarding Adoption of Technologies
for Sorghum/Millet Production
Two Discount Rates

Technology Scenario	Level of Adoption	Benefit-Cost Ratio 10%	Benefit-Cost Ratio 12%	Net Present Worth of Net Benefit 10% ($'000)	Net Present Worth of Net Benefit 12% ($'000)
BETTER-YIELDING TECHNOLOGY (e.g., soil fertility improvements leading to small but gradual improvements in yield/hectare: varietal improvement, leading to larger but on-time increase in yield/hectare)					
1% yield increase annually	Operation Haute Vallee region[a]				
	A: 10% of land improved each year after project year (PY) 5; maximum of 40% of land using new technology after PY 9	1.06	0.73	226	-826
	B: 10% of land improved each year after PY 5; 60% of land using new technology after PY 11	1.55	1.04	1809	131
15% one-time yield increase	C: 10% of land planted to new variety in PY 5; 20% thereafter	0.86	0.70	-453	-9[illegible]
	D: 10% of land planted to new variety in PY 5; 20% in PY 6; 30% in PY 7; 40% thereafter	1.57	1.26	1897	257
	Operation Mil-Mopti region[b]				
2% yield increase annually	A: 10% of land improved each year after PY 8; maximum of 40% of land using new technology after PY 11	1.78	1.[illegible]	2207	25[illegible]
	B: 5% of land improved each year after PY 8; maximum of 25% of land using new technology after PY 12	1.15	0.70	395	-[illegible]
3% yield increase annually	C: Same as case B	1.71	1.09	1995	231

Table 8 (cont). Summary of Cost-Benefit Indicators

Technology Scenario	Level of Adoption	Benefit-Cost Ratio 10%	Benefit-Cost Ratio 12%	Net Present Worth of Net Benefit 10%	Net Present Worth of Net Benefit 12%
YIELD-MAINTAINING TECHNOLOGY					
Avoid 0.5% annual decline in average yields	Operation Haute Vallee	2.12	1.61	3692	1879
	Operation Mil-Mopti	n.c.	n.c.[c]	3290	1472
Avoid 0.25% annual decline in average yields	Operation Haute Vallee	1.07	0.92	247	-557
	Operation Mil-Mopti	n.c.	n.c.	288	-519
AREA-EXPANDING TECHNOLOGY (e.g., more efficient use of animal traction equipment to permit same number of workers to cultivate larger area of land)					
	Operation Haute Vallee region only				
20% increase over "base ha" per household[d]	1500 farm households increase area cultivated in PY 5; 1500 more each year do the same -- up to a maximum of 6000 households in and after PY 8 (max is assumed to be half of equipped farmers)	1.18	0.93	604	-224
25% increase over "base ha" per household	Same rate of adoption	1.47	1.16	15[illegible]	484
30% increase over "base ha" per household	A: Same rate of adoption as above	1.77	1.39	2556	1192
	B: Slower rate of adoption, 1000 farm households each year after PY 5, up to a maximum of 4000 after PY 8	1.10	0.93	604	-224

SOURCE: Table 4, manipulated with SuperCalc

a. In OHV region, hectarage cultivated each year is assumed to grow at 2% -- roughly the rate of growth in the labor force.
b. In the OMM region, hectarage cultivated is not assumed to grow throughout the period as it appears presently to be close to the maximum.
c. Not calculated.
d. "Base Ha" are average areas of sorghum/millet cultivation per household for the region as a whole.

216

:: B :: C :: D :: E :: F :: G :: H :: I :: J :: K :: L :: M :: N :: O :: P :: Q :: R :: S :: T :: U :: V :: W :: X :: Y :

4. Three Scenarios for Returns to FSR/E Research: Various Assumptions about Possible Improvements in Millet and Sorghum Production
Stream of Benefits to the Year 2004 (20 Years Post-Project Initiation)

ar year		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total
t year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Data:																						
t.on rate		1.05	1.050000	1.102500	1.157625	1.215506	1.276282	1.340096	1.407100	1.477455	1.551328	1.628895										
unt factors	10%		.909	.826	.751	.683	.621	.564	.513	.467	.424	.386	.35	.319	.29	.263	.239	.218	.198	.18	.614	.149
	12%		.893	.797	.712	.636	.567	.507	.452	.404	.361	.322	.287	.257	.229	.205	.183	.163	.146	.13	.116	.104
price ($/kg)		.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667	.1466667
price ($/kg)		.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059	.2647059
ata:																						
osts in current $		159.4	337.4	412.4	460.4	412.4	412.4	460.4	187.4	112.4	160.4											
costs in current $		149.66	256.5267	250.46	231.7933	152.46	145.7933	175.1267	45.79333	52.46	65.12667											
al OMV costs ($000)		339.966	653.3194	729.146	761.4126	621.346	614.0126	699.0794	256.5127	181.346	248.0793	0	0	0	0	0	0	0	0	0	0	5104.22
c. contingency,no inflation)																						
osts in current $		0	0	190	317	[illegible]	428.78	428.78	508.78	128.78	128.78											
costs in current $		149.66	256.5267	250.46	231.7933	152.46	145.7933	175.1267	45.79333	52.46	65.12667											
al OMM costs ($000)		164.626	282.1794	484.506	603.6726	819.764	632.0306	664.2974	610.0307	199.364	213.2973	0	0	0	0	0	0	0	0	0	0	4673.768
c. contingency,no inflation)																						
NPV of Gross Cost,10%		309.0291	539.6418	547.5896	520.0448	385.[illegible]	[illegible] 346.3031	358.6277	119.7914	76.89[illegible]	95.75862											
NPV of Gross Cost,10%		149.6450	233.0502	363.8640	412.3084	509.[illegible]	[illegible].4653	340.7846	284.8843	84.5[illegible]	82.33277	0	0	0	0	0	0	0	0	0		3299.532
NPV of Gross Cost,12%		303.5896	520.6955	514.1520	484.2584	352.3[illegible]	[illegible].3044	315.9839	103.6311	65.4[illegible]	79.88155	0	0	0	0	0	0	0	0	0	0	2816.968
NPV Of Gross Cost,12%		147.0110	224.8970	344.9883	383.9358	464.8[illegible]	0.4395	300.2624	246.4524	71.[illegible]	68.68174	0	0	0	0	0	0	0	0	0	0	2573.425

917

30:SCENARIO ONE: BETTER YIELDING TECHNOLOGY
31:....in Operation Haute Vallee Region

32:OHV base has. ('000)		105.5																					
33:w/out proj ha inc	.02	107.61	109.7622	111.9574	114.1966	116.4805	118.8101	121.1863	123.6101	126.0823	128.6039	131.1760	133.7995	136.4755	139.2050	141.9891	144.8289	147.7255	150.6800	153.6936	156.7675		
34:w/proj ha inc	10%/40%	0	0	0	0	11.64805	23.52907	35.64770	48.00871	50.43291	51.44156	52.47040	53.51980	54.59020	55.68200	56.79564	57.93156	59.09019	60.27199	61.47743	62.70698		
35:	10%/60%					11.64805	23.52907	35.64770	48.00871	60.61693	77.16235	78.70559	80.27971	81.88530	83.52301	85.19347	86.89734	88.63528	90.40799	92.21615	94.06047		
36:																							
37:																							
38:OHV base yield(rq/ha)		1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003	1003		
39:w/project:																							
40:annual yld increas	.01	0	0	0	0	1013.03	1023.160	1033.392	1043.726	1054.163	1064.705	1075.352	1086.105	1096.966	1107.936	1119.015	1130.206	1141.508	1152.923	1164.452	1176.096		
41:one time yld inc	.15	0	0	0	0	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45	150.45		
42:																							
43:Gross ben w proj ($000)																							68/60
44:A:ann yld/40% max						17.13506	69.57178	158.8989	286.7618	378.4444	465.5474	556.7944	652.3408	752.3473	856.9801	966.4111	1080.818	1200.384	1325.300	1455.761	1591.972	11815.47	
45:B:ann yld/60% max						17.13506	69.57178	158.8989	286.7618	454.8645	698.3211	835.1916	978.5112	1128.521	1285.470	1449.617	1621.227	1800.576	1987.950	2183.642	2387.957	17344.22	
46:C:once/20% max						257.0259	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	8044.911	
47:D: once/40% max						257.0259	519.1924	786.6021	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	15334.50	
48:																							
49:NPW of Gr ben 10%,Case A						10.64087	39.23848	81.51512	133.9178	160.4604	179.7013	194.8780	208.0967	218.1807	225.3858	230.9723	235.6183	237.6761	238.5540	893.8375	237.2038	3525.877	1.068599
50:NPW of Gr ben 10%, Case B						10.64087	39.23848	81.51512	133.9178	192.8626	269.5519	292.3171	312.1451	327.2711	338.0787	346.4584	353.4275	356.5141	357.8310	1340.756	355.8056	5108.331	1.548199
51:NPW of Gr ben,10%,Case C						159.6131	292.8245	266.3457	242.4628	220.1376	200.4083	181.7173	165.6224	150.5658	136.5476	124.0870	113.1839	102.8001	93.45463	318.7841	77.35966	2845.914	.8625207
52:NPW of Gr ben, 10%,Case D						159.6131	292.8245	403.5269	494.7212	449.1687	408.9130	370.7760	337.9359	307.2144	278.6117	253.1871	230.9405	209.7533	190.6848	650.4471	157.8447	5196.163	1.574818
53:NPW of Gr ben, 12%, Case A						9.715580	35.27289	71.82229	115.8518	136.6184	149.9063	159.8000	167.6516	172.2875	175.6809	176.8532	176.1733	175.2561	172.2890	168.8683	165.5650	2229.812	.7295218
54:NPW of Gr ben,12%, Case B						9.715580	35.27289	71.82229	115.8518	164.2061	224.8594	239.7000	251.4774	258.4313	263.5214	265.2798	264.2600	262.8841	258.4335	253.3025	248.3476	3187.366	1.042895
55:NPW of Gr ben,12%,Case C						145.7337	263.2305	234.6750	209.7537	187.4284	167.1799	149.0082	133.4324	118.8951	106.4344	95.01220	84.62836	75.80209	67.49501	60.22631	53.99601	2152.931	.7044320
56:NPW of Gr ben, 12%,Case D						145.7337	263.2305	355.5442	427.9815	382.4290	341.1140	304.0364	272.2555	242.5935	217.1688	193.8629	172.6757	154.6666	137.7168	122.8858	110.1735	3844.068	1.257766
57:																							
58:Gross benefit-Gross Cost ($'000)																							
59:Case A:		-339.966	-653.319	-729.146	-761.413	-604.211	-544.441	-540.180	30.24913	197.0984	217.4681	556.7944	652.3408	752.3473	856.9801	966.4111	1080.818	1200.384	1325.300	1455.761	1591.972	6711.248	
60:Case B:		-339.966	-653.319	-729.146	-761.413	-604.211	-544.441	-540.180	30.24913	273.5185	450.2418	835.1916	978.5112	1128.521	1285.470	1449.617	1621.227	1800.576	1987.950	2183.642	2387.957	12240.00	
61:Case C:		-339.966	-653.319	-729.146	-761.413	-364.320	-94.8203	-179.887	262.6797	337.8484	271.1130	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	519.1924	
62:Case D:		-339.966	-653.319	-729.146	-761.413	-364.320	-94.8203	87.52277	802.8474	878.0141	811.2808	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	1059.360	
63:NPW,Case A, 10%		309.029	-539.642	-547.589	-520.045	-375.215	-307.065	-277.113	14.12634	83.56973	83.94268	194.8780	208.0967	218.1807	225.3858	230.9723	235.6183	237.6761	238.5540	893.8375	237.2038	226.3452	
64:NPW, Case B, 10%		-309.029	-539.642	-547.589	-520.045	-375.215	-307.065	-277.113	14.12634	115.9719	173.7933	292.3171	312.1451	327.2711	338.0787	346.4584	353.4275	356.5141	357.8310	1340.756	355.8056	1808.800	
65:NPW,Case C, 10%		-309.029	-539.642	-547.589	-520.045	-226.243	-53.4786	-92.2820	122.6714	143.2469	104.6496	181.7173	165.6224	150.5658	136.5476	124.0870	113.1839	102.8001	93.45463	318.7841	77.35966	-453.617	
66:NPW,Case D, 10%		-309.029	-539.642	-547.589	-520.045	-226.243	-53.4786	44.89918	374.9298	372.2780	313.1544	370.7760	337.9359	307.2144	278.6117	253.1871	230.9405	209.7533	190.6848	650.4471	157.8447	1896.631	
67:NPW, Case A,12%		-303.590	-520.696	-519.152	-484.258	-342.588	-276.032	-244.162	12.22065	71.15253	70.02472	159.8000	167.6516	172.2875	175.6809	176.8532	176.1733	175.2561	172.2890	168.8683	165.5650	-826.653	
68:NPW, Case B, 12%		-303.590	-520.696	-519.152	-484.258	-342.588	-276.032	-244.162	12.22065	98.74019	144.9779	239.7000	251.4774	258.4313	263.5214	265.2798	264.2600	262.8841	258.4335	253.3025	248.3476	131.1000	
69:NPW, Case C, 12%		-303.590	-520.696	-519.152	-484.258	-206.569	-48.0739	-81.3089	106.1226	121.9625	87.29840	149.0082	133.4324	118.8951	106.4344	95.01220	84.62836	75.80209	67.49501	60.22631	53.99601	-903.334	
70:NPW, Case D, 12%		-303.590	-520.696	-519.152	-484.258	-206.569	-48.0739	39.56029	324.3504	316.9631	261.2324	304.0364	272.2555	242.5935	217.1688	193.8629	172.6757	154.6666	137.7168	122.8858	110.1735	787.8027	

.... in Operation Mil-Mopti region

1 base ha.('000) 290.177																							
out project no increase	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	290.177	
roj ha imp 10%/40%	0	0	0	0	0	0	0	29.0177	58.0354	87.0531	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	116.0708	
5%/25%	0	0	0	0	0	0	0	14.50885	29.0177	43.52655	58.0354	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	72.54425	
base yield(kg/ha)	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	541	
roj yield inc .02	0	0	0	0	0	0	0	551.82	562.8564	574.1135	585.5958	597.3077	609.2539	621.4389	633.8677	646.5451	659.4760	672.6655	686.1188	699.8412			
ess ben w/proj ($000)																							
10% max ha imp @10%/yr	0	0	0	0	0	0	0	46.04916	186.0386	422.7865	759.1863	958.5666	1161.935	1369.370	1580.954	1796.770	2016.902	2241.436	2470.462	2704.067			
5% max ha imp @5%/yr	0	0	0	0	0	0	0	23.02458	93.01929	211.3933	379.5931	599.1041	726.2091	855.8562	988.0962	1122.981	1260.564	1400.898	1544.039	1690.042			
of Gr ben,Case A,10%	0	0	0	0	0	0	0	21.50496	73.88036	163.1556	265.7152	305.7828	336.9610	360.1443	377.8480	391.6958	399.3465	403.4585	1516.863	402.9061	5024.302	1.783595	
of Gr ben,Case B,10%	0	0	0	0	0	0	0	10.75248	39.44018	81.59780	132.8576	191.1142	210.6006	225.0902	236.1550	244.8099	249.5916	252.1616	948.0396	251.8163	3074.027	1.091254	
of Gr ben,Case A,12%	0	0	0	0	0	0	0	18.60386	67.15993	136.1373	217.8865	246.3516	266.0830	280.7208	289.3146	292.8734	294.4676	291.3867	286.5735	281.2230	2968.782	1.153631	
of Gr ben,Case B,12%	0	0	0	0	0	0	0	9.301929	33.57997	68.06863	108.9432	153.9698	166.3019	175.4505	180.8216	183.0459	184.0423	182.1167	179.1085	175.7644	1800.515	.6996572	
ess Benefit - Gross Costs:																							
se A: yld inc on 40%	-164.626	-282.179	-484.506	-603.673	-819.764	-632.031	-664.297	-563.982	-13.3254	209.4892	759.1863	958.5666	1161.935	1369.370	1580.954	1796.770	2016.902	2241.436	2470.462	2704.067			
e B: yld inc on 25%	-164.626	-282.179	-484.506	-603.673	-819.764	-632.031	-664.297	-587.006	-196.345	-1.90408	379.5931	599.1041	726.2091	855.8562	988.0962	1122.981	1260.564	1400.898	1544.039	1690.042			
Case A, 10%	-149.645	-233.080	-363.864	-412.308	-5[illegible]73	-356.465	-340.785	-253.379	-5[illegible]797	80.86262	265.7152	305.7828	336.9610	360.1443	377.8480	391.6958	399.3465	403.4585	1516.863	402.9061	2207.334		
Case B, 10%	-149.645	-233.080	-363.864	-412.308	-[illegible]	-356.465	-340.785	-274.132	-4[illegible]702	-.734977	132.8576	191.1142	210.6006	225.0902	236.1550	244.8099	249.5916	252.1616	948.0396	[illegible].8163	257.0587		
Case A, 12%	-147.011	-224.897	-344.968	-383.936	-4[illegible]	320.440	-300.262	-227.849	-[illegible]47	67.45551	217.8865	246.3516	266.0830	280.7208	289.3146	292.8734	294.4676	291.3867	286.5735	281.2230	395.3572		
Case B, 12%	-147.011	-224.897	-344.968	-383.936	-4[illegible]	320.440	-300.262	-237.150	-[illegible]04	-.613115	108.9432	153.9698	166.3019	175.4505	180.8216	183.0459	184.0423	182.1167	179.1085	175.7644	-772.909		

219

SCENARIO TWO: A YIELD MAINTAINING TECHNOLOGY

.... In Operation Haute Vallee region

Base yield assuming decline of:

.0025%/yr fr current	1000.493	997.9913	995.4963	993.0075	990.5250	988.0487	985.5786	983.1147	980.6569	978.2052	975.7597	973.3203	970.8870	968.4598	966.0386	963.6235	961.2145	958.8114	956.4144	954.0234			
Value of loss ($'000)	39.57537	80.63284	123.2141	167.3619	213.1200	260.5334	309.6480	360.5110	413.1707	467.6768	524.0799	582.4321	642.7867	705.1983	769.7229	836.4178	905.3418	976.5550	1050.119	1126.098			
w/out project = Value of benefit with project																							
NPW of Gr be,10%	35.97401	66.60273	92.53379	114.3082	132.3475	146.9408	158.8494	168.3586	175.184[illegible]	180.5232	183.4280	185.7958	186.4081	185.4672	183.9638	182.3391	179.2577	175.7799	644.7733	167.7886	3546.624	1.074	
NPW of Gr ben, 12%	35.34081	64.26437	87.72344	106.4422	120.8390	132.0904	139.9609	145.6464	149.1546	150.5919	150.4109	149.6851	147.1982	144.5656	140.8593	136.3361	132.1799	126.9522	121.8138	117.1142	2499.174	.8177	
Gross ben-Gross cost	-300.391	-572.687	-605.932	-594.051	-408.226	-353.479	-389.431	103.9983	231.8247	219.5975	524.0799	582.4321	642.7867	705.1983	769.7229	836.4178	905.3418	976.5550	1050.119	1126.098			
NPW of net ben,10%	-273.055	-473.039	-455.055	-405.737	-253.508	-199.362	-195.778	48.56721	98.29369	84.76462	183.4280	185.7958	186.4081	185.4672	183.9638	182.3391	179.2577	175.7799	644.7733	167.7886	247.0922		
NPW of net ben,12%	-268.249	-456.431	-431.424	-377.816	-231.464	-179.214	-176.023	42.01532	83.68873	70.71039	150.4109	149.6851	147.1982	144.5656	140.8593	136.3361	132.1799	126.9522	121.8138	117.1142	-557.091		

.... In Operation Mil-Mopti region

Base yield assuming decline of:

.0052%/yr fr current	538.295	535.6035	532.9255	530.2609	527.6096	524.9715	522.3467	519.7349	517.1363	514.5506	511.9778	509.4179	506.8708	504.3365	501.8148	499.3057	496.8092	494.3252	491.8535	489.3943			
Value of loss ($'000)	0	0	0	0	0	0	0	905.0261	1015.624	1125.669	1235.163	1344.110	1452.513	1560.373	1667.694	1774.478	1880.729	1986.448	2091.639	2196.303			
w/out project = Value of benefit with project																							
Gross ben-Gross cost	-164.626	-282.179	-484.506	-603.673	-819.764	-632.031	-664.297	294.9954	816.2598	912.3713	1235.163	1344.110	1452.513	1560.373	1667.694	1774.478	1880.729	1986.448	2091.639	2196.303			
NPW of net ben, 10%	-149.645	-233.080	-363.864	-412.308	-509.073	-356.465	-340.785	137.7629	346.0942	352.1753	432.3071	428.7712	421.2286	410.3781	398.5788	386.8363	372.3843	357.5607	1284.266	327.2492	3290.372		
NPW of net ben,12%	-147.011	-224.897	-344.968	-383.936	-464.806	-320.440	-300.262	119.1781	294.6698	293.7835	354.4918	345.4363	332.6254	319.8764	305.1880	289.2400	274.5864	258.2382	242.6301	228.4156	1472.040		

220

ARIO THREE: AREA EXPANDING TECHNOLOGY
(in Operation Haute Vallee Region)

ha sq/al	30	3.587	3.65874	3.731915	3.806553	3.882684	3.960338	4.039545	4.120335	4.202742	4.286797	4.372533	4.459984	4.549183	4.640167	4.732970	4.827630	4.924182	5.022666	5.123119	5.225582	
oject increase		.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	
of farmers						1000	2000	3000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	
of addtl sq/al ha		0	0	0	0	1164.805	2376.203	3635.590	4944.403	5043.291	5144.156	5247.040	5351.980	5459.020	5568.200	5679.564	5793.156	5909.019	6027.199	6147.743	6270.698	
s ben w/proj ($'000)		0	0	0	0	171.3566	349.5553	534.8195	727.3546	741.9017	756.7397	771.8745	787.3120	803.0582	819.1194	835.5018	852.2118	869.2561	886.6412	904.3740	922.4615	11733.53	
of Gr ben 10%		0	0	0	0	106.4087	197.1492	274.3624	339.6746	314.5663	292.1015	270.1561	251.1525	232.8869	215.4284	199.6849	185.7822	172.1127	159.5954	555.2856	137.4468	3903.794	1.183136
of Gr ben 12%		0	0	0	0	97.15580	177.2245	241.7384	293.8513	267.8265	243.6702	221.5280	202.3392	183.9003	167.9195	152.8968	138.9105	126.9114	115.2634	104.9074	95.93599	2831.979	.9266142
s ben-Gross cost		-339.966	-653.319	-729.146	-761.413	-449.995	-264.457	-164.260	470.8419	560.5557	508.6604	771.8745	787.3120	803.0582	819.1194	835.5018	852.2118	869.2561	886.6412	904.3740	922.4615	6629.312	0
of net ben, 10%		-309.029	-539.642	-547.589	-520.045	-279.447	-149.154	-84.2653	219.8832	237.6756	196.3429	270.1561	251.1525	232.8869	215.4284	199.6849	185.7822	172.1127	159.5954	555.2856	137.4468	604.2624	
of net ben, 12%		-303.590	-520.696	-519.152	-484.258	-255.147	-134.080	-74.2454	190.2201	202.3606	163.7886	221.5280	202.3392	183.9003	167.9195	152.8968	138.9105	126.9114	115.2634	104.9074	95.93599	-224.286	

231

FINANCIAL ANALYSIS

Overview

The overall cost of the FSR/E project described here, including a ten percent contingency allowance and assuming five percent annual inflation (from a 1984 base), is estimated to be $20.4, of which AID will contribute $19.1 million. million. AID will contribute about 75 percent of the anticipated recurrent costs and almost 100 percent of the infrastructure, technical assistance, and training costs of the project. The Government of Mali will provide 25 percent of recurrent expenditures to be incurred under this project. An additional, but unquantified, contribution to the project's implementation will be made by the GRM in the form of already established public agricultural research infrastructure which will be used by DRSPR. Personnel employed in other IER Divisions and research organizations will also work in project activities on a collaborative basis; their salaries have not been attributed to project costs.

Further unquantified contributions to project activities will be made by the regional development organizations which will collaborate with project-supported researchers and by the farmers who will participate in village-level research activities.

Tables 1 and 2 present the detailed breakdowns of the capital (infrastructure, technical assistance, training) and recurrent budgets. Summaries of these budgets are provided in Tables 3 and 4. Table 5 is a consolidated budget for the project as a whole, organized by project component. Details on all items of capital and recurrent expenditures are specified for each of the components: expansion of of farming systems research/extension; improved coordination and linkages; and training.

The proposed funding levels reflect detailed consideration of three principal issues:

1. future recurrent financing capability of the GRM;

2. appropriateness of the level of expenditures compared to similar IER research activities; and

3. appropriateness of the levels of expenditure compared to results expected.

Overall, the project level of project funding is about 18 percent higher than anticipated in the PID. For comparison purposes, all costs in the summary table below are given in current dollars, and are classified according to the budget categories used in the PP.

Comparison of PID and PP Budget Proposals, by Budget Category

(in $'000 -- 1983/84 dollars)

	PID level	PP level
Capital Budget:		
Technical assistance	5800	6040
Training	1575	1836
Commodities	750	1433
Construction	1310	1039
Recurrent Budget:		
Salaries, allowances	1074	1793
Vehicle POL, maintenance	459	323
Office supplies	--	210
Rents, utilities, building maintenance	162	248
Expendable research supplies	63	592
Cooperative research	600	612
Publication expenses	250	155
Evaluations	500	480
Total	12543	14761

The Capital Budget: Infrastructure, Technical Assistance, and Training

Nearly 60 percent of the capital budget will provide 35 person years of long-term full-time technical assistance resident in Mali and some 60 months of short-term, part-time professional input both in the U.S. and Mali. Just over 16 percent of the capital budget will provide long-term training opportunities for 19 Malians and 32 short courses or observation/[illegible] opportunities as well as substantial numbers of individual workshops, seminars, etc. Vehicles, at just under [illegible] the capital budget, will give the research s[illegible] for village-level work; about 13 percent [illegible] supply office space and equipment and station-based housing DRSPR and DRA. The remaining funds (six percent) will [illegible] for the acquisition of research equipment, principally [illegible] puters for data management and analysis.

The infastructure investments to be underwritten by this propo[illegible] will be one of three types: buildings, equipment, or vehicles. [illegible] general, the level of infrastructure investment proposed would seem to represent a major increase for IER, which according to their 1983 budget, spends about $100,000 annually on buildings and equipment for DRSPR in its CMDT area research. The overall

223

annual expenditure on such fixed investments under this project will be $247,000 in current dollars (without allowing for inflation or contingencies). This amount, however, will establish a new headquarters and two new field units for DRSPR as well as an expansion of an existing regional sub-station, the Kopor PAR. The average infrastructure cost per DRSPR program of field research is thus projected to remain roughly at the 1983 level. The development of the cost estimates was as follows:

Buildings: All buildings have been costed at current standard GRM rates for local construction. The designs will be controlled by the GRM as the new buildings will be placed in close proximity to others already on the stations. The standard of construction will be established in consultation with the Mission engineer and will be monitored continuously by the Mission engineering office with the assistance of an independent construction coordinator and A & E supervisor who be employed by AID for this purpose. These locally-hired technical assistance costs have been included in the Construction budget in Table 1.

It should be noted that the GRM has agreed to finance the costs of two senior professional houses at Sotuba. It is the GRM policy to house as many researchers as possible on-station. In order to keep AID's costs down in this regard, the GRM agreed to provide enough additional financing to enable all six senior and middle-level Malian professionals who will work in the DRSPR headquarters and in the OHV field unit to live on-station.

Equipment: The equipment which will be purchased under this project will be of two types: specialized research equipment and general office furnishings. In addition, project funds will be used to constitute a DRSPR library (which it does not now have) and to add to the general IER collection those materials relevant to research conducted under the project. The field equipment category will include both measuring equipment (scales, balances, tapes, area measurement devices) and agricultural equipment (carts, experimental cultivation and threshing equipment) which will be needed for the research program. Microcomputers, peripherals, and software will be acquired for DRSPR office use, both at headquarters and in the regional field offices. The specific hardware and software requirements will be determined in the first year of the project by a short-term data processing/statistician consultant who will take into consideration the issues and project data requirements laid out in Annex A. At a present cost of roughly $10,000 per microcomputer set-up (based on recent Mission acquisitions), it has been estimated that three systems will be initially acquired and will be supplemented or replaced with slightly more powerful systems during the course of the project. None of these systems were included in the PID, which accounts for the significant difference in this category.

224

Vehicles: Vehicles purchased with project funds will be a mix of four-wheel drives (probably Toyota Land-Cruisers, see waivers), ordinary cars (e.g. Peugeot 504's), pick-up trucks (either Toyota or Peugeot), motorcycles and mobylettes. All of these vehicles can be purchased and serviced locally and are compatible with the present vehicle fleet of DRSPR. All have proven records of cost-effective operation in Mali. EAch vehicle will be replaced every fourth year.

The costs of <u>technical assistance</u> have been estimated at a straight $150,000 per year. This is the present Mission planning figure for relocating a professional from a U.S. residence to one in Mali and supporting this person and dependents under an institutional contract for a term of at least two years. The determination of the number and the qualifications of technical assistance personnel was made on the basis of considerations of IER staff capabilities, the project's objectives, and Mission management requirements rather than on strictly financial considerations. This analysis is presented in the Technical Analysis, Annex ___. The number of person-years of technical assistance has been increased from the PID level of 28 years to to total of 35 person-years. The increase is largely due to the addition of a full-time financial manager for six person-years and due to a more detailed assessment of the potential Malian staffing situation.

The long-term <u>training costs</u> have been estimated to be $1,700 per month, with an M.S. program lasting on average 30 months and a Ph.D. program 42 months. Each of these courses of study is expected to be preceded by a ten-month period of English training; this training will be conducted locally in Mali, at a cost of $500 per month. Short courses are budgeted at $10,000 each, which is about what recent trainees at ICRISAT and IITA have required. Observation/study tours, both in the U.S. and other African countries, are estimated to cost about $7,500. Again, this level is consistent with current air fare and per diem rates in Africa. It will allow for trips of up to [illegible] weeks. If shorter trips are taken, then the number of opportunities offered will be increased.

<u>The Recurrent Budget</u>

Recurrent expenditures will account for approximately [illegible] of total FSR/E project costs. Forty percent of recurrent expenses will be allocated for salaries and allowances [illegible] and travel), nearly 14 percent for collaborative research and student research interns, 19 percent for expendable research and office supplies, 10 percent for evaluations, almost 6 percent for rental of temporary office space and long-term maintenance and utilities for the newly-constructed buildings, and 3.[illegible] percent for publications.

225

The Government of Mali and AID will share responsibility for recurrent project expenses, with AID picking up all of the expenses of project evaluation and collaborative research (which is, by definition, "additional" to the present program of commodity research) and with the GRM assuming greater responsibility with regard to salaries in all years and normal operating expenses in the last three years of the project. Overall, AID will be responsible for about 90 percent of recurrent expenses in the first seven years of the project. After this, the GRM share will rise to about 27 percent and AID's will fall to 73 percent.

Project operating expenses will rise gradually throughout the life of the project, starting at about $275,000 per year (current dollars) and levelling out at approximately $450,000 per year when activities in both expansion zones are fully underway. In 1983, DRSPR reported annual budgeted expenditures of approximately $250,000 on personnel and operating costs, of which 77 percent was covered by external financing. This level of recurrent expenditure is expected to be required to sustain the DRSPR/Sikasso effort. It is also anticipated that Dutch assistance will be extended at approximately the current levels; there are some indications, however, that the Canadian assistance may be terminated in two or three years. For this reason, the FSR/E operating budget includes an allocation of $50,000 per year beginning in year 3 of this project to permit the present level of activity to be maintained by the Sikasso field unit.

The level of recurrent expenditure for DRSPR as a whole, therefore, will be roughly doubled in the short term (as the new OHV area field unit is added) and increased by about 60 percent more as the third zone activity is undertaken. AID's assistance will be initially slightly more than proportional (when compared to the prsent sharing of recurrent expenditures by the GRM and donors) but will decline to a relatively lower level in year 7 of the project life.

Cost Estimation

Procedures for estimating recurrent expenses involve a combination of experience and guesswork. Assumptions and methods of calculation for each budgetary category are considered separately below.

Salaries and Allowances: Scales for salaries, incentives, and travel used are included in Table 2. These are the scales currently being applied by the GRM, according to the policies laid out in Decree No. 151 of August 1975 and standard agreements made with donors associated with internationally-financed projects (see annexed documents). The Stand-By agreement with the IMF has enforced a wage freeze which is expected to be retained for the near future, although continued market price

liberalization may contribute to a push for increased wages somewhere down the road. It is unlikely, however, that nominal wage increases exceeding the project five percent annual inflation rate will be granted, so the overall estimation . the budget should not be affected.

USAID/Mali has recently given considerable attention to the matching of incentive payments with performance standards in its implementation of the Livestock II project. Such performance standards will also be formulated by FSR/E project staff and DRSPR management as this project moves into implementation phases.

Vehicles , POL and Maintenance: Cost estimates for this category were based upon the following set of assumptions:

-- Four wheel drive vehicles are expected to be used for 30,000 km per year, use 20 liters of gasoline per 100 km at a cost of 520 MF per liter.

-- Two wheel drive vehicles (pick ups and sedans) were assumed to also cover 30,000 km a year, using only 14 liters of gas per 100 km, again at a cost of 520 MF per liter.

-- Motorcycles are expected to used for 10,000 km of travel, with one liter of gas per 25 km.

-- Mobylettes will cover 6,000 km per year and use one liter of gas per 35 km.

A flat rate of $8,000 per year has been allowed for repairs and maintenance after year 1 (when only $5,000 is allowed). Each vehicle is scheduled to be replaced (from the capital budget every fourth year.

Office Supplies: Field units have been allotted $10,000 annually for office supplies (paper, stencils, etc.) and the quarters $5,000. Publication expenses are separately [illegible]

Rents, Utilities, and Building Maintenance: These costs have been estimated on the basis of present USAID experience in Bamako. Region V costs are higher than Bamako as it is [illegible] that electricity costs (using an individual generator) and shipping costs for maintenance materials will be higher.

Expendable Research Supplies: This category will cover the costs of inputs used in on-farm trials -- seeds, fertilizers, veterinary medicines, etc. -- in all areas. The amount for the CMDT zone is higher as this funding will also cover some of the items included in office supplies for the other field units.

Cooperative Research and Studies: The budgeted levels here are fairly arbitrary but should be adequate to permit substantial programs of research to be mounted in each zone. Specific items to be covered will be specialized equipment or inputs used for the trials, travel, and labor for these studies.

Evaluations: Programmed for years 4, 7, and 10, the evaluation budgets will permit up to ten person-months per evaluation. This is roughly in line with USAID/Mali's experience for other major evaluations.

Some Policy Considerations

Many of the judgements made above and in the economic analysis with regard to the reasonability of the proposed levels of project financing assume that the GRM will hold steady on the policy reforms it has already initiated. Specifically, it is assumed that the GRM will continue to:

1. maintain national budgetary control;

2. reduce public employment and increase its effectiveness; and

3. liberalize foodgrain markets, recognizing the importance of producer price incentives to long-term increases in food supply.

The implications of these policy reforms for the FSR/E project are several. First, IER now receives more than half of its budget from external aid, a very small amount from internal cash generations (selling of seeds and produce from demonstration plots), and the balance from the national budget. While the national budget contribution to IER has grown from year to year, much of the increase has gone to personnel costs for a growing staff. IER, as a government agency, has been under an obligation to recruit a share of the current year's graduates. The consequences of this lack of flexibility in allocating its budgetary resources is apparent in examination of past year's budget requests and receipts. In 1979, for example, IER requested a budget of 1.4 billion MF, 530 million of which were to be used for personnel costs, 532 million, for operating costs, and 369 for investments. The level of funding approved was 903 million MF, with nearly all the cuts taken from the operating cost request and the investment budget request. Actual receipts by IER in 1979 were 743 million MF, with still further cuts being made in the non-personnel categories. In the end, 518 million (out the requested 530) went to pay salaries; less than 70 million (out of 369 million requested) were released for research investments, and only 159 million (out of the 532 requested) were left for operating costs.

This situation is probably not untypical for more recent years. National budget constraints ensure that requests will not be fully met; the IER staff already on board will ensure that only extra allocations will be available for increasing operating costs and improving the research infrastructure. However, by reducing the number of graduates which must be hired each year, the demands on the additional budget resources will be gradually reduced and IER's overall capacity to rely less on external finances for operating and investment costs may increase. Until that time, the GRM could only expand its operating cost contributions for one project (such as the FSR/E project) at the expense of its contributions to others.

At the present time, with no overall increase in national budgetary resources, therefore, it is the Mission's judgement that IER cannot commit itself to financing non-salary recurrent expenditures or to the payment of salaries for additional employees. It is only over the long-term, as the national financial situation improves, and as the policy on restricting mandatory recruitment is more vigorously implemented, that IER's abilities will increase in this regard. One of the factors, of course, which is expected to improve the national income is the increased agricultural production arising in response to improved producer price incentives. As is discussed at some length in the Project Paper for the Cereals Marketing Restructuring (Section 206) project, it is USAID/Mali's view that such price incentives are critically important to stimulating long-term agricultural growth.

It is the premise of this project that new technologies for production are also needed to stimulate agricultural growth. As the economic analysis points out, there is [illegible] to believe that even modest rates of adoption of technologies developed and adapted to farmers' conditions through this project's activities will generate a stream of benefits adequate to cover the additional research costs to the GRM which this project will incur.

TABLE 1. CAPITAL COSTS: TECHNICAL ASSISTANCE, TRAINING, CONSTRUCTION, AND COMMODITIES (IN $'000)

ANNEX D

	PHASE ONE			PHASE TWO				PHASE THREE			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOT.
TECHNICAL ASSISTANCE:											
Research manager	0	150	150	150	150	150	150	0	0	0	6040.0
Financial manager	0	150	150	150	150	150	150	0	0	0	900.0
Data processing/statistician	0	150	150	150	150	150	150	0	0	0	900.0
Agronomist, Region II, OHV	0	112.5	150	150	0	0	0	0	0	0	450.0
Agricultural economist, Region II, OHV	0	112.5	150	150	150	150	150	37.5	0	0	900.0
Agronomist, Region V	0	0	0	0	150	150	150	150	0	0	600.0
Agricultural economist, Region V	0	0	0	0	150	150	150	150	0	0	600.0
Financial systems set-up	165	85	0	0	0	0	0	0	0	0	250.0
Unallocated short-term assistance @$15,000/month	90	90	90	90	80	50	20	10	10	10	540.0
TRAINING:											
Master's Degrees (30 mos. * $1700/mo.)											1836.4
DRSPR- 7	10.2	30.6	61.2	81.6	91.8	61.2	20.4	0	0	0	357.00
DRA-2	10.2	20.4	30.6	20.4	20.4	0	0	0	0	0	102.00
IPR -1	10.2	20.4	20.4	0	0	0	0	0	0	0	51.00
CAA - 3	10.2	30.6	51	40.8	20.4	0	0	0	0	0	153.0
PhD's (42 mos. @ $1700/mo.):											
DRSPR - 3	0	0	0	10.2	40.8	61.2	61.2	40.8	0	0	214.20
DRA -2	0	10.2	20.4	30.6	40.8	20.4	20.4	0	0	0	142.80
IPR-1	0	0	10.2	20.4	20.4	20.4	0	0	0	0	71.40
Short-term:											
Courses, e.g., six-month @ $10,000	20	20	20	20	20	20	20	20	0	0	160.00
Language training, @$5,000	20	15	25	20	15	0	0	0	0	0	95.0
Observation tours @$7,500	15	15	15	15	15	15	15	15	0	0	120.00
In-country workshops, seminars, etc.	20	30	20	20	20	20	20	20	20	20	210.00
Participant training coordination	0	20	20	20	20	20	20	20	20	0	160.00

230

TABLE 1. CAPITAL COSTS: TECHNICAL ASSISTANCE, TRAINING, CONSTRUCTION, AND COMMODITIES (IN $'000)

ANNEX D

	PHASE ONE			PHASE TWO				PHASE THREE			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
COMMODITIES:											
Vehicles:											
DRSPR/HQ: 4 WD (2)											1415.00
passenger car	30	0	0	30	0	0	30	0	0	30	120.00
pick up	15	0	0	15	0	0	15	0	0	15	60.00
mobylette	12	0	0	12	0	0	12	0	0	12	48.00
DRSPR/OHV: 4 WD (2)	1	0	0	1	0	0	1	0	0	1	4.00
pick up (1)	30	0	0	30	0	0	30	0	0	30	120.00
motorcycles (2)	12	0	0	12	0	0	12	0	0	12	48.00
mobylettes (8)	2	0	0	2	0	0	2	0	0	2	8.00
DRSPR/Region V: 4 WD (2)	4	0	0	4	0	0	4	0	0	4	16.00
pick up (2)	0	0	0	0	30	0	0	30	0	0	60.00
motorcycles (2)	0	0	0	0	24	0	0	24	0	0	48.00
mobylettes (8)	0	0	0	0	2	0	0	2	0	0	4.00
DRA/SRCVO: 4 WD (1)	0	0	0	0	4	0	0	4	0	0	8.00
	15	0	0	15	0	0	15	0	0	15	60.00
Research Equipment											
Computers	30	0	0	20	20	0	0	0	20	0	90.00
Computer software, upgrading	3	3	3	3	3	3	3	3	3	3	30.00
Field Equipment	25	0	0	25	25	0	25	50	0	25	175.00
Office Equipment:											
DRSPR/HQ and OHV	30	0	0	30	0	0	30	0	0	0	90.00
DRSPR/Region V	0	0	0	0	20	0	0	20	0	0	40.00
Reference Books/Journals	40	2	10	2	20	2	10	2	10	2	100.00
[illegible]hings											
DRSPP/HQ and OHV Offices	0	30	30	0	0	0					60.00
State housing, Bawako	0	0	26	0	0	0					26.00
Koporo Station housing	0	0	20	20	0	0					40.00
Fifth Region Generators	[illegible]	0	0	25	0	0					25.00
Fifth Region housing	[illegible]	0	0	50	25	0					75.00
Fifth [illegible]		0	40	50	0	0					60.00

TABLE 1. CAPITAL COSTS: TECHNICAL ASSISTANCE, TRAINING, CONSTRUCTION, AND COMMODITIES (IN $'000)

ANNEX D

			PHASE ONE			PHASE TWO				PHASE THREE			
			FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
CONSTRUCTION:													1056.50
DRSPR HQ and OHV Office													
Office, 350 m2 @$290			20	40	42	0	0	0					102.00
Professional housing, 2 x 110 m2 @ $290		(AID)	20	23.8	20	0	0	0					63.80
Professional housing, 2 x 110 m2 @ $290		(GRM)**	20	23.8	20	0	0	0					63.80
Staff housing, 2 x 80 m2 @ $290			10	20	16.4	0	0	0					46.40
Kooro Station Development:													
Office addition, 50 m2 @ $360			8	10	0	0	0	0					18.00
Professional Housing, 2 x 110 m2 @ 360			10	30	30	9	0	0					79.00
Staff Housing, 3 x 80 m2 @ $290			10	30	20	10	0	0					70.00
Guest house, 110 m2 @ 360			0	15	15	10	0	0					40.00
DRSPR, Region V:													
Office construction, 250 m2 @ $360			0	0	30	42	0	0					72.00
Professional Housing, 4 x 110m2 @$360			0	0	50	80	30	0					160.00
Staff housing, 6 x 80m2 @ $290			0	0	50	70	20	0					140.00
Guest house, 110m2 @$360			0	0	20	20	0	0					40.00
Garages 50 m2 @$360			0	0	0	10	10	0					20.00
Construction coordinator			10	10	10	10	10	0					50.00
A&E Services, Supervision		.1	9.8	19.26	31.34	25.1	6	0					91.50
Sub-Total			737.60	1319.06	1617.54	1741.10	1553.60	1193.20	1286.00	635.80	83.00	181.00	10347.90
Contingency	.10		73.76	131.91	161.75	174.11	155.36	119.32	128.60	63.58	8.30	18.10	1034.79
Inflation	1.05		40.57	148.72	280.46	412.74	472.15	446.38	575.88	333.92	50.34	125.21	2886.39
TOTAL			851.93	1599.69	2059.76	2327.95	2181.11	1758.90	1990.48	1033.30	141.64	324.31	14269.08

** The Government of Mali will provide financing for this investment from its own resources. All others will be financed under the project by AID.

ABLE 2. RECURRENT EXPENSES BUDGET

ANNEX D

	Per Person..... Monthly rates in $ salary	incentive	Annual travel	ANNUAL COSTS IN DOLLARS FOR Years 1 through 7 (1985-1991) GRM	AID	ANNUAL COSTS IN DOLLARS FOR Years 8 through 10 (1992-1994) GRM	AID	RECURRENT PROJECT COSTS ($00 Total GRM	Total AID	Grand Total
ALARIES										
DRSPR Headquarters				57600	76280	134280	75380	928.44	865.04	1793.48
Professional Staff										
Director	450	125	1120	5400	2620	5400	2620	54.00	26.20	80.20
Assistant Director	350	150	1120	4200	2920	4200	2920	42.00	29.20	71.20
Statistician	350	120	0	4200	1440	4200	1440	42.00	14.40	56.40
Support Staff								.00	.00	.00
Accountants (2)	250	30	0	3000	3720	5100	1620	36.30	30.90	67.20
Data specialist	250	100	0	0	4200	2100	2100	6.30	35.70	42.00
Secretary/typist (2)	150	30	0	1800	2520	3060	1260	21.78	21.42	43.20
Admin. Asst.	500	40	0	0	6480	4200	2280	12.60	52.20	64.80
Procurement Asst.	300	40	0	0	4080	2520	1560	7.56	33.24	40.80
Warehouseman	150	30	0	0	2160	1260	900	3.78	17.82	21.60
Drivers (3)	100	20	560	1200	5160	2880	3480	17.04	46.56	63.60
Messenger	50	30	0	0	960	420	540	1.26	8.34	9.60
Guards (2)	50	30	0	600	1320	1020	900	7.26	11.94	19.20
DRSPR/OHV Office										
Professional Staff										
Agronomist	350	130	900	4200	2460	4200	2460	42.00	24.60	66.60
Economist	350	1[illegible]	900	4200	2460	4200	2460	42.00	24.60	66.60
Livestock specialist	350	[illegible]	900	4200	2460	4200	2460	42.00	24.60	66.60
Sociologist	350	1[illegible]	900	4200	2460	4200	2460	42.00	24.60	66.60
Research Assistants (2)	250	10	900	6000	4200	6000	4200	60.00	42.00	102.00
Moniteurs (8)	150	7[illegible]	0	14400	6720	14400	6720	144.00	67.20	211.20
Support Staff										
Data specialist	250	100	0	0	4200	2100	2100	6.30	35.70	42.00
Accountant	250	30	0	0	3360	2100	1260	6.30	27.30	33.60
[illegible]	150	[illegible]	0	0	2160	1260	900	3.78	17.82	21.60
Messenger	50	30	0	0	960	420	540	1.26	8.34	9.60
Drivers (3)	[illegible]	[illegible]	540	0	6300	2520	3780	[illegible].56	55.44	63.00
Guard	[illegible]	[illegible]	0	0	960	420	540	[illegible].26	8.34	9.60

TABLE 2. RECURRENT EXPENSES BUDGET

ANNEX D

	Per Person..... Monthly rates in $ salary	incentive	Annual travel	ANNUAL COSTS IN DOLLARS FOR Years 1 through 7 (1985-1991) GRM	AID	ANNUAL COSTS IN DOLLARS FOR Years 8 through 10 (1992-1994) GRM	AID	RECURRENT PROJECT COSTS Total GRM	Total AID
DRSPR/Region V Office:				(Yrs. 5- 7)					
Professional Staff									
Agronomist	350	80	900	4200	1860	4200	1860	25.20	11.16
Economist	350	80	900	4200	1860	4200	1860	25.20	11.16
Livestock specialist	350	80	900	4200	1860	4200	1860	25.20	11.16
Sociologist	350	80	900	4200	1860	4200	1860	25.20	11.16
Research Assistants (2)	250	60	900	6000	3240	6000	3240	36.00	19.44
Moniteurs (8)	150	40	0	14400	3840	14400	3840	86.40	23.04
Support Staff									
Accountants (2)	250	0	0	3000	3000	4200	1800	21.60	14.40
Data specialists (2)	250	60	0	0	7440	4200	3240	12.60	32.04
Typist	150	0	0	0	1800	1260	540	3.78	7.02
Messenger	50	0	0	0	600	420	180	1.26	2.34
Drivers (3)	100	0	540	0	5220	2520	2700	7.56	23.76
Guards (2)	50	0	0	600	600	840	360	4.32	2.88
Warehouseman	150	0	0	0	1800	1260	540	3.78	7.02

BLE 2. RECURRENT EXPENSES BUDGET

ANNEX D

	Per Person..... Monthly rates in $ salary	incentive	travel	Annual	ANNUAL COSTS IN DOLLARS FOR Years 1 through 7 (1985-1991) GRM	AID	ANNUAL COSTS IN DOLLARS FOR Years 8 through 10 (1992-1994) GRM	AID	RECURRENT PROJECT COSTS ($0 Total GRM	Total AID	Grand Total
					(in thousands of U.S. dollars)						
HICLE POL, MAINTENANCE											
DRSPP/HQ					0	9.4(a)	2.82	6.58	8.46	85.54	94.00
DRSPP/OHV					0	14.5(a)	4.35	10.15	13.05	130.95	144.00
Region V					0	14.5(b)	4.35	10.15	13.05	130.95	144.00
FICE SUPPLIES											
DRSPP/HQ					0	5	1.5	3.5	4.50	45.50	50.00
DRSPP/OHV					0	10	3	7	9.00	91.00	100.00
Region V					0	10(d)	3	7	9.00	51.00	60.00
NTS, UTILITIES, BUILDING MAINTENANCE											
DRSPP/HQ and OHV Rents					0	9.6(c)	0	0	.00	28.80	28.80
DRSPP/HQ and OHV Maintenance, Utilities					0	12	3.6	8.4	10.80	109.20	120.00
Region V					0	16.5(d)	4.95	11.55	14.85	84.15	99.00
EXPENDABLE RESEARCH SUPPLIES											
OHV					0	12	3.6	8.4	10.80	109.20	120.00
Region V					0	12(d)	3.6	8.4	10.80	61.20	72.00
COOPERATIVE RESEARCH, STUDIES											
with DRA					0	30	0	30	.00	300.00	300.00
with DMA, PIRT, INRZFH					0	30	0	30	.00	300.00	300.00
with IPR					0	1.2	0	1.2	.00	12.00	12.00
[illegible] EXPENSES											
Research Journal					0	10	3	7	9.00	91.00	100.00
[illegible] Publications					0	5(e)	3	7	9.00	46.00	55.00
VACATIONS					0	120(f)	0	160(f)	.00	480.00	480.00
OPERATING EXPENSES [illegible]					0	50(e)	15	35	45.00	355.00	400.0

TABLE 2. RECURRENT EXPENSES BUDGET

ANNEX D

	Per Person..... Monthly rates in $ salary	incentive	Annual travel		ANNUAL COSTS IN DOLLARS FOR Years 1 through 7 (1985-1991) GRM	AID		ANNUAL COSTS IN DOLLARS FOR Years 8 through 10 (1992-1994) GRM	AID	RECURRENT PROJECT COSTS Total GRM	Total AID	Gr To
Annual Sub-Total:				FY 85	57.6	217.98	FY 92	190.05	266.71			
				FY 86	57.6	219.98	FY 93	190.05	266.71			
				FY 87	57.6	274.98	FY 94	190.05	426.71			
				FY 88	57.6	425.38						
				FY 89	98.4	352.36						
				FY 90	98.4	353.36						
				FY 91	98.4	513.36						
LOP Contingency			.1		52.56	235.74		57.015	96.013			
Annual Totals including Inflation				FY 85	66.528	251.7669	FY 92	308.8694	433.4574			
				FY 86	69.85440	266.7807	FY 93	324.3129	455.1302			
				FY 87	73.34712	350.1561	FY 94	340.5286	764.5722			
				FY 88	77.01448	568.7573						
				FY 89	138.1447	494.6816						
				FY 90	145.0520	520.8898						
				FY 91	152.3045	794.5840						
GRAND TOTAL										1695.96	4900.78	65

(a) Project year 1 only in left column; project years 2 - 7 in right column
(b) Project year 5 only in the left column; project years 6 and 7 in the right column
(c) Project years 1 - 3
(d) Project years 5 - 7
(e) Project years 3 - 7
(f) Evaluations in years 4, 7, and 10

Table 3. SUMMARY CAPITAL COSTS: TECHNICAL ASSISTANCE, TRAINING, COMMODITIES, CONSTRUCTION (in $'000)

ANNEX D

		PHASE ONE			PHASE TWO				PHASE THREE			
		FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
TECHNICAL ASSISTANCE:												
Long-Term Technical Assistance		165	760	750	750	900	900	900	375	0	0	6040.00
												5500.00
Short-Term Technical Assistance @$15,000/month		90	90	90	90	80	50	20	10	10	10	540.00
TRAINING:												
Master's Degrees (13)		40.8	102	163.2	142.8	132.6	61.2	20.4	0	0	0	1836.40
PhD's (6)		0	10.2	30.6	61.2	102	102	81.6	40.8	0	0	663.00
Short-term		75	80	80	75	70	55	55	55	20	20	428.40
Coordination		0	20	20	20	20	20	20	20	20	0	585.00
												160.00
COMMODITIES:												
Vehicles		121	0	0	121	60	0	121	60	0	121	1415.00
Research Equipment		58	3	3	48	48	3	28	53	23	28	604.00
Office Equipment		30	0	0	30	20	0	30	20	0	0	295.00
Reference Books/Journals		40	2	10	2	20	2	10	2	10	2	130.00
Furnishings		0	30	116	115	25	0	0	0	0	0	100.00
												286.00
CONSTRUCTION:												
DRSPR HQ and DHV Office		70	107.6	98.4	0	0	0					1056.50
Koporo Station Development		28	85	65	29	0	0					276.00
DRSPR, Region V		0	0	150	222	60	0					207.00
												432.00
Construction coordinator		10	10	10	10	10	0					
A&E Services, Supervision	.1	7.8	19.26	1.34	25.1	6	0					50.00
												91.50
Sub-Total		737.60	1319.06	1617.54	1741.10	1553.60	1193.20	1286.00	635.80	83.00	181.00	10347.90
Contingency	.10	73.76	131.91	161.75	174.11	155.36	119.32	128.60	63.58	8.30	18.10	1034.79
Inflation	1.05	40.[illegible]	148.72	280.46	412.74	472.15	446.38	575.88	333.92	50.34	125.21	2886.39
TOTAL		85[illegible]	1599.69	2059.76	2327.95	2181.11	1758.90	1990.48	1033.30	141.64	324	14269.08

Table 4. SUMMARY RECURRENT OPERATING EXPENSES BUDGET, BY YEAR, GRM AND AID (in $'000)

ANNEX D

	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
Government of Mali:											
Personnel costs	57.60	57.60	57.60	57.60	98.40	98.40	98.40	134.28	134.28	134.28	928.44
Vehicle, POL	.00	.00	.00	.00	.00	.00	.00	11.52	11.52	11.52	34.56
Office supplies	.00	.00	.00	.00	.00	.00	.00	7.50	7.50	7.50	22.50
Rents, Utilities	.00	.00	.00	.00	.00	.00	.00	8.55	8.55	8.55	25.65
Research supplies	.00	.00	.00	.00	.00	.00	.00	7.20	7.20	7.20	21.60
Coop. research (a)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Publications	.00	.00	.00	.00	.00	.00	.00	6.00	6.00	6.00	18.00
Evaluations	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sikasso Support	.00	.00	.00	.00	.00	.00	.00	15.00	15.00	15.00	45.00
Sub-total	57.60	57.60	57.60	57.60	98.40	98.40	98.40	190.05	190.05	190.05	1095.75
Contingency	5.76	5.76	5.76	5.76	9.84	9.84	9.84	19.01	19.01	19.01	109.58
Inflation	3.17	6.49	9.99	13.65	29.90	36.81	44.06	99.81	115.26	131.47	490.63
GRM RECURRENT	66.53	69.85	73.35	77.01	138.14	145.05	152.30	308.87	324.31	340.53	1695.96
AID:											
Personnel costs	76.28	76.28	76.28	76.28	111.26	111.26	111.26	75.38	75.38	75.38	865.04
Vehicle, POL	21.90	23.90	23.90	23.90	37.40	38.40	38.40	26.88	26.88	26.88	288.44
Office supplies	15.00	15.00	15.00	15.00	25.00	25.00	25.00	17.50	17.50	17.50	187.50
Rents, utilities	21.60	21.60	21.60	12.00	28.50	28.50	28.50	19.95	19.95	19.95	222.15
Research supplies	12.00	12.00	12.00	12.00	24.00	24.00	24.00	16.80	16.80	16.80	170.40
Coop. research	61.20	61.20	61.20	61.20	61.20	61.20	61.20	61.20	61.20	61.20	612.00
Publications	10.00	10.00	15.00	15.00	15.00	15.00	15.00	14.00	14.00	14.00	137.00
Evaluations	.00	.00	.00	160.00	.00	.00	160.00	.00	.00	160.00	480.00
Sikasso Support	.00	.00	50.00	50.00	50.00	50.00	50.00	35.00	35.00	35.00	355.00
Sub-total	217.98	219.98	274.98	425.38	352.36	353.36	513.36	266.71	266.71	426.71	3317.53
Contingency	21.80	22.00	27.50	42.54	35.24	35.34	51.34	26.67	26.67	42.67	331.75
Inflation	11.99	24.80	47.68	100.84	107.09	132.19	229.89	140.08	161.75	295.19	1251.49
AID RECURRENT	251.77	266.78	350.16	568.76	494.68	520.89	794.58	433.46	455.13	764.57	4900.78
PROJECT RECURRENT COSTS (n $'000)	318.29	336.64	423.50	645.77	632.83	665.94	946.89	742.33	779.44	1105.10	6596.73

(a) The contributions of the GRM to this activity could not be calculated at this time. IER/DRA, INRZFH, and DMA will, however, be providing staff and equipment to complement AID's contributions in this activity.

238

Table 5. Budget Breakdown by Project Activities, Life of Project

(In $ 000)

ANNEX D

	Phase One			Phase Two				Phase Three			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
EXPANSION OF FARMING SYSTEMS RESEARCH/EXTENSION											
Relocation of DRSPR HQ											
Construction:											
Office, 350 m2 @$290	20	40	42	0	0	0					102.00
Professional housing, 2 x 110 m2 @ $290(AID)	20	23.8	20	0	0	0					63.80
Professional housing, 2 x 110 m2 @ $290(GRM)**	20	23.8	20	0	0	0					63.80
Staff housing, 2 x 80 m2 @ $290	10	20	16.4	0	0	0					46.40
Technical assistance:											
Research manager	0	150	150	150	150	150	150	0	0	0	900.00
Financial manager	0	150	150	150	150	150	150	0	0	0	900.00
Data processing/statistician	0	150	150	150	0	0	0	0	0	0	450.00
Financial systems set-up	165	85	0	0	0	0	0	0	0	0	250.00
Commodities:											
Vehicles: 4 WD (2)											
passenger car	30	0	0	30	0	0	30	0	0	30	120.00
pick up	15	0	0	15	0	0	15	0	0	15	60.00
mobylette	12	0	0	12	0	0	12	0	0	12	48.00
Computers	1	0	0	1	0	0	1	0	0	1	4.00
Computer software, upgrading	30	0	0	20	20	0	0	0	20	0	90.00
Office equipment	3	3	3	3	3	3	3	3	3	3	30.00
Office furniture	30	0	0	30	0	0	30	0	0	0	90.00
Furniture (housing)	0	30	30	0	0	0	0	0	0	0	60.00
	0	0	26	0	0	0	0	0	0	0	26.00
Recurrent Costs:											
Professional staff	20.78	20.78	20.78	20.78	20.78	20.78	20.78	20.78	20.78	20.78	207.80
Support staff	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	372.00
Vehicle POL, Maintenance	[illegible]	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	9.4	93.00
Office Supplies	[illegible]	5	5	5	5	5	5	5	5	5	50.00
[illegible] Utilities, building maintenance	[illegible]	21.6	21.6	12	12	12	12	12	12	[illegible]	148.80
Bivasso FSR Support	[illegible]	0	50	50	50	50	50	50	50	[illegible]	400.00
Total Capital [illegible]	[illegible]	[illegible]	607.4	561	323	303	391	0	3	23	61	3304.00
	[illegible]	[illegible]	[illegible]	134.38	134.38	134.38	134.38	134.38	134.38	134.38	1271.60
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	437.38	[illegible]	137.38	157.38	195.38	4575.60

239

Table 5. Budget Breakdown by Project Activities, Life of Project (In $'000)

ANNEX D

	Phase One			Phase Two				Phase Three			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
Expansion into Region II, Operation Haute Vallee											
Technical Assistance:											
Agronomist, Region II, OHV	0	112.5	150	150	150	150	150	37.5	0	0	900.00
Agricultural economist, Region II, OHV	0	112.5	150	150	150	150	150	37.5	0	0	900.00
Commodities:											
Vehicles: 4 WD (2)	30	0	0	30	0	0	30	0	0	30	120.00
pick up (1)	12	0	0	12	0	0	12	0	0	12	48.00
motorcycles (2)	2	0	0	2	0	0	2	0	0	2	8.00
mobylettes (8)	4	0	0	4	0	0	4	0	0	4	16.00
Recurrent Costs:											
Professional staff	57.96	57.96	57.96	57.96	57.96	57.96	57.96	57.96	57.96	57.96	579.60
Support staff	17.94	17.94	17.94	17.94	17.94	17.94	17.94	17.94	17.94	17.94	179.40
Vehicles, POL, Maintenance	13.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	144.00
Office supplies	10	10	10	10	10	10	10	10	10	10	100.00
Rents, utilities, building maintenance											
Expendable research supplies	12	12	12	12	12	12	12	12	12	12	120.00
Total Capital, Technical Assistance	48	225	300	348	300	300	348	75	0	48	1992.00
Total Recurrent	111.4	112.4	112.4	112.4	112.4	112.4	112.4	112.4	112.4	112.4	1123.00
Sub-Total Region II, OHV	159.4	337.4	412.4	460.4	412.4	412.4	460.4	187.4	112.4	160.4	3115.00

Table 5. Budget Breakdown by Project Activities, Life of Project

(In $'000)

ANNEX D

	Phase One			Phase Two				Phase Three			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
Expansion into Region V											
Technical Assistance:											
Agronomist, Region V	0	0	0	0	150	150	150	150	0	0	600.00
Agricultural economist, Region V	0	0	0	0	150	150	150	150	0	0	600.00
Commodities:											
Vehicles: 4 WD (2)	0	0	0	0	30	0	0	30	0	0	60.00
pick up (2)	0	0	0	0	24	0	0	24	0	0	48.00
motorcycles (2)	0	0	0	0	2	0	0	2	0	0	4.00
mobylettes (8)	0	0	0	0	4	0	0	4	0	0	8.00
Furnishings: Generator, tools	0	0	0	25	0	0	0	0	0	0	25.00
Furniture (housing)	0	0	0	50	25	0	0	0	0	0	75.00
Office equipment, furniture	0	0	40	20	0	0	0	0	0	0	60.00
Other office equipment	0	0	0	0	20	0	0	20	0	0	40.00
Construction:											
Office, 250 m2 @ $360	0	0	30	42	0	0					72.00
Professional Housing, 4 x 110m2 @$360	0	0	50	80	30	0					160.00
Staff housing, 6 x 80m2 @ $290	0	0	50	70	20	0					140.00
Guest house, 110m2 @$360	0	0	20	20	0	0					40.00
Garages, 50 m2 @$360	0	0	0	10	10	0					20.00
Recurrent Costs:											
Professional staff	0	0	0	0	51.72	51.72	51.72	51.72	51.72	51.72	310.32
Support staff	0	0	0	0	24.06	24.06	24.06	24.06	24.06	24.06	144.36
Vehicles, POL, Maintenance	0	0	0	0	13.5	14.5	14.5	14.5	14.5	14.5	86.00
Office supplies	0	0	0	0	10	10	10	10	10	10	60.00
Rents, utilities, building maintenance	0	0	0	0	16.5	16.5	16.5	16.5	16.5	16.5	99.00
[illegible] research supplies	0	0	0	0	12	12	12	12	12	12	72.00
Total Capital, Technical Assistance	0	0	190	317	465	300	300	380	0		1952.00
Total Recurrent	0	0	0	0	127.78	128.78	128.78	128.78	128.78	128.78	771.68
Sub-Total: Rec.	0	0	190	317	592.78	428.78	428.78	508.78	128.78	128.78	2723.68

Table 5. Budget Breakdown by Project Activities, Life of Project (In $'000)

ANNEX D

	Phase One			Phase Two				Phase Three			TOTAL
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	
IMPROVED COORDINATION AND LINKAGES											
Reference Books/Journals	40	2	10	2	20	2	10	2	10	2	100.00
Improvement of the Koporo Station:											
Office addition, 50 m2 @ $360	8	10	0	0	0	0					18.00
Professional Housing, 2 x 110 m2 @ 360	10	30	30	9	0	0					79.00
Staff Housing, 3 x 80 m2 @ $290	10	30	20	10	0	0					70.00
Guest house, 110 m2 @ 360	0	15	15	10	0	0					40.00
Furniture	0	0	20	20	0	0					40.00
Vehicle for SRCVO field collaboration 4WD	15	0	0	15	0	0	15	0	0	15	60.00
Cooperative Research, Studies:											
With DRA	30	30	30	30	30	30	30	30	30	30	300.00
With DMA, PIRT, INZRFH	30	30	30	30	30	30	30	30	30	30	300.00
With IPR	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	12.00
Publications:											
Research Journal	10	10	10	10	10	10	10	10	10	10	100.00
Extension Publications	0	0	5	5	5	5	5	10	10	10	55.00
Total Capital, Technical Assistance	83	87	95	66	20	2	25	2	10	17	407.00
Total Recurrent	71.2	71.2	76.2	76.2	76.2	76.2	76.2	81.2	81.2	81.2	767.00
Sub-Total: Coordination and Linkages	154.2	158.2	171.2	142.2	96.2	78.2	101.2	83.2	91.2	98.2	1174.00

Table 5. Budget Breakdown by Project Activities, Life of Project

(In $'000)

ANNEX D

	Phase One			Phase Two				Phase Three			
	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93	FY 94	TOTAL
TRAINING											
Master's Degrees (30 mos. @ $1700/mo.)											
DRSPR- 7											.00
DRA-2	10.2	30.6	61.2	81.6	91.8	61.2	20.4	0	0	0	357.00
IPR -1	10.2	20.4	30.6	20.4	20.4	0	0	0	0	0	102.00
CAA - 3	10.2	20.4	20.4	0	0	0	0	0	0	0	51.00
	10.2	30.6	51	40.8	20.4	0	0	0	0	0	153.00
PhD's (42 mos. @ $1700/mo.):											
DRSPR - 3	0	0	0	10.2	40.8	61.2	61.2	40.8	0	0	214.20
DRA -2	0	10.2	20.4	30.6	40.8	20.4	20.4	0	0	0	142.80
IPR-1	0	0	10.2	20.4	20.4	20.4	0	0	0	0	71.40
Short-term:											
Courses, e.g., six-month @ $10,000	20	20	20	20	20	20	20	20	0	0	160.00
Language training, @$5,000	20	15	25	20	15	0	0	0	0	0	95.00
Observation tours @$7,500	15	15	15	15	15	15	15	15	0	0	120.00
In-country workshops, seminars, etc.	20	30	20	20	20	20	20	20	20	20	210.00
Participant training coordination	0	20	20	20	20	20	20	20	20	0	160.00
Sub-Total: Training	115.8	212.2	293.8	299	324.6	238.2	177	115.8	40	20	1836.40
NOT CLASSIFIED BY ACTIVITY											
Unallocated short-term assistance	90	90	90	90	80	50	20	10	10	10	540.00
Field Equipment	25	0	0	25	25	0	25	50	0	25	175.00
Construction coordinator	10	10	10	10	10	0					50.00
A&E Services, Supervision .1	9.8	19.26	31.34	25.1	6	0					91.50
Evaluations				160			160			160	480.00
Total Capital, Technical Ass[illegible]nce	134.8	119.26	13[illegible]4	150.1	121	50	45	60	10	35	856.50
Total Recurrent	0	0	0	160	0	0	160	0	0	160	480.00
Sub-Total: Unclassified	134.8	119.26	131.34	310.1	121	50	205	60	10	195	1336.50
TOTAL CAPITAL, TECHNICAL ASSISTANCE, TRAINING	737.60	1319.06	1617.54	1741.10	1553.60	1193.20	1286.00	635.80	83.00	181.00	10347.90
[illegible] RECURRENT COSTS	275.58	277.58	332.58	482.98	450.76	451.76	611.76	456.76	456.76	616.76	4413.28
[illegible]ntingency .1[illegible]	101.32	159.66	195.01	222.41	200.44	164.50	189.78	109.26	53.98	79.78	[illegible]5.12
Inflation	55.72	180.02	338.13	527.23	609.14	615.39	849.84	573.81	327.34	551.88	4[illegible].51
GRAND TOTAL	[illegible]	[illegible]	2483.26	2973.72	2813.54	[illegible]24.84	2937.37	1775.63	921.08	1429.41	20865.81

[illegible]ces, [illegible] [illegible]nanced under the project by AID.

FARMING SYSTEM RESEARCH AND EXTENSION PROJECT

INSTITUTIONAL ANALYSIS

Table of contents

Summary and conclusions	E1
A. Institutional Environment	E2
B. Relationship of the Agronomic Research Division with the Farming Systems Research Division	E3
C. Coordinating Mechanisms Between DRA and DRSPR	E6
D. Rate of Expansion and Number of Sites	E7
E. National and Regional Functions of DRSPR	E10
F. Research and Extension Linkages	E11
G. Linkages Between the DRSPR and Livestock and Forestry Research	E14
H. Agricultural Policy Linkages	E15
I. Personnel and Staffing	E16
J. USAID/Mali Management	E19

Attachments

Attachment I: Organigram: Ag. Research in Mali

Attachment II: Agricultural Decision-Making and IER Structure

Attachment III: National and Regional Functions of DRSPR

Summary and Conclusions

The purpose of this Institutional Analysis is to identify and analyze key institutional issues which will influence the implementation of this project and propose solutions to those which may negatively affect project success. Issues which are covered here are:

- Institutional Environment
- Relationship of the Agronomic Research Division (DRA) with the Farming Systems Research Division (DRSPR)
- Coordinating mechanisms between DRA and DRSPR
- Rate of expansion and number of sites
- Functions of national and subnational units
- Research and extension linkages
- Coordination of livestock and agricultural research
- Agricultural policy linkages
- Personnel and staffing
- USAID/Mali management

The conclusion of this Analysis is that the project can be implemented successfully and that the proposed design will support the research and institution building activities.

Based on the analysis of existing capabilities of agricultural research in Mali, this report indicates the following:

1. The Farming Systems Research Division (DRSPR) provides an appropriate organizational base for placement of the project.

2. The approach of gradually phasing expansion into new regions provides the opportunity to learn from the experience of early project activities.

3. The project provides adequate mechanisms and processes for involving commodity and disciplinary researchers as well as extension organizations.

4. The training plan can be implemented. However, it will not provide staff for the program until 1988.

It is also noted that the project can adeuqately address existing constraints in the following ways:

245

5. In order to initiate project activities as scheduled, it will be necessary to draw agricultural economists, sociologists, and livestock specialists from both DRSPR and other Divisions of the Institute of Rural Economy (IER). It will be somewhat difficult to recruit M.S. level agricultural economists and sociologists/anthropologists as there are currently very few in IER.

6. Staff in DRSPR, DRA (Division de la Recherche Agronomique) and extension agencies will also require training in FSR methods and in inter-disciplinay research.

7. The existing system of rewards and incentives must be improved.

8. An institutional contractor will be responsible for financial management, training, and procurement and construction contracting, as USAID/Bamako does not have the personnel to manage these activities.

A. Institutional Environment

This analysis indicates that a satisfactory institutional environment exists for implementation of an FSR institutional strengthening project.

1. There is awareness of and pressure for improvement of technical and institutional strengthening from the executive level. During the past year, four extension agency Directors requested that DRSPR undertake research in collaboration with them. The Directors of DRSPR and of IER are aware that the current level of trained staff is insufficient for this increased activity.

2. DRSPR is open to new and innovative ideas. The FSR program in Mali is one of the earliest projects of this type to be established in Africa. The staff have been willing to try different methodological approaches in data gathering. They have also sought collaboration with a number of other research organizations (see Technical Analysis).

3. Extension agencies participate in research activities. One extension agency (proposed Project site) is among the agencies collaborating with SAFGRAD in [illegible] trials and has established research coordination [illegible] formally requested the services of DRSPR. This proposal provide support to facilitate the involvement of [illegible] staff in the research process. There have been collaborative arrangements between the cotton extension agency [illegible] DRSPR in technology design and development aspects.

4. There is a minimum level of organized stability to provide for continuity of the improvements efforts over time. While it is not known if the current Director of IER or of DRSPR will

Best Available Document

remain in these positions throughout the project, the structure of IER/DRSPR insures that the unit and its positions are permanently established.

5. The availability of staff to participate in training and to work with technical consultants needs to be assured due to the scarcity of experienced staff. The utilization of returning trainees and staff from other divisions of IER must be carefully examined and included as a condition precedent in the program agreement if necessary.

6. The degree and nature of cooperative between DRA and DRSPR in identifying problems for research and developing an appropriate research program is an important issue which must be carefully promotec during implementation. While there is evidence of collaboration between the two units and the Director General of IER provides a powerful means of coordinating these units, additional horizontal linkages between the two divisions are required. The project design provides for these mechanisms to be established.

B. Issue: Relationship of the Agronomic Research Division with the Farming Systems Research Division

The relationship between the DRA and DRSPR is an important issue in this project. In the current organizational structure, farming systems research activities are carried out by the Farming Systems Research Division (DRSR; see organigram Annex A). Commodity and disciplinary research in undertaken by the Division of Agronomic Research (DRA). The DRSPR was originally establihes as a cell within DRA. It was elevated in 1980 to become a division, giving the Director equal status with the Director of DRA. A separate Technical Commission was established. Both divisions are directly responsible to the Director of IER who is powerful as the President of each Technical Commission in influencing what research tasks will be undertaken and where. A description of the research decision process is presented in Annex A.

Recommendations

1. Retain DRA and DRSPR as seperate units in the near future.

2. Develop other coordinating mechanisms to provide linkages for specific tasks as discussed in the next section.

3. In the short-run, separate Technical Commisions seem appropriate. The DRSPR Commission permits an iterative process of research in different settings which is not currently practiced for commodity disciplinary work.

4. Re-assess organizational structures as part of the two major evaluations during the life of the project.

Discussion

Two options for improving the structural relationships betw en the two divisions are: (1) to merge the DRA with the DRSPR and establish FSR capability within the new combined unit, or (2) to retain DRSPR as tha focal unit for the project and to d lop other coordinating mechanisms to assure involvement of commodity and disciplinary specialists.

The recommendation of retaining the separate divisions is based on the following observations:

1. There are important differences between the DRA and the DRSPR. the decision-making process within DRA is formal, hierarchical, multi-layered, and includes specialists within the same discipline. The process in the DRSPR is based on a relatively horizontal and interdisciplinary team approach in which all members provide input. The DRSPR is able to undertake research activities without the constraint of the sequential research process required by DRA. This approach is appropriate for situations requiring a problem solving approach.

2. The time orientations of the two divisions are different. Based on the classical/conventional research approaches, th on-station researchers concentrate on activities which wil contribute to increased productivity in several years. In contrast, the DRSPR staff are concerned with problems which may be addressed in the long-run as well as those which may contribute to productivity in the short-run.

3. The goal of DRSPR is defining technologies appropri te r groups of farmers with similar sets of constraints and varyi levels of resources within a well defin d agro-ecologic zone. The DRA tends to focus its re arc cash and fo crops, emphasizing purchased inputs and covers broad agro climatic zones.

4. There are differences in the domain and tasks o units. The Directors of DRSPR and DRA view the fulfilling separate research roles: DRA conducts on research on single crops and bio-physical fac production. DRSPR is involved in tasks technologies to different systems and t levels, and making hypotheses about differen populations. The Director of IER also views the unit substantially differentiated in their research orien believes that they should remain separate at this t

5. This project's intent is to strengthen FSR appr research and development. It is easier to accomplish th in unit which is receptive and has used the interdi research approach.

248

6. The existing mode of hierarchical integration will be retained, providing less disruption for the other divisions of IER while the DRSPR expands.

7. The gains DRSPR has made in institutionalizing an interdisciplinary approach to pursue different types of research will be sustained. The identity of an interdisciplinary team would quickly be undermined by merging the DRSPR staff of 48 with the DRA staff of 590. The involvement of social scientists in agriculture research has been institutionalized here. The merger could shift the research orientation towards specialized agronomic research rather than interdisciplinary research. The number of levels between the DRSPR staff and the Director of IER will not be increased. Assuming that there will not be major changes in the research decision-making process within DRA in the near future, a merger of the two divisions and their Technical Commissions at this point would jeopardize flexibility of DRSPR and would not contribute significantly to better problem identification for on-station research.

8. The DRSPR does not yet have the capacity to influence significantly the problem choices of DRA researchers. Other mechanisms and processes can be developed under the project to facilitate coodination of this task (discussed in next section).

9. The organizational design which is appropriate for the near future may become less appropriate as the on-station researchers become familiar with FSR approaches. Thus, the structures should be re-assessed during the two major project evaluations.

C. Issue: Coordinating Mechanisms Between DRA and DRSPR

Assuming that the DRSPR and DRA will be retained as separate units, the design must address the issue of improving coordination between the two divisions and processes for avoiding conflict and duplication of effort between the two divisions.

There are several options for improving coordination between DRA and DRSPR. The appropriate mechanism may vary according to the task.

Recommendations

1. The role of the Director General of IER provides powerful, hierarchical coordination of the two units, and this role should be emphasized. While this is extremely important, however, it will not be sufficient; other horizontal mechanisms will be needed.

2. The headquarters of DRSPR should be located in Sotuba as soon as possible. Physical proximity is important for communication among researchers. USAID should provide funds for office rent until construction of new facilities is completed. The Director of DRSPR should be responsible for liaison between DRA and DRSPR.

3. Joint workshops should be held annually for DRA and DRSPR staff on FSR approaches.

4. Joint DRA-DRSPR meetings should take place in January. DRA researchers would present technologies which they believe may be appropriate for on-farm testing. In turn DRSPR would suggest to DRA problems for research based on analysis of constraints. These meetings should be broad based involving researchers from DRA, DRSPR and representatives of extension agencies.

5. A task force including senior staff at DRSPR, DRA, INZRFH, DMA, and the extension agencies should be established at the extension agency level. One task of this group would be to identify the research problems which would best address the known problems in the area and assign the problems to relevant agencies.

6. The redesign of personnel policies should include incentives to encourage working on joint projects.

7. The need for these mechanisms should be explicity required in the project agreement, and a process for establishing them should be required in the monitoring and evaluation plans.

Discussion

The principal mechanism of coordination now in use is hierarchical integration. Both DRA and DRSPR Directors report to the Director of IER. The second form is overlapping membership on the Technical Commissions of both divisions. The Director of IER is extremely influential in his role as President of the Commissions. The Directors of DRSPR and DRA attend monthly [illegible] meetings in Bamako (which is administrative and coordinative in nature). There also exist some horizontal coordi[illegible] [illegible] has recently begun to collaborate with DRA on [illegible] However, these linkages do not provide fo[illegible] [illegible] information and resources at the levels below the [illegible] Thus, the project design and implementation plans must [illegible] for additional coordinating mechanisms. The [illegible] recommended above are intended to increase formal and [illegible] communication among researchers at each level.

Other mechanisms which have been considered and are not recommended at this time are:

1. Secondment of DRA staff would provide DRSPR with trained personnel, but the use of this mechanisms is less effective in providing an exchange of information between the two divisions. A disadvantage of secondment in the Malian context is that this mechanism is used frequently to transfer staff to another agency and the ties between the original agency and the seconded staff member are not necessarily maintained.

2. Written binding inter-divisional agreements should not be established until the DRSPR does in fact have the capacity to identify research problems based on their field data and experience. The use of formalized scopes of activity between divisions of one agency is not customary, and the future need of this mechanism should be discussed during project negotiations.

3. Similarly, fixed reimbursement agreements are not currently used between divisions of the same agency. From a management perspective, it will be difficult for DRA to keep accurate records of staff time and support costs which would provide the basis for reimbursement. However, the budget support for specific research tasks should be negotiated annually and specified in the annual program and budget proposals. These documents are already established mechanisms for indicating sharing of information and resources and should be used in lieu of new fixed reimbursement mechanisms.

D. Issue: Rate of Expansion and Number of Sites

The most critical constraints in determining the rate of expansion is the availability of trained and experienced Malians for staffing in the field and at headquarters. Other determinants include: capacity of DRSPR to support the expanded activities, availability of technical assistance; the viability of extension services in the area, and logistical difficulties in the proposed area of expansion.

Etablisment of new field sites should be undertaken gradually, beginning first with Region Two where a formal agreement between the extension agency and DRSPR has already been negotiated. Specification of subsequent sites can be clarified as work in the Second Region and headquarters progresses.

Recommendations

1. The national office should be established in Bamako as soon as possible; projects funds will be provided for rental space until new offices can be constructed.

2. The functions and administrative routines of the office and of the field should be well delineated before expansion to a third regional site is attempted.

3. The training plan provides sufficient scientists to initiate team work in each region as scheduled. It will be necessary to obtain agreement that these specialties can be recruited outside of DRSPR if for any reason training targets are not achieved.

4. Expansion to the Fifth Region should be delayed until 1988. This will permit involvement of Malian staff returning from long-term training.

5. In order to provide candidates for training who have had at least two years of work experience (a GRM criterion for training), it will be necessary to obtain an exception to the current hiring freeze in the Malian civil service so that new graduates can be recruited for DRSPR and subsequently considered for training.

6. The proposed model for staffing of the regional units and of headquarters (see Technical Analysis) should be evaluated in light of the functions of each unit during the third year. The results of this assessment and the availability of returning trainees will determine the feasibility and rate of further expansion.

7. The technical assistance strategy should encourage transfer of experience from one region to another. If possible, at least one Malian and one expatriate member of the initial team should work with the new groups in subsequent regional sites. This will provide feedback to the DRSPR headquarters on the methods and approaches employed in FS Research.

Discussion

From a management and institutional development perspective, the gradual phasing of additional field units will provide a better opportunity to begin training of staff, and to define and establish the field unit functions and roles based on the experience in Sikasso and in OHV.

There is a shortage of Masters level staff in all disciplines in the Ministry. Sufficient staff will not be produced by the training plan in time to initiate regional units [illegible] Thus, it is assumed that the following staff [illegible] Sikasso: 2 agronomists, (M.S); livestock [illegible] livestock specialist, (B.Sc.); [illegible] sociologists, (M.S.); [illegible] agricultural economist, (M.S.). It is assumed that [illegible] agronomists per field unit will be recruited from [illegible] graduates of IPR or from existing staff in other divisions [illegible] shortage will affect implementation in the following ways:

1. In order to begin work in OHV by December 1985, the project must:

- recruit 1 livestock specialist from existing staff in DRSPR/Sikasso;

- recruit 1 agronomist from DRSPR/Sikasso;

- recruit 1 agricultural economist from DRSPR/Sikasso;

- recruit 1 sociologist from DRSPR/Sikasso.

2. In order to begin work in the Fifth Region in 1987, the project will:

   - immediately select an agrocnomist from the two B.Sc. level agronomists currently in DRSPR and initiate M.S. level training, under the Sahel Manpower Development Project II (SMDP II), in the U.S.;

   - immediately select and train an agricultural economist (M.S.), either an economist from DET or an agriculturalist from another division in IER;

   - obtain the services of a livestock specialist from the Ministry of Rural Development;

   - a sociologist (M.S.) will return from training in 3/88 to join the team;

   - short-term consultants in Sociology will provide support necessary in the initial phases.

The choice of regions for subsequent expansion should take into consideration the capacity of extension services in the area at that time. Initial expansion of field units will thus be undertaken in the OHV where DRSPR and OHV have already initiated collaboration. OHV is currently strengthening the management and technical capabilities of its field service capacity. Given the lack of appropriate themes in the Fifth Region, the absence of a full-scale extension agency will not necessarily be a significant handicap in that area; a substantial number of field agents remain at OMM who could work in data gathering and field testing activities, and OMM has managed to continue collaboration with SAFGRAD. Thus a fully operational multi-purpose Operation may not be essential though desirable.

Logistics will also influence the choice of sites. Logistics are relatively uncomplicated in the Second Region and to a less degree in the Fifth Region. The research stations serving the two regions are under the DRA and are located at Sotuba and in Koporo Kéniépé which are about 1/2hour and 10 hours respectively from Bamako. There are some improved roads in the Fifth Region. The drive from the extension agency headquarters to the Koporo Kéniépé research station in the Fifth Region requires over two hours. Because of limited educational and helth services, it may

be difficult to place expatriate technical personnel in the Fifth Region on a long-term basis.

E. Issue: National and Regional Functions of DRSPR

DRSPR currently conducts both program development, managem . and research functions. As the program expands, it will become necessary to differentiate the roles and tasks of the headquarters and the regional units.

This differentiation could be initiated as soon as a headquarters office is established in Bamako. The DRSPR haedquarters would become responsible for program development, training, guidance to field teams in methodology, analysis and reporting and program supervision, interagency linkages and coordination. Technical assistance team members would assist the headquarters staff in these tasks

Recommendations

1. The exact distribution of functions between headquarters and field offices will be developed gradually as Malian staff return from training and assume positions in headquarters and in the field.

2. The technical assistance support should be planned accordin, to the level of support needed in developing skills at the appropriate organizational levels.

3. The Research/Management Advisor/Chief of Party of the technical assistance team will assist the DRSPR Director i. defining these functions. The division of functions i summarized below to illustrate the type of differentiatic between the national and regional unit which is needed. (Anne. B provides a detailed listing of functions)

The national office will have substantial responsibility for:

- providing the overall research management and d[illegible]

- developing research methods and technical guidance [illegible] support field units;

- reviewing annual work plans of field [illegible]

- developing administrative routines, and pers[illegible] financial management functions;

- planning training programs and staff [illegible] activities;

- coordinating with DRA, INRZFH, DMA, and international research programs and extension agencies;

254

Initially, the OHV Field unit and headquarters staff will work jointly in developing technical guidance so that there is exchange between the headquarters and field staff.

Field units would be responsible for:

- implementing research (collect and analyze data; identify problems, develop hypothesis, etc);

- establish linkages with extension agencies.

F. Issue: Research and extension Linkages

The nature of proposed research requires both formal and informal linkages between DRSPR and the extension agencies. Even through this project does not seek to improve the capacity of the extension agencies to deliver technical information, these linkages are considered for the following reasons. Firstly, to ensure that proposed research activities address the technology concerns of the extension agencies and farmers. Secondly, knowledge and information possessed by extension agents leads to economies of time and resources. The staff of these agencies have had the most direct contact with the farmers, and they can provide researchers with support in several phases of FSR activity. Many extension agents in Mali have already had experience in conducting on-farm field trials. Thirdly they will ultimately be responsible for the dissemination of improved technologies to farmers. These linkages will vary according to the phase of the research-extension process. Those which are recommended are indicated below and subsequently discussed. Finally, other mechanisms which have been considered but are not recommended are noted at the end of this section.

Recommendations

1. The geographic areas to be covered by the FSR teams will be coterminus with the geographical areas of the extension agencies. These are broadly differentiated agroclimatic zones. Inputs, credit, and extension services are organized on that basis.

2. The existing linkages (discussed below) will be retained;

3. Field agents of the extension agencies will be participants in the informal data gathering and the problem identification activities.

4. Research liaison positions within the extension agencies should be strengthened.

5. An interagency task force can be established on an as-needed basis.

6. A formal interagency agreement between the DRSPR and the extension organization would specify the scope of cooperation in executing research and distribution of tasks and costs to be shared. According to current pratice, the agreement must be approved by the Director of the Direction Nati nal de L'Agriculture (DNA) for the extension agencies and by [illegible] for the DRSPR.

Discussion

Extension agencies' participation in the Annual Technical Commission meetings, the existence of research coordinator positions in some agences, agreements for cooperation between DRSPR and at least two extension agencies and participation of extension agencies in the SAFGRAD on-farm trials provide a basis for improving research extension linkages.

1. The principal formal coordination mechanisms between research and extension in Mali are based on participation of extension agencies in the National Technical Commission meetings which are held in March each year. In principle, this forum provides the extension agency directors with the opportunity to recommend research topics to IER and also to review recent research results. It is from these findings that extension recommendations are generated. In reality, the research results which have been developed into new technical recommendations have been limited and extension agencies have not been significantly successfull in influencing overall choice of research problems.

2. Formal and informal linkages between the research stations and the extension agencies in the area are essentially non existent. On the other hand, SAFGRAD (considered as a unit within DRA)has developed an informal procedure for linking the field level agents with SAFGRAD researchers. During the 19[illegible] agricultural campaign, SAFGRAD researchers conducted 272 on farm field trials in collaboration with field agents in the following extension agencies: OMM, OHV. UDIPAC, CMDT. and [illegible] In addition, several extension agencies are participating [illegible] applied research Programs conducted thru DRA (CMDT, [illegible] ODIK) and international organizations such as IFDR. The linkages could form the basis upon which res[illegible] linkages for a range of research activ[illegible] level can be built.

3. Formal interagency agreements have recently been [illegible] DRSPR. An agreement negotiated between DRSPR and CM[illegible] provides for sharing of information and parti[illegible] research. The recently drafted accord between DRS[illegible] provides OHV vehicles and funds to DRSPR for the deter[illegible] of target areas and identification of problems for r[illegible]

4. Research liaison positions within the extension ag[illegible]

256

be strengthened. The staffing pattern of the collaborating extension agency should provide for this, and position descriptions should be developed which specify their tasks. In addition to assisting SAFGRAD and DRSPR in supervising on-farm trials, the role of these members could be revised to include analysis of research proposals to determine the potential implications of the research task on the extension agency. They could be also responsible for presenting research needs to the Director and to the DRA and DRSPR. If the Opération has to lead in referring particular research problems to other researchers, they will need a clear understanding of the types of research conducted by research units. This will require the coordinator to work with both on-station researchers, SAFGRAD and DRSPR. These individuals would require additional training in FSR approaches. Research coordinators in extension agencies are below the level of Division Chief, i.e intermediate level of staff responsibility.

5. Involving field agents in the informal data gathering and in the problem identification phases will bring them into the research process at an earlier stage. They also assist researchers in arranging meetings with farmers during the informal and formal data gathering phases. However, they will not be directly involved in data collection or in the identification of farmers to participate in on-farm field trials. This is the approach currently used by DRSPR. FSR unit will employ enumerators who will be supervised by the field units rather than relying on extension agents who have other tasks. Thus, the need for continuously training data gathering agents for formal surveys is limited. The response of the enumerators will not be influenced by an agent's pre-existing ties in the village, and the researchers themselves have increased direct contact with a limited number of farmers in a given area.

6. The extent to which field agents can be involved depends on the methodological approach which DRSPR takes in defining recommendation domains and designing tests. If the current method of choosing representative villages for in-depth survey and for on-farm testing is retained, a small number of agents would be required, but they would be needed on an intensive basis which would make it difficult for them to carry out their other tasks. If other methods are tried which involve wides scale testing, the time required of an individual agent would be reduced and the number of agents participating would be increased.

7. An interagency task force should be established on a temporary and as-needed basis to address specific problems. A core group would include FSR team members, a SAFGRAD representative, a SRCVO representative, and the research coordinator of the extension agency. Additional expertise needed would be called in on a case by case basis. One function of this group would be to review field research problems and determine the roles

of the different units for the upcoming season (e.g. whether a particular test be conducted by SAFGRAD or by DRSPR). Only those members significantly involved in planning or implementing the solution should be included, and they should have the ability to provide relevant detail as well as make decisions.

8. The recommendations support the strategic choice made by DRSPR in defining the organization s geographic domain. In accepting the extension agency boundaries as the domain for the DRSPR regional teams, the geographic areas for research and for future service delivery would remain the same. Coordination of data gathering activities, adaptive research, and definitions of extension facilities are thus facilitated. However, the ability of the extension agency to provide differentiated supporting services to specific recommendation domains (within the boundaries of the extension agency) should be kept in mind. In attempting to correct the conventional research approach which seeks solutions appropriate for broad agro-climatic zones, FSR-E runs the risk of defining domains which are more specific or smaller than the extension agencies can support.

9. While this proposed project will not directly provide resources for strengthening the service delivery capacity of the multi-purpose extension agencies, a process should be developed for assessing the demands that a proposed innovation/activity places on the existing delivery systems for that area. It is assumed that the capacity of an extension agency to support a given level of additional activity will vary according to the degree and type of innovation/activity. The feasibility of including this analysis as part of the joint research planning process should be investigated. The routine utilization of this process would be another indicator of linkages between research and extension in future evaluation.

6. <u>Issue: Linkages Between the DRSPR and Livestock and Forage Research</u>

The linkages between livestock and agricultural research are particularly important in some regions. Mali Livestock Project provides for farming systems research activities through a cooperative agreement with International [illegible] Africa (ILCA). While ILCA's previous work in Mali was [illegible] forage for migratory animals in areas north of [illegible] emphasis under the new project will be primarily on identifying constraints of on-farm cattle feeding.

ILCA will support the FSR unit in INRZFH which will include forage production specialists, two animal production specialists, one sociologist, and one agricultural economist as well as an expatriate agricultural economist and a forage agronomist.

Best Available Document

258

Recommendations

1. The proposed project will provide additional training for livestock specialists who will be members of the DRSPR regional teams and possibly provide support for INRZFH/ILCA farming systems effort.

2. Funds should be made available for travel and perdiem costs for INRZFH scientists to advise, develop and participate in research activities focussing on farming-livestock-forestry interface.

3. Cooperative research agreements should be developed between DRSPR and INRZFH to address agro-forestry and on-farm livestock problems identified thru FSR/E efforts.

Because the FSR unit within INRZFH is just being developed, the formal linkages between the two agencies should be established slowly as the capacity and experience of INRZFH is developed. Formal interagency binding agreements will only be appropriate when the problem identification skills of the two groups are developed to the point where each group has something to offer the other.

H. Issue: Agricultural Policy Linkages

While this project is not intended to have a substantial macro-economic focus, agricultural policies, particularly price policies, may emerge from field studies as a problem for consideration. As a result of the liberalization of cereals marketing, producer prices for those crops have been significantly increased. Negotiations for liberalization of rice marketing are currently underway. The Multi-donor Cereals Market Restructuring Project will conduct policy research, propose changes, and support these long-needed policy reforms. It is unlikely that price policy constraints are identified as major constraints to production, the collaboration with the Cereals Market Restructuring Project will be pursued. The need for further investigation of these potential constraints can be identified by the DRSP and referred to the Director of IER for discussion with the Steering and Coordination Committee of the DRSP, Office de Régulation et de Stabilisation des Prix (under the Ministère d'Etat Chargé de l'Economie et du Plan). In the case of non-food cash crops, prices are set at the national level. The issue of price disincentives for cash crop production is an important one for the extension agencies with cash crop marketing involvement (e.g. OHV and CMDT) as the price schedule (barème) provides basic operating revenues for these agencies. Again, the channel for pursuing this particular constraints is through the Director General of IER to the Director General of National Agriculture (DNA) in charge of the Operation or to the Minister of Agriculture.

Policies regarding subsidies, input provision and credit programs are within the purview of the extension agencies. As indicated in the section on research-extension linkages, the project will establish a process for assessing those constraints.

I. Issue: Personnel and Staffing

In order to increase the productivity of the Malian personnel who will be working directly with the project, consideration should be given to personnel policy changes.

Recommendations

1. During project negotiations, the Mission should clarify the ability of DRSPR to hire the additional staff required. These new entrants into the staff will be necessary to maintain the existing activities of DRSPR and to identify appropriate candidates for long-term training. This should be specified as a condition precedent.

2. Staffing levels should be indicated along with the proposed annual research program, and the authority of the Division Director to refuse staff not in an approved staffing pattern should be established. This should be specified in the program agreement.

3. An improved job design and personnel evaluation and promotion process should be developed and maintained at least in DRSPR.

4. The USAID policy on incentive allowances should be clarified and provided equally in all USAID-funded projects. However the system of allowance should be provided only after adequate personnel evaluation and promotion systems are established. This should be a condition precedent.

5. The project should also provide incentives to encourage joint activities between research units and within interdisciplinary teams. The current legal framework for allowances does provide for this possibility.

6. Non-monetary rewards should also be developed: opportunity to publish, certificates and small [illegible] contributions to joint research activities, research collaboration or team performance.

Discussion

The distribution of staff, the ability to recruit, hire [illegible] staff will be an important issue during implementation. [illegible] some variation according to classification as a fo[illegible] (career civil servant) or conventionnaire (contract [illegible] DRA, only 43% of the total Malian staff of [illegible] fonctionnaires. In DRSPR, 27% of 64 Malian empl[illegible] fonctionnaires.

Best Available Document

26D

The Directors of IER Divisions (also extension agencies) appear to have little control over the recruitment and selection of staff, particularly in the fonctionnaire category. Selection criteria and processes for staff are under the control of a national Employment Commission which assigns public service employees to specific positions. All professional level positions (IA, ITA, CTA) and top management positions are fonctionnaire slots. When a director decides to establish a new position or wants to fill a vacant position, a written request specifying qualifications is sent to the Commission des Mutations et Affectations. Directors do not have the authority to refuse an employee who is nominated to a post in their organization. In theory, however, if the employee fails to perform adequately, he/she can be submitted to the Commission for reassignment. Data on the level of turnover in staff is not available.

Malian salary levels are quite low. Top level administrators earn about $3,000 per year, and the average salary of B.S. level staff currently in DRSPR is less than $1,500 per year.
Promotional systems do not provide incentives for individual performance or for joint collaboration. In most French-based promotion systems, promotions are based on fine graduations of educational differences rather than on work related factors. Moreover, decisions about promotions are made outside of the employing agency, thereby substantially reducing the instrumentally of these rewards.

Because compensation levels and promotion are heavily tied to educational levels, training provides the principal incentive available to agencies for rewarding employees. The initial nomination for training is made at the division level and reviewed by the Director and Minister, and finally by the Ministry of Plan. Specific criteria are not fixed, but three years of prior service is often required.

Projects do provide a number of extrinsic incentives such as supplementary allowances for additional responsibility, hardship posts, access to vehicles for senior staff, access to credit for pu chase of mobylettes or bicycles. The legal basis for extrinsic incentives to public employees in development projects was established in Decree No. 151 on August 26, 1975. These are as follows:

- supplement for responsibility limited to specified senior level staff responsible for implementing projects (individual rewards for specified individuals based on status);

- performance award to individuals or groups performance according to norms of reference for exact specialty paud periodically;

- risk allowance provided to specified groups who are subjected

T
261

to physically or morally difficult conditions due to their jobs, e.g. certain types of health workers and prison guards.

This legislation provides the framework within which each donor provides these incentives. Thus, projects within IER, supported by USAID regional funds and by other donors, are all pr[illegible]ing the following types of primes though the level of support varies:

- supplement for responsibility for directors, deputy directors and division chiefs ranging from $127 to $231 per month;

- research supplements ranging from $38 ro $82 per month;

- performance awards to individuals based on exemplary work in their designated positions equivalent to one month salary provided one time per year to staff in each grade level (maximum percentage is specified);

- hardship allowances (similar to risk allowances) paid monthly to all individuals in remote areas.

Similar supplements are provided in the extension agencies [illegible] the Ag. training insitutions. On the other hand, the UNDP has eliminated primes and provides no fuel or other operatin[illegible] expenses. There is currently a UNDP project with the DRA. (Th[illegible] effect of limited operating expenses can be noted: DRA staff [illegible] not have fuel to visit sub stations). A uniform policy should be developed and applied to all USAID Projects taking in[illegible] consideration policies of other donors.

Non monetary incentives should also be considered. Researchers [illegible] other countries are often motivated by the opportunity to publi[illegible] and gain professional recognition among thei[illegible] peers. There currently no publications in Mali other [illegible] annual repor[illegible] to the Technical Commissions. Other special awards such [illegible] certificates (and some cash bonuses) could be made f[illegible] contributions to joint research activities, extension-resea[illegible] collaboration, or team performance. Awards for joint [illegible] could be made to members of two different divisions or [illegible] who have demonstrated productive collaboration or to the [illegible] team with the best performance records for a given [illegible]

Encouragement of the team approach used in [illegible] important role in improving the effectiveness of thes[illegible] For example, performance of researchers is higher [illegible] researcher participates with the supervisor in determi[illegible] research topics to be pursued. In addition, supervisory [illegible] influence these groups; those supervisors with [illegible] authoritarian style may be able to influence job commi[illegible] improved performance of their staff.

Best Available Document

J. Issue: USAID/Mali Management

This analysis is based upon following assumptions which might have substantial implications for the role and staffing of USAID/Bamako, and technical assistance team.

These assumptions are:

1. contracts for technical assistance as well as construction will be made directly by USAID/Mali. No major host country contracts will be used.

2. TA Contractors will be responsible for procurement and participant training.

3. Authorization for payment of all vouchers and for procurement orders will require the signature of a USAID authorized contractor in addition to those of the relevent Malian counterpart.

It will readily be seen that the arrangements which result from these assumptions will pose a substantial management responsibility for USAID/Bamako and the contractor. Because IER has not worked directly and extensively with USAID in the actual implementation of projects, the involvement of USAID in implementation has to be very close.

Mission management resources will be reorganized to accomodate needs generated by the change in program emphasis as discussed in the FY 1985 CDSS. At the moment one full-time agronomist (at the Ph.D. level) is currently under long-term contract, and the Agricultural Development Officer is experienced in FSR approaches. A senior level project management position, to be vacated in May 1984, has been redefined to emphasize agronomic skills and research management experience; recruitment for this position is underway. Short-term counsel is available from qualified staff at the SDPI and REDSO offices. With the disbanding of SDPI the Mission agricultural development staff will be augmented by an agricultural economist experienced in design evaluation and implementation of farm level research programs. The project officer would be responsible for appropriately utilizing the technical staff of USAID from the livestock and forestry sections.

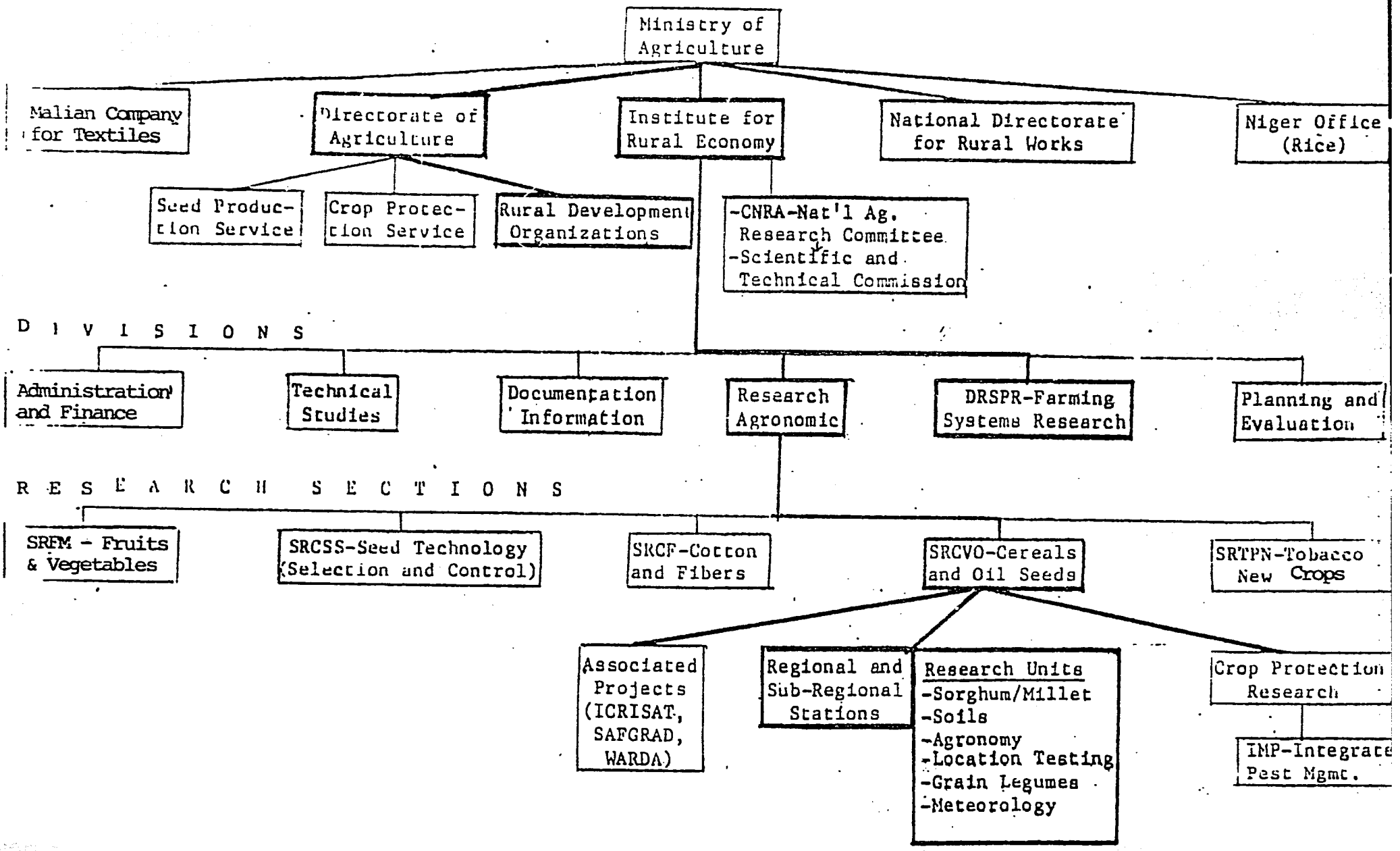
The project will place a relatively heavy burden on the USAID Management and Engineering staff in the initial phases of this project. The project anticipates construction as detailed in the proposed budget. Until an institutional contractor is available, initial construction will be managed by USAID based on plans developed by a A&E firm.

Existing level of staff and personal service contractors in the Engineering and Management Offices of USAID/Bamako are not sufficient to meet this workload. Thus, a contractor should provide support in preparing and managing construction plans. Construction plans would be managed by a contractor and will be reviewed and approved by the USAID/Mali Engineering Office. It is expected that local contractors will be awarded contracts based upon the Mission's standard open-bidding policy. All renovation and construction management including payments and certification of completion and release of funds would be based upon Mission policy in force at the time of project implementation. In addition, the contractor will provide administrative support staff with experience in procurement and financial management and familiarity with USAID requirements, as well as a U.S. based backup system for facilitating overseas procurement and shipping. The responsibility for selecting and processing candidates for long-term training should be clearly assigned. In addition, USAID and IER procedures for identifying, selecting and placing candidates in the U.S. and upon their return to Mali should be developed immediately.

A procurement waiver anticipated for certain equipment is in the Attachments. Procurement in the U.S. and shipping to Mali will be contracted to a purchasing center (e.g. AAPC) or the technical assistance contractor.

ANNE-G
ATTACHMENT-1

ORGANIZATION OF AGRICULTURAL RESEARCH IN MALI



Agricultural Research Decision-Making and IER Structure

The major decision-making bodies are the specified technical commissions of DRA and DRSPR. In DRA, chief of each research unit (called as cell) submits research proposals to the appropriate research section (e.g. SRCVO). The research section in turn (e.g. SRCVO) review the proposals internally before submitting to the technical commissions. Research programs must be revowed and approved in the annual meetings of the Technical Commissions of DRA.

The staff and chiefs of each division, section and cell attend the technical commission meetings which generally lasts for about a week in March. Written reports on results of research conducted by each section during the past year and proposed work for the upcoming year are distributed. These documents are summarized in a 15-30 minute formal presentation by the section chiefs. Proposed elements are crop specific. Brief discussion is permitted and the individual elements of the work program are accepted, revised, or deleted. Modifications in suggested activities may also be proposed. This process requires that all work on research problems must be initiated at the national level and must move through testing at the various research centers and at locations. The process does not readily permit an iterative referral of problems from field based researchers.

The existing agricultural research decision_making processes within DRA are strongly oriented towards development and testing of new varieties on a crop basis. There is a tendency for research to be conducted under strict experimental conditions on the research stations. Once a new variety or practice is identified at a research station, similar trials will be conducted at regional stations in one or all of the regions (i.e. Cinzana, Mopti, Diré, Samé). Then multilocational trials are conducted at Points d'Appui Recherche (PARs), using promising technologies from these trials. SAFGRAD may also initiate on-farm tests which are researcher-managed. The objective of these tests is to conduct trials on one technical practice throughout a large area to determine its applicability to that entire area. It is possible for similar trials to be continued at the national and regional centers simultaneously. However, no work may be undertaken on farmers' fields unless trials have first been conducted on regional stations and at multilocational sites. The multilocational testing unit is relatively weak in terms of both trained personnel and operating resources and conducts trials only on research stations and other locations (PAR's). Only 14 trials were set out this year. SAFGRAD, which is located in multilocational testing, unit conducts 250 to 300 on-farm tests annually. (The exception to this process occurs when ICRISAT has produced results which require field testing; these tests can be undertaken by SAFGRAD without previous testing by the multilocational unit. The results of SAFGRAD's on-farm field

trials will then be made available to the Operations. This process is intended to generate results which are applicable for broadly defined agro-climatic areas.

National and Regional Functions of DRSPR ATTACHMENT II.

A. National Functions

1. Management support functions

- Work plan and budget review with IER Director and USAID (Dutch and Canadian also)
- Establishing an effective personnel review process and corresponding incentives
- Approval of research plan
- Allocation of budget
- Disbursement of funds
- Allocation of fuel and vehicles and other means of transport
- Allocation of staff and level of effort to each unit
- Backstopping field units for transport, supplies and procurement
- Establishing and maintaining accounting and financial planning
- Scheduling implementation activities
- Monitoring progress and evaluation

2. External liaison functions (resource exchanges):

- Liaison with DRA, including negotiations for on-station research activities
- Arranging for specialists from other divisions/agencies to assist in specific research tasks

3. External liaison functions (information exchanges):

- Appraising existing technologies relevant to problem
- Assessing implication of national policy for research
- Dissemination of reports to extension, training and research agencies
- Gathering and analyzing secondary data on Mali
- Collaboration with international agencies

4. Training support functions:

- Organizing and conducting workshops and seminars [illegible] sharing [illegible] information and exchanging research results
- Development of on-the-job training program
- Identification of candidates for training
- Assisting in the introduction of FSR/E curricula [illegible] agricultural training schools

5. Research support activities in the field:

- Develop annual work plans and budgets for entire program
- Develop guidance on research design

- Analyze and approve recommendations for on-farm research
- Assure quality of data collection at regional level
- Assist in analyzing results of surveys and on-farm tests
- Appraise existing technologies relevant to problems
- Support in assessing the input/support services for a given intervention
- Set criteria for choice of research activities

6. Construction and maintenance

- Develop building plans and review them with USAID/Engineers
- Issue requests for bids and select contractor
- Monitor contracting
- Monitor facilities maintenance

B. Regional Field Unit Functions

1. Data collection and analysis

- Selection and determination of recommendation domains
- Data collection
  . hypotheses to be tested
  . develop methoodology
  . data collection procedures
  . design of instruments and techniques
  . sampling
  . implementing and monitoring surveys
  . data analysis
  . evaluation and interpretation of data and reporting

2. Planning and conducting on-farm research:

- Identify intervention, develop hypotheses for on-farm testing
- Determine number of tests, factors, select farmers and sites
- Establish criteria for evaluating results
- Assess marketing conditions and implications for research
- Conduct field trials with extension agency support
- Analyze and evaluate data and report results

3. External liaison functions (regional and national levels, information sharing):

- Appraise existing technologies relevant to problem
- Communicate and share information with the extension agency
- Coordinate with the extension agency in the delivery of inputs to farmers participating in trials
- Report implications of research for extension agencies

4. Training functions:

- Train extension agents to conduct on-farm research
- On-the-job training of technical staff
- Training enumerators

T 268

5. Program Related-functions:

- Propose annual technical work plan/budget and staffing
- Allocation of staff and level of effort for research activities
- Maintain vehicles
- Maintain personnel and financial records

ENVIRONMENTAL ANALYSIS

Concerning the environmental threshold decision, the AID/W Africa Bureau environmental officer granted a categorical exclusion for research activities and a negative declaration for construction and housing (STATE UNCLASS. 223324, Aug. 9, 1983). The basis for these determinations remains valid.

The environmental officer indicated that a risk-benefit analyses is required before pesticides can be procured. Recently, risk-benefit analyses of pesticides used and recommended for use in research programs in Mali were conducted for the following projects (see attached tables):

- Semid-Arid Tropics Research II (688-0226) in 1981; and
- OMVS/Aggonomic Research II (625-0957) in 1982.

These projects operate in areas in which proposed FSR units are to be initiated. Concerning pesticide use, the FSR/E project should adhere to the already approved approaches for these areas.

Although research efforts financed by this FSR/E project will be carried out under carefully controlled conditions, pesticides will be examined for their potential for farmer-level use. It is imperative, therefore, that both AID and project staff propose the use of safe and effective pesticides.

Table I lists the pesticides currently used and recommended by the Malian government. Table II proposes a tentative list of Environmental Protection Agency (USEPA) and are relatively less toxic and safe. If pesticides are proposed that are not registered or acceptable to the USEPA, a request should be prepared in accordance with the criteria set forth in Regulation 16, paragraph 216.3 (b) (1) (i). This document would then be presented to the AID/W Africa Bureau environmental officer for review and consultation with the Bureau of Science and Technology's Agricultural Office.

In addition, AID/W approval will be required prior to procurement of all pesticides with project funds.

The role of pesticides in the project should be viewed as a secondary pest management component. The primary management strategies should emphasize traditional integrated methods such as cultural practices, resistant varieties, and preservation of naturally occuring agents. The objectives of the Integrated Pest Management Project (IPM) in Mali, described in the Technical Analysis, are highly compatible with the FSR methodology to be followed in this project. IPM participation should be solicited in design and implementation of FSR practices.

T 27D

TABLE I

INSECTICIDES USED BY GRM

Atrazine
Axodrine (Monocrotaphos)
BHC
Bromophos
Chlordane + Dieldrin (Procidax poudre)
Cotodon
Cotoran
Curacron
Cyanophos
Cymbush
Decis
Diazinon
Dieldrin
Dieldrin + thiram
Dithane
Dichlorethane
Endrin + DDT
Endosulfan
Ethyl Parathion
Fenvalerate
Finitrothion
Navacron
Nuvation
Preprothion
Phosalon + DDT
Phostoxin
Politrine
Primagan
Propoxur
Ronstar
Sorghoprim
Sumicidine
Torak
Vapam

---

1. Data obtained from CMDT and OPSR (Protection Protect. Semences et récoltes)

TABLE II

Insecticides		Regulation Status	Crops
Acephate	oral (rat) 945 dermal (rabbits) - 2000	Registered	all
Bacillas thuringiensis	non-toxic	Registered	all
Carbaryl	oral (rat) 800 dermal (rabbits) - 2000	Registered	all
Diazinon	oral (rat) 300-380 dermal (rat) -2150	Registered	all
Dimethoate	oral (rat) 320-380 dermal (rat) 610	Registered	R, M/S, W
Fenitrothion	oral (rats) 250-500 dermal (mice) - 3000	Registered	all
Glyphosphate	oral (rats) 4320	Registered	R, M/S, W
Malathion	oral (rats) 2800 dermal (rabbits) 4100	Registered	all
Phostoxin	2.8 mg/l air (2000 ppm)	Registered on basis of user hazard	seed storage (all crops)
Thiram	oral (rats) 780	Registered	M, M/S

1) Partially adopted from risk/benefit analysis- OMVS/Agronomic Research II (625-0955)

2) R: rice
M: maize
M/S: millet/sorghum
W: wheat
V: vegetables

all: acceptable on any of the above.

272

INFORMATION MANAGEMENT IN THE FSR/E PROJECT

This project will place major emphasis on quantitative data gathering and analysis at the farm level and village level. Experience in other farming systems research projects elsewhere in the region indicates that much more data is generally collected than is analyzed and that much of the data collected is never processed into a form which facilitates later access and utilization. To some extent, this has also been the experience of DRSPR to date. It is often throught that the acquisition of a computer will automatically resolve all data handling and management problems. It is now well-known that it is not always so. To avoid these traps, the following decisions will be made by DRSPR, the technical assistance team, and USAID/Bamako in order to address the problems of data handling and management:

- on procurement of hardware and related software
- on systems to be established for data storage, management, and access.

To assist DRSPR in developing policies and procedures related to data management and analysis, a short-term consultant (a specialist in statistics and data management) will be employed by USAID/Bamako in the first of project implementation to:

1. review in depth the present equipment, experience, and statistical objectives and approaches of DRSPR; and
2. develop, in collaboration with DRSPR, a phased plan for the following:
   a. computerization and management of the present data base;
   b. guidelines for periodic additions to the data base in the life of the project;
   c. guidelines for access to the data base by non-DRSPR personnel;
   d. hardware acquisition/maintenance options;
   e. software acquisition/maintenance options;
   f. staff training needs; how these needs will be met; and
   g. short-term technical assistance needs in the statistics/data management area.

X 273

As the technical assistance team will not be on board at this time, USAID/Bamako will participate in the preparation and review of this plan to the extent possible. USAID/Bamako will in collaboration with DRSPR, be responsible for seeing that the plan is understood and, if necessary, appropriately revised once the technical assistance contractor is selected.

USAID/Bamako will, in its contract with the organization providing the technical assistance personnel, specify that the data generated under this project, with project funds, will be deliverable data. "Deliverable data" will be defined in terms of:

1. format: machine readable on IBM-Pcs, 5 and 1/4 inch floppy disks, double density/double sided;

2. time of delivery: within 18 months of collection (or end of collection cycle); and

3. documentation: hard copy, information on sample selection, complete variable descriptions and codes cross-referenced to questionnaires, information needed to access and process record using specified software packages, cautions regarding further analysis of the data (possible bias, etc.) and specific dates associated with data set.

IER and DRSPR will be parties to the preparation of these contract terms and will agree, in writing, to the Mission policy on data access which will be prepared when the contract team is chosen. No data will be deliverable to USAID which has not already been delivered to IER.