PD-ABB-177
66926

AGENCY FOR INTERNATIONAL DEVELOPMENT

MALI

STRENGTHENING RESEARCH PLANNING AND RESEARCH ON COMMODITIES (SPARC)

PROJECT PAPER (PP)

(688-0250)

UNCLASSIFIED

AUTHORIZED: $19,466,000

DATE: March 31, 1992

PROJECT PAPER

STRENGTHENING RESEARCH PLANNING AND RESEARCH ON COMMODITIES (SPARC)

(688-0250)

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: 688-0250

4. BUREAU/OFFICE: USAID/MALI [5]

5. PROJECT TITLE (maximum 40 characters): Strengthening Research Planning and Research on Commodities

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 06 DD 30 YY 99

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 92 B. Quarter C. Final FY 98

8. COSTS ($000 OR EQUIVALENT $1 = FCFA 270)

A. FUNDING SOURCE	FIRST FY 92 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	1,600	700	2,300	13,123	6,343	19,466
(Grant)	(1,600)	(700)	(2,300)	(13,123)	(6,343)	(19,466)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country		1,000	1,000		6,724	6,724
Other Donor(s)						
TOTALS	1,600	1,700	3,300	13,123	13,067	26,190

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) DFA				0		19,466		19,466	
(2)									
(3)									
(4)									
TOTALS				0		19,466		19,466	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each) — 11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)
A. Code
B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To strengthen the capacity of the national agricultural research system to develop and disseminate sustainable, productive, income-generating technologies for small farmer use.

14. SCHEDULED EVALUATIONS
Interim MM 03 YY 95 MM YY Final MM 03 YY 99

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[X] 000 [ ] 941 [X] Local [ ] Other (Specify) 935

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

17. APPROVED BY
Signature: [signature]
Title: Dennis Brennan, Director, USAID/Mali
Date Signed: MM 03 DD 31 YY 92

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

ACTION MEMORANDUM FOR THE MISSION DIRECTOR

FROM: PRM, Jon H. Breslar

DATE: 10 March 1992

SUBJECT: Strengthening Research Planning and Research on Commodities (SPARC: 688-0250)

Problem: Your approval is requested for the $19.466 million Strengthening Research Planning and Research on Commodities Project (SPARC) for Mali. A total of $2.3 million will be obligated in FY 1992.

Discussion: Since the mid-1970s Mali's Institute of Rural Economy (IER) has been concerned with improving its capacity to generate and disseminate improved technologies that respond to the needs of the country's resource-poor farmers. In support of this objective, USAID/Bamako has become a principal source of financial and technical assistance for research under the ongoing Farming Systems Research and Extension Project, the recently completed ICRISAT bilateral project (Semi-Arid Tropics Crops Research), and other activities including Cooperative Research Strengthening Programs (CRSPs), food security studies, and regional research network activities.

During the past two years IER has pursued a major reorganization and regionalization program designed to enable the Institute to respond more effectively to farm-level needs while at the same time maintaining the effectiveness of long-term research program planning and management. Key to this process is their putting in place important new administrative, procedural and programmatic measures, specifically (1) national-level research program and financial management systems, comprised of decentralized client-oriented research activities implemented through a network of regional centers; (2) regionally-based research activities that satisfy needs not addressed by independent research projects, i.e. those not under the umbrella of IER; and (3) management systems that can ensure the accountability of donor resources.

USAID through SPARC, and in collaboration with other donors working in the agricultural research sector, will assist IER to implement these initiatives and meet the challenges of its new organization. Specifically, SPARC, over a seven-year period, will strengthen the capacity of Mali's national agricultural research system to develop and transfer sustainable, productive and income-generating technologies for small farmer use. Within the framework of IER's long-term agricultural research strategy, SPARC will support selected, priority, multidisciplinary research activities managed by three regional research centers. It will also establish improved financial management, accounting and research planning and management systems to meet regional and international needs.

b'

These activities, which promote the accountability of research to farmers and foster donor-government collaboration, best reflect USAID's comparative advantage in Mali's agricultural research sector. They directly support GRM development priorities and strategies for achieving food security; the CDSS goals of more efficient resource allocation, increased agricultural production, productivity and incomes; and the DFA goal of broad-based, market-oriented and sustainable economic growth.

The impact of SPARC will be evaluated mainly in terms of increases in on-farm yield or area that result from farmer adoption of IER-developed technologies; and, ultimately, growth in rural employment and the economy at large.

The $19.466 million LOP funding for the project is divided into technical assistance ($6 million), IER operating costs ($4.7 million), training ($3.9 million), commodities ($1.7 million), project support costs ($1.6 million), audit and evaluation ($390,000), construction ($230,000), and contingency ($926,000). The GRM will contribute $6,724,000 to the Project. The total Project cost is $26,190,000.

Congressional Appraisal: A Planned Program Summary (PPS) for SPARC was presented in the FY 1992 Congressional Presentation (see page 333). No further justification or appraisal is needed as (1) the description in the Project Paper is the same as the PPS; (2) the funding source (DFA) is the same; and (3) the LOP figure of $19.466 million is less than a $5 million increase from the $18 million figure proposed in the PPS.

Initial Environmental Examination (IEE): The IEE conducted by the Africa Bureau Environmental Officer recommended a Categorical Exclusion for the SPARC Project (see IEE dated August 2, 1991, attached as Annex I of the Project Paper).

Justification: Under Africa Bureau Delegation of Authority 551 you have the authority to authorize programs and projects that do not exceed $20 million over the life-of-project or have a life-of-project that exceeds ten years. The A.I.D. $19.466 million grant for the seven-year project is within the limits of your delegated authority.

Recommendation: That you sign the attached Project Authorization and Project Data Sheet, thus approving the $19.466 million Strengthening Research Planning and Research on Commodities Project.

C

Clearances:

PRM: Richard Byess		Date:	30 III 92
ADO: David Atwood		Date:	3/31/92
~~ADO: Tracy Atwood~~		~~Date:~~	3/31/92
MGT: Nancy Hoffman	N. Hoffman	Date:	3/30/92
CON: Mark Miller		Date:	3/30/92
D/D: Alan Getson		Date:	3/31/92

Drafted: c:\doc\actmemo\sparc.w51\JHBreslar\12Mar92
Revised: RLA:DAAdams:3/25/92

PROJECT AUTHORIZATION

Name of Country: Mali

Name of Project: Strengthening Research Planning and Research on Commodities ("SPARC")

Number of Project: 688-0250

1. Pursuant to Section 496 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Strengthening Research Planning and Research on Commodities Project (the "Project") for The Republic of Mali (the "Cooperating Country"), involving planned obligations not to exceed Nineteen Million Four Hundred Sixty-Six Thousand United States Dollars (US $19,466,000) in grant funds (the "Grant") over a seven-year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/ allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of the project is seven years and three months from the date of initial obligation.

2. The Project consists of assistance to the Cooperating Country to strengthen the capacity of the national agricultural research system to develop and disseminate sustainable, productive, and income-generating technologies for small farmer use through the provision of technical assistance, training, commodities, construction, project management support, evaluations, audits, and financial support for operations.

3. The Project Grant Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. 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 A.I.D. may deem appropriate.

4. a. <u>Source/Origin of Commodities, Nationality of Services</u>

(1) Commodities financed by A.I.D. under the Project shall have their source and origin in countries included in A.I.D. Geographic Code 935, except as A.I.D. may otherwise agree in writing.

(2) The suppliers of commodities and services financed by A.I.D. under the Project shall have as their place of nationality countries included in A.I.D. Geographic Code 935, except as A.I.D. may otherwise agree in writing.

(3) Ocean shipping under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the United States or of countries included in A.I.D. Geographic Code 935.

b. Conditions Precedent to First Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Grant Agreement, except for the provision of technical assistance, the Cooperating Country shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(1) An opinion of counsel acceptable to A.I.D. that the Project Grant Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Grantee, and that it constitutes a valid and legally binding obligation of the Cooperating Country in accordance with all of its terms;

(2) A statement of the name of the person holding or acting in the office of the Grantee specified in Section 8.2 of the Project Grant Agreement, and of any additional representatives, together with a specimen signature of each person specified in such statement;

(3) Evidence of the establishment of a separate bank account to deposit all Grant funds received from A.I.D. for the Project.

c. Conditions Precedent to Disbursement for Construction Services

Prior to any disbursement, or to the issuance of any commitment document under the Project Grant Agreement to finance any construction activity, the Cooperating Country shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(1) Plans, drawings, specifications and a construction schedule for each specific construction activity to be financed;

(2) A copy of the Invitation for Bids (IFB) for the procurement of each construction activity estimated to exceed $100,000, including any local currency portion, prior to its issuance;

(3) A copy of each host country contract for construction services in excess of $100,000 including any local currency portion, prior to its execution by the Cooperating Country;

(4) An original or copy of the executed host country contract entered into for each construction activity under $100,000 to be carried out; and

(5) A description of the arrangements made to provide engineering supervisory services for each such construction activity.

Dennis Brennan
Director, USAID/Mali

March 31, 1992
Date

Clearances:

PRM:	Richard Byess		Date: 30 III 92
ADO:	David Atwood		Date: 3-30-92
ADO:	Tracy Atwood		Date: 3-30-92
MGT:	Nancy Hoffman		Date: 3/30/92
CON:	Mark Miller		Date:
D/D:	Alan Getson		Date: 3/31/92

Drafted: c:\doc\author\sparc.w51\JHBreslar\10Mar92
Revised: RLA:DAAdams:3/25/92

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ACRONYMS

AIRD	Associates for International Resources and Development
CFM	Consolidated Funding Mechanism
CIDA	Canadian International Development Agency
CILCA	Food Crops International Liaison Committee
CIMMYT	International Center for Maize and Wheat Improvement
CIRAD	Center for Cooperation in Agricultural Research for International Development)
CMDT	Compagnie Malienne pour le Developpement des Textiles (Malian Textile Development Company)
CNRA	National Committee for Agronomic Research
CNRST	Comité National pour la Recherche Scientifique et Technologique (National Center for Scientific and Technical Research)
CRED	Centre for Research on Economic Development
CRRA	Centres Régionaux de Recherche Agronomique
CRSP	Programme d'Appui pour la Recherche Collaborative (Collaborative Research Support Program)
CTR	Regional Technical Committee
DDG	Deputy Director General of IER
DG	Director General of IER
DET	Division des Études Techniques
DHV	Development of the Haute Vallée
DPE	Division de la Planification et de l'Évaluation
DPER	Département de la Planification et de l'Économie Rurale
DRA	Département de la Recherche Agronomique
DRFH	Département de la Recherche Forestière et Hydrobiologique
DRSP	Département de la Recherche sur les Systèmes de Production
DRZ	Département de la Recherche Zootechnique
EDF	Economic Development Fund (Fond pour le Développement Economique)
EM/PV	Multilocational testing unit (Essais Multilocaux/Prévulgarisation)
ENA	Ecole Nationale d'Administration
ENSUP	École Normale Supérieure
EPA	Administrative Public Establishment (Établissement Public d'Administration)
EPIC	Public Establishment for Industrial and Commercial (Établissement Public a Charactere Industrielle et Commercialle)
EPP	Professional Public Establishment (Établissement Public Professionnel)
FAO	Food and Agriculture Organization of the United Nations
FIDA	International Agricultural Dèvelopment Fund (Fond International pour le Développement de l'Agriculture)
FMS	Financial Management Specialist
FSR	Farming Systems Research
FSR/E	Farming Systems Research and Extension
GDP	Gross Domestic Product
GRM	Government of the Republic of Mali
GSB	General Services Bureau
ICIPE	International Center of Insect Physiology and Ecology
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics

IDRC	International Development Research Center
IER	Institut d'Économie Rurale
IFDC	International Fertilizer Development Center
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Center for Africa
ILRAD	International Laboratory for Research on Animal Diseases
IMF	International Monetary Fund
IMPHOS	Institut Malien des Phosphates
INRZFH	National Institute for Animal Science, Forestry and Water Resources Research
INSAH	Sahel Institute
INRSP	National Public Health Research Institute
INTSORMIL	International Sorghum and Millet CRSP
IPM	Integrated Pest Management CRSP
IPR	Rural Polytechnic Institute - Katibougou
IRAT	Institut de Recherche Agronomique Tropicale et des Cultures Vivrières
IRDC	International Development Research Center
IRR	Internal Rate of Return
IRRI	International Rice Research Institute
ISFRA	Applied Research Training School
ISNAR	International Service for National Agricultural Research
M&E	Monitoring and Evaluation
MIS	Management Information Systems
MOA	Memorandum of Agreement
NARS	National Agricultural Research System
NGO	Non-governmental Organization
NPV	Net Present Value
NRMS	Natural Resources Management Support Project (AID)
ODR	Operation de Développement Rural
OHV	Operation Haute Vallée
OIAP	Office of International Agricultural Programs
OPS	Organisation Production des Semences (Government seed agency)
ORSTOM	Organisation de Recherche Scientifique pour les Territoires Outre-Mer (French Institute for Scientific Research for Coopreative Development)
PARA	Projet d'Appui à la Recherche Agricole (SPARC)
PC	TAMU Project Coordinator
PD	IER Project Director
PID	Project Identification Document
PIL	Project Implementation Letter
PIRT	Projet d'Inventaire des Ressources Terrestres
PNVA	National Agriculture Extension Project
PRMC	Cereals Marketing Restructuring Program
PS	Permanent Secretary
PT	Participant Training
PVO	Private voluntary organization
SARFA	Supporting Agricultural Research and Faculties in Africa
SAFGRAD	Semi-Arid Food Grain Research & Development Program
SANREM	Sustainable Agriculture and Natural Resources Management
SECID	Southeast Consortium for International Development
SPAAR	Special Program for African Agricultural Research
SPARC	Strengthening Research Planning and Research on Commodities
SRCVO	Section de Recherche sur les Cultures Vivrières et Oléagineuses

SRFMP	Sahel Regional Financial Management Project
TA	Technical Assistance
TAMU	Texas A&M University
TAMU CG	Texas A&M University Contractor Group
TAMRF	Texas A&M University Research Foundation
TDY	Temporary Duty
TropSoils	Tropical Soils - Soil Management CRSP
UNDP	United Nations Development Program
USAID/AID	United States Agency for International Development
WARDA	West Africa Rice Development Association
WASIP	West African Sorghum Improvement Program (ICRISAT)
WID	Women in Development

I. PROJECT BACKGROUND AND RATIONALE

Agriculture plays a principal role in Mali's prospects for sustained economic growth. Major economic liberalization and policy reform over the past ten years have laid the groundwork for increased growth. However, for Mali to realize its growth potential requires sustained increases in productivity, which will come in large measure from the agriculture sector and from rural areas. Measures to increase rural productivity are essential components of sustaining and increasing economic growth.

Mali's agricultural research system has already made some significant contributions to rural productivity and to economic growth. A highly competitive cotton subsector, a healthy cattle population, increased use of forage for animal feed, practices and varieties that produce more millet and sorghum grain in bad production years - these appreciable productivity gains of the last decade are directly attributable to Mali's increasingly effective agricultural research system.

Sustained growth in productivity requires more effective use of resources within the agricultural research system in order to develop techniques that farmers and others in the agriculture sector can use to their benefit. The GRM has taken important steps over the past two years to increase the efficiency with which it uses financial and human resources in developing new technologies. These steps include the following:

- Merging the crops and livestock/natural resources institute into a single national agricultural research institute, the Rural Economy Institute (IER) in 1990;
- Reviewing in-depth constraints in the sector, and developing a clear and prioritized set of limited research activities to which IER is committed to devoting sufficient human and financial resources in order to have an impact;
- Initiating a research planning process in sorghum and millet in which teams of researchers working together plan and implement research programs;
- Reorganizing IER scientists and administrators in ways that more efficiently use scarce research resources and establishing a long-term relationship with the International Service for National Agricultural Research (ISNAR) for the provision of continued advisory services in the management and organization of research;
- Establishing stronger relations with both extension agencies and other research institutions;
- Actively seeking a legal status and organizational framework which can both keep scientists in the research system and provide the incentives and flexibility required to do better research; and.
- Rationalizing the formal structure within which research plans are developed and approved.

These solid changes signal a new direction and a new, more efficient way of IER conducting research to improve farmers' incomes and Mali's growth prospects.

The changes are also significant because they are undertaken with support from a cadre of competent researchers and research administrators that already exists in Mali. The government of Mali, with the assistance of several major donors (including USAID), has over the past twenty years made major investments in the human resources needed to conduct solid agricultural research. Without such investment, the changes outlined above would not have been made nor could they be implemented.

The challenge for the future, and the rationale for the SPARC project, is to assist the IER to implement the changes outlined above, while at the same time continuing to provide direct support for several of the research programs which USAID has supported in the past. IER needs such support. While it has made most of the critical organizational and structural changes required to be more efficient, translating these changes into actions and resource flows at the level of the research station and the farm has yet to be accomplished.

For IER's plans to bear fruit will require a combination of technical and financial assistance, a few prototype research programs to serve as an example of IER's new and better way of conducting research, and budgeting and programming mechanisms to permit IER to better manage all of the resources at its disposal, including the considerable financial resources provided by several donors. Using such project inputs to fully implement the organization and structural changes already made will enable IER to better meet the needs of Malian families in increasing their incomes and food production.

II. PROJECT DESCRIPTION

A. Project Goal, Objective and Purpose

1. Project Goal and Objective

The goal of the Project Supporting Research Planning and Research on Commodities is to support sustainable economic growth in Mali. The strategic objective will be to increase incomes in areas of relatively high productive potential.

This goal and objective are consistent with the development strategy presented in the USAID/Mali 1990-1994 CDSS to promote economic growth through policy change, increased agricultural productivity and private sector development in ways that improve the incomes, nutritional status, and well-being of Malians. The project goal and objective support of the Development Fund for Africa overall goal to achieve broad-based, market-oriented and sustainable economic growth, including its objectives to develop the potential for increased agricultural productivity, improved food security, and improved public sector management and efficiency.

2. Project Purpose

The purpose of the project is to strengthen the capacity of the national agricultural research system to develop and disseminate sustainable, productive and income-generating technologies for small farmer use. Support for commodity research and technical assistance in research and financial management will broaden national capacity to develop and promote farmer-usable and sustainable technologies, to analyze the cost-effectiveness and impact of research investments, to develop improved responsiveness to farm-level needs, and to manage an effective research system.

B. Project Overview

Since the mid-1970s the Institute of Rural Economy has been concerned with improving its capacity to generate and disseminate improved technologies that respond to the needs of the country's resource-poor farmers. In support of this objective, USAID/Bamako has become a principal source of IER financial assistance for research through the on-going Farming Systems Research and Extension project, the recently completed ICRISAT bilateral project (Semi-Arid Tropics Crops Research), and other activities including CRSP's, food security studies, and regional research network activities.

In the last two years, IER has pursued a major reorganization and regionalization program designed to help it respond more effectively to farm-level needs while maintaining the integrity and effectiveness of long-term research program planning and management. This effort requires a significant number of profound administrative, procedural and programmatic changes which must be implemented while the Institute simultaneously pursues the objectives of its strategic plan.

First, in order to establish and manage national research programs comprised of decentralized and client-oriented research activities through the new regional centers, the Institute must create a new and national system of research program and financial management. Over 90% of the agricultural research funding which supports IER scientists is financially and administratively independent of the Institute, approximately 65% coming from donors and another 25% in the form of salaries managed by GRM but not by IER. Moreover, the Institute currently lacks the administrative capacity to assure the responsiveness of these activities to local needs and to the objectives of the Strategic Plan. SPARC will be the first externally-funded project designed to help the Institute create this management and programming capacity.

Second, several new, regionally-based research activities must be designed and supported in order to meet research needs not addressed by the current independent research projects. As "IER projects" instead of separate, donor-controlled research projects, these new activities can be used to test the effectiveness of the new management system for research implementation.

Third, as IER designs and tests its new financial and program management system, it must also identify ways to expand the system to the current "independent" projects while simultaneously assuring the accountability of multiple donor financial resources.

The SPARC Project, in collaboration with other donors, is designed to meet these challenges. The project consists of seven years of financial and technical assistance to be provided principally by the Texas A and M University consortium (TAMU), with an additional grant to the International Service for National Agricultural Research (ISNAR). SPARC will support selected, priority, multidisciplinary research activities in IER's core long-term plan at three different regional centers of research . At the same time, the project will focus on a program of technical and financial assistance and training designed to help establish new and improved financial management, accounting and research planning and management systems which are responsive to the Institute's regionalized research program needs.

With SPARC project support, IER will be a pacesetter within the context of the SPAAR (Special Program for African Agricultural Research) initiative to revitalize agricultural research in the Sahel. With project assistance, IER can serve as a model for financial and program management which both encourages the accountability of research to farmers and serves as a basis for improved donor and government collaboration and coordination.

C. Project Inputs

1. Technical Assistance

a. Long-Term Technical Assistance

The project will provide 12 person-years of long-term technical assistance in support of IER's efforts to design and implement effective research management systems.

IER scientists and managers are fully engaged in a major process of institutional reorganization and an ambitious program to regionalize their research programs. Under these conditions, seven person-years of long-term technical assistance by a Project Coordinator (PC) assigned directly to the Office of the Director-General can make an invaluable contribution to helping IER launch its new research

planning and management system. The PC will give specific attention to the establishment of a planning, monitoring and evaluation system, including support at the regional level and to inter-departmental programming.

At the same time, in the absence of full-time qualified and experienced personnel and a functional financial management system, 5 person-years of long-term technical assistance are essential to help design and test a new IER system of financial management which both supports regionalized research programs and encourages greater donor confidence in coordinated research funding. IER lacks the qualified personnel required to design and establish a new system. Under these circumstances USAID needs Long-term TA in place in order to ensure proper disbursement of and accounting for funds provided by the project for selected IER research and management activities.

Long term technical assistance, together with a substantial part of the short term technical assistance and training activities, will be contracted for through Texas A and M University and its consortium partners in the Title XII Collaborative Assistance Mode. The joint IER-USAID Title XII Collaborative Mode selection process took place in 1991, leading to the selection of Texas A and M and its consortium partners as the contractor for the design and implementation of the SPARC project.

b. Short-Term Technical Assistance

Short-term TA, and especially those who make a commitment to regular support over a long period of time, is a proven, acceptable and effective mechanism for providing professional technical support in Mali. It avoids the costs and problems associated with large long-term TA teams, it provides senior scientific advice, and it places research program responsibility in the hands of national program researchers.

In order to ensure that SPARC related research is both effective and efficient at developing appropriate farm level technologies, short-term technical assistance from TAMU will be required to (1) link IER/SPARC research to other similar regional and international efforts; (2) provide professional guidance to the more junior IER researchers who constitute the bulk of IER work force implicated; (3) assist IER to better formulate and implement true interdisciplinary collaborative research programs; and (4) assist IER research collaborators to publish research results and develop external funding contracts and grants.

SPARC will support thematic research managed through five research stations in three different regional centers. In addition, several social scientists and economists in DPER (the centrally located Department of Planning and Rural Economy) will receive support, and -- beginning in Year Four -- two production systems research teams. SPARC will provide short term TA to these thematic, socio-economic, and production systems teams, according to the needs identified in the annual IER workplanning process in which the SPARC PD and PC will participate. All short term TA requests will be initiated and made in-country by IER. An average of 11 person months of short term TA per year will be provided by TAMU, approximately 60% of which will support station research and the remainder support socio-economic research, improvements in research and financial management, and training.

In order to reduce cost SPARC will utilize CRSPs where possible, paying travel but not salary costs. There is a very close fit between the short term TA requirements of the SPARC project and the attributes of many CRSP scientists currently conducting collaborative research with IER. US scientists from the INTSORMIL CRSP, for example, provide IER sorghum and millet programs with technical backstopping and strong research collaboration in several disciplines. The basic principle involved in using CRSP's will be that SPARC activities will be additive to already-planned CRSP costs. SPARC will cost-share plane fares and add the required additional travel and other costs, for example, for a CRSP scientist to spend a week more than he would have spent in country under only central CRSP funding, in order for him or her to provide support to an additional IER research project or scientist. Approximately 40% of short term TAMU TA will come from CRSP's.

In addition to short-term TA to support research programs and training, USAID will negotiate a grant with ISNAR to continue and complement ISNAR's core program of technical assistance in support of IER research planning and management. With USAID financing, ISNAR has provided research management advisory services to IER since 1988. This has been an essential element permitting IER to effectively manage the development of its Strategic Plan and reorganization.

The ISNAR grant will supplement the technical assistance and training in research planning and management provided to IER under the TAMU contract. This grant will enable ISNAR to offer strategically defined planning and management advisory services, including the introduction of a management information system, that supports and augments the more day-to-day and operational management and research assistance under the TAMU technical assistance contract.

Regular, joint IER, TAMU and ISNAR discussions will help to ensure that the technical services available under the contract and grant are used in the most effective, complementary fashion to support improved research planning and management at IER.

2. Training

a. Long-Term Training

As part of its long-term strategic plan, IER, with support from ISNAR, has evaluated its scientific training needs. This assessment is based on the deployment of current research staff and the estimated needs for research scientists to implement the Institute's long-term research strategy. The Institute's preliminary analysis identifies a need for almost 65 new research positions, required to carry-out the IER strategic plan. As the Institute continues to revise and adjust this plan during the next 2-3 years, the number of positions may be adjusted accordingly.

Based on the identification of the Institute's training needs in the strategic plan, the staffing required to achieve those IER core research and program priorities to receive SPARC support, and the distribution of BSc., MSc. and PhD-level scientists currently in place, the project will finance 19 long-term degree programs. Training will be provided for 10 MSc. and 9 PhD programs in 13 key disciplinary areas that will strengthen project-supported research and management activities (see Table II-1) in support of the IER Strategic Plan objectives.

In order to ensure an even flow of departing candidates and returning degree holders, the long-term training will be scheduled in three phases. At least 7 long-term training programs have been initially identified that will immediately strengthen priority project programs: one sorghum pathologist, at least

one sorghum or millet physiologist, and a cereals entomologist who are currently at the MSc. level require PhD level training; 3 researchers (a weed scientist and pathologist with the millet program and a cereals food technologist) with Bachelor-level degrees need MSc.-level training. A candidate for MSc.-level training in Accounting and Financial Management will also be identified for a first phase departure. In addition, two more PhD program candidates will be identified during the first trimester of project implementation.

A combination of experienced IER researchers and short-term technical assistance will continue the research activities of those individuals selected for long-term training. Candidates for the second and third "waves" will be identified and selected by the end of the first and second years, respectively, of the project. Costs of in-country research are not provided through the SPARC project (with the exception of a second round trip airfare), but project staff will assist dissertation candidates to seek financial support for such research when it is appropriate and approved by IER.

Long-term training will also include a spousal training component, providing for up to two years of academic, professional, technical or other training to spouses of long-term participants who accompany them to the overseas training location, and who are sufficiently interested in training to take the initiative to learn English and identify suitable training opportunities.

Table II-1: Indicative Training Programs

	MS	PhD
Accounting/Fin. Mgt.[a]	2[b]	0
Agricultural Economics[c]	0	1
Agronomy	0	1
Applied Anthropology/ Rural Sociology	1	1
Biometrics (Agronomist Biometrician)	0	1
Food Science Technology (Cereals)	2	0
Entomology	0	1
Forage Crops	1	0
Plant Breeding	1	1
Plant Pathology	1	1
Plant Physiology	0	1
Soil Microbiology	1	0
Weed Science	1	1
Total	10	9

a The degree training should be based in Public Finance and through a School or Program in Public Administration which also permits coursework in business management. One of these degrees might be substituted or complemented by a graduate program in human resources management.

b Should a relevant PhD program in this category be identified, one MS degree will be changed to a PhD degree.

c Given the number of agricultural and/or socioeconomists in IER, this training program could begin in the 2nd or 3rd "wave" of PTs.

Table II-2: Proposed Schedule of Long-Term Training

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
MS Students						
Number Departing	5	4	1			
Number Abroad	5	9	10	5	1	
Number Returning				5	4	1
PhD Students						
Number Departing	4	4	1			
Number Abroad	4	8	9	9	5	1
Number Returning					4	4

b. Short-Term Training

This training is designed to improve the professional skills of IER scientific, technical, administrative and support staff. The training will be provided through special, short-courses, on-the-job instruction, workshops, conferences or seminars in the US, another country or in Mali. The initial program for short-term training will be prepared for the first annual project workplan and revised annually in response to IER needs and training opportunities.

It is estimated that some of the short-term technical assistance will be used in support of short-term training. Over the life of the project, participation by approximately 105 IER staff in overseas short-courses, workshops and conferences are expected to be planned. Short-term TA in support of in-country short-courses is budgeted in the short-term TA line item.

Table II-3: Short-Term Training Schedule and Costs (000 US dollars)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	TOTAL
Short Courses	No. Courses	5	10	10	10	10	5	50
	Cost	65.9	136.5	143.3	150.5	158.0	83.0	737.2
Workshops and Conferences	No. Trips	5	5	5	10	15	15	55
	Cost	26.3	26.3	26.3	52.6	86.9	91.3	309.7

3. Commodities

Commodities to be purchased under SPARC include vehicles (4x4 passenger vehicles, motorcycles, mobylettes), micro-computers, laboratory and field research equipment, and office and household furniture and equipment to meet the administrative needs of the project and to provide the necessary infrastructure to carry out the commodity and socio-economic research programs. Table II-4 identifies the commodities to be purchased. Commodities will support either the tasks of research management and project coordination at IER headquarters or support research in the three regions (and five locations) where SPARC will be most active.

Table II-4: SPARC COMMODITIES

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
U.S. Procurement:								
Household Furniture	2 sets			1 set				3 sets
Office Furniture	6 sets							6 sets
Computers & Programs	20			10				30
Printers & Accessories	20			10				30
Field Research Equipment	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Food Tech Lab Equipment	misc.	misc.	misc.	misc.	misc.			
In-country Procurement:								
4x4 vehicles/ parts	9			6				15
Motorcycles/parts	12			6				18
Mobylettes/parts	6			3				9
Generators/parts	5							5
Photocopiers (lg)	1			1				2
Photocopiers (sm)	2			1				3
Fax machine	1			1				2
Typewriters	3			1				4
Refrigerators	2			1				3
Office refrigerators	1							1
Freezers	2			1				3
Stoves	2			1				3
Air Conditioners	14			6				20
Washing Machines	2			2				4
Clothes Dryers	2			2				4
Food Tech Equipment	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Field Research Eq	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Transformer	1							1

Slightly more than 50% of all commodities will be acquired in Year One of the project. Year Four activities will also include the acquisition of a significant amount of commodities, primarily to replace Year One equipment expected to be beyond active use. Small amounts of field and laboratory research equipment will be acquired each year of the project. More detail on commodities, including justification, is presented in Annex H.

4. Construction

The SPARC project will support modest infrastructure improvements. These will be made at headquarters and in those stations in which SPARC is supporting research activities. These improvements will be limited to those required to ensure that high quality research can take place, such as land leveling to ensure consistency in experimental treatments and installing fences to keep out cattle, to repairing office or laboratory buildings. Two stations outside of the three main regions of SPARC support (Longorola and Ntarla) may benefit from some minor construction upgrading.

During 1992 IER will prepare an infrastructure repair and development plan, and seek resources (in part to come from the upcoming World Bank loan) for the proposed infrastructure rehabilitation and upgrading. SPARC support to modest infrastructure improvement will provide transitional support to ensure that research can continue while the more ambitious World Bank infrastructure upgrading program is getting started.

5. Operating Expenses

SPARC will provide financial support to operating expenses of IER. The bulk of such support will be to support the priority IER research programs (on crops, socio-economics, animal production, and later farming systems research) receiving other SPARC assistance. The remainder will be to support project coordination and research planning and management. These activities include such things as in-country short-term training, travel funds for Department administrators to use in supervision of regional technical programs, vehicle and equipment maintenance and repair, licensing and insurance, communications, documentation and publication.

Operating expense support will be committed through Project Implementation Letters (PIL's) between USAID and IER based on a satisfactory annual workplan approved by IER with TAMU involvement and forwarded to USAID. The operating expenses will be managed through the SPARC/IER financial management system. USAID will provide approximately 45% of project operating costs, and the GRM 55%.

Undertaking productive agricultural research in Mali is expensive. Field labor, inputs, transportation, communications, infrastructure maintenance, and other operating costs constitute major, but necessary, expenses in the development of more productive farm technologies. The GRM recognizes the significance of agricultural research and has increased GRM contributions for operating as well as investment costs. The GRM has increased IER's overall operating and investment budget in 1989, and again -- by 22% -- for the 1992 cropping season. GRM resources alone, however, are inadequate for the research required to increase the flow of productive and income-enhancing technologies to farmers.

IER has taken the initiative to diversify its sources of revenue. The Ciba-Geigy Foundation, affiliated with the international agribusiness firm CIBA-Geigy, is the major source of support for the Cinzana research station which was established in the early 1980's with AID funding. With SPARC support, IER will be encouraged to contact the charitable foundations of other international agribusinesses which may provide similar support to IER's programs and stations.

IER has contracts to implement research for various extension and agricultural development agencies in Mali. The CMDT cotton company in southern Mali funds much of IER's cotton and some maize research programs in the CMDT zone. The National Agricultural Extension Program (PNVA), recently

established with World Bank funding, supports IER on-farm trials where the PNVA is active. Such relationships are extremely productive. They ensure funding for quality research, and help to maintain a "client orientation" by IER researchers.

In addition to these current initiatives to diversify funding sources, the IER financial management system to be established with SPARC support may make it possible for IER to charge overhead on its services or activities. This also will broaden its revenue sources. Finally, there is the possibility over the medium term of an independent IER establishing an endowment based on local currency proceeds from some donor food aid programs.

All of these initiatives and possibilities need to be complemented by sustained donor support in order for IER to increase the speed with which it produces technologies for farmers in Mali's key agricultural zones. Consistent with recent SPAAR initiatives and with IER's own reorganization and planning, financial support for research under SPARC will be provided for IER's core research programs, rather than for a plethora of special projects and activities. This support will be based on continued and increased GRM support for IER and on continued IER initiatives to diversify its funding.

6. Project Support Costs

USAID will provide one PSC project manager for the life of the SPARC project. In addition, costs associated with USAID management of the project, such as photocopy, communication, and travel by the PSC, are included under the project support costs line item.

7. Evaluation

Evaluations will take place in Years 3 and 7 of the project. Evaluations will involve IER, TAMU, and USAID staff, as well as outside evaluators under contract. In addition, participation by ISNAR and other donors will be indispensable.

8. Audit

USAID has analyzed the need for audit, and has made available $140,000 for annual project audits throughout life of the project. In addition, IER may request involvement of the GRM national Inspector General's office on a regular basis, in possible association with semi-annual or annual audits of the entire Institute, funded through the World Bank loan.

D. How the Project Will Work

SPARC activities will be coordinated and managed by a TAMU Project Coordinator and an IER Project Director. They will make up a project coordination unit which will be an integral part of IER, reporting to the Director-General. They will work very closely with the head of the IER General Services Bureau and the TAMU Financial Management Specialist (FMS) on issues related to financial management and administration. The PC and PD will facilitate and help manage four related sets of activities:

- Specific IER research programs receiving SPARC support
- The evolving IER research planning and management process
- Training
- Research linkages

With the assistance of other IER staff, the TAMU Financial Management Specialist (FMS), and the AID project manager, the PC and PD will mobilize and manage operating expenses, commodities, construction, and technical assistance in support of these activities.

1. Research Program Support

The PC and PD will provide support to several high priority activities in the core research program of IER's long term plan. These are detailed in section III. D below (Research Programs Analysis) and in Annex F-4. Specific in-the-field support for these ongoing research programs is a necessary condition for competent and credible participation by the PC and PD in the second project activity, support to IER's overall research planning and management process.

SPARC will support several high priority research projects identified by IER as part of three long term programs: The Cereal and Legume Program, the Animal Production Program, and the Production Systems and Rural Economy Program. Support for these activities will be provided in three regional centers (encompassing five primary research locations) in the Second, Fourth, and Fifth Regions. In addition, as the project and IER's own research planning evolve, it may be possible to provide modest support to other IER research efforts, if such support becomes part of the annual IER/SPARC workplan and research proposal review process, and if sufficient funds are in the operating expense line item of the budget.

The field research projects and programs supported by SPARC will provide a model for the kinds of management, planning, financing, and monitoring methods that IER is committed to eventually introducing across the entire Institute. In this sense, support to specific research programs will at the same time lead into the second project activity, which is supporting research planning and management, as discussed in the next section. The PC and PD will act as catalysts to ensure that the project-supported research activities serve as a basis for development of several new IER research planning and management initiatives. These include the annual meetings of the Regional Technical Committees and national Program and Resources Committees; links for pre-extension testing in collaboration with IER Farming Systems Teams and possibly NGOs; regular relationships with regional extension/development agencies; and program budgetting, control, and financial tracking procedures.

The PC and PD will help the research program leaders implement multi-disciplinary activities, consistent with regional needs articulated in the annual Regional Technical Committee meetings. Research management will be based on the concept of a Regional Center-based research team. The PC and PD will assist commodity program leaders, program coordinators and scientific Department heads to ensure the most effective implementation of programs, from problem identification, to station trials, to multi-locational trials, to on-farm pre-extension. In collaboration with the IER Research Department Heads, the PD and PC will also help to identify means for improving scientific communication ("animation") within and between the Institute's departments.

Short-term technical assistance will be provided in support of IER research programs financed by SPARC. When possible, all short-term assistance to specified programs will be requested to make a long-term (LOP) commitment to regular, short-term technical support to specific research programs. Requests for short-term technical assistance will come from research program coordinators and other research leaders, and will be assessed as part of the IER annual research planning process. Requests approved by IER, with participation by the TAMU PC, will be forwarded to TAMU.

SPARC will provide a significant level of operating expenses to those IER core research activities it supports. PP budgetting for these expenses is only indicative, based on ISNAR's analysis of the average annual research operating costs per scientist across several well-functioning IER activities. The actual level of SPARC financing for each program will be determined during IER's review of the annual presentation of research proposals and budgets by research program coordinators. One SPARC innovation; which will be more broadly adopted through IER, is the presentation of research programs together with program budgets, and the use of program budgets as a management tool by those responsible in the field for conducting the research programs. The PD and the PC will be key participants in the annual research program reviews.

It is likely that the budget breakdown by program in the indicative SPARC budget will not match the actual approved programs of IER which are presented to AID in the annual IER/SPARC workplan. For example, it is possible that some SPARC programs may see approved program levels higher than in the indicative PP budget and others lower. This will be a function of specific differences by location, type of research, and requirements of the program in question. Funds will be disbursed and tracked through the project financial management system, located in the General Services Bureau under the supervision of its Director and the TAMU Financial Management Specialist (FMS).

2. Support to IER Research Planning and Management

The first steps in SPARC assistance to improved IER research planning and management will be through the support by the PC, PD, and Financial Management Specialist (FMS) for the research programs discussed above. In assisting researchers and research coordinators in multi-year team-based programming and budgetting, the PC and PD will be helping to introduce, in a few model research projects, research management techniques which can serve as prototypes for the entire Institute as it evolves during the LOP.

At the same time, the financial management system developed for SPARC -- due to its location at IER headquarters instead of at a separate donor-funded project site -- will, for the first time, help to strengthen IER's own capacity to manage the resources going to IER research programs. SPARC support for IER research planning and management will evolve during the LOP from an initial focus on the prototype SPARC-supported research activities to a broader focus on the full spectrum of IER activities. The specific ways in which SPARC will support more effective IER research planning and management are described below.

a. Strengthening the Research Planning Process

The evolution of IER's research planning and approval process will continue with active support from the PC and PD, and financial information provided by the project financial management system. A multi-year planning horizon, prioritized long-term research objectives, and new procedures to review previous research program results will be put into place. The process will be based on the new IER regional research planning meetings to be first tested in 1992. Research scientists and managers from stations and regional centers, GRM administrative authorities, extension agencies, and farmers will participate.

By decentralizing the staffing and management of research to the regional level, IER will:

- Ensure closer client feedback to researchers, getting extension and farmer linkages early in the research process;
- Promote effective team-based approaches to technology development; and
- Test new technologies, and monitor their adoption at the field level.

The effectiveness of any long-term research strategy depends on regular feedback of information on costs, benefits, appropriateness of research to farmer needs, on-farm technology adoption, and a wide variety of other parameters. The project will provide TA and operating expenses to develop and institutionalize two major programs to track research cost, appropriateness and impact: a new financial management and accounting system to program, budget, and track research funds by activity, location, and donor; and a monitoring and evaluation system which will allow research managers and administrators to track research progress and the effectiveness of research expenditures as reflected through the on-farm adoption of technologies.

Early in Year One, the PD and PC will introduce the project to research program scientists and Department directors, Regional Center and station management staff, and appropriate IER administrators. Through a series of presentations and workshops, IER research and administrative staff will better understand, and indeed help to more precisely define, the concepts underlying the IER reorganization and long-term strategy, the outline of the project, and how project activities can help to carry out the new regionalized, interdisciplinary commodity team-based research programs. In addition, a series of workshops and training programs let by the FMS and the head of the IER General Services Bureau will serve to make the financial management system operational.

Based on requests by IER, specific, short-term technical assistance will be made available to help address specific subjects related to improved research management. Some of the short-term assistance might include: improved communications between stations; station-based researcher access to the IER Documentation Center computerized holdings (e.g., through radio-linked computers); and alternatives for generating more revenue and sustainable financial support for agricultural research. At selected points during the life of the project, short-term technical assistance will offer other useful outside advice and suggestions for improving research administration, such as improvement of research program review procedures, and resolution of financial management problems that may arise during the process of fine-tuning the new system as a management tool.

As part of SPARC's support to improved research management, modest support will be provided to improve IER's documentation and publication. This support will be focused initially on seeking ways to improve access to available scientific documentation, and increasing the quality of presentation and

publication of results of IER's ongoing research programs The latter might be accomplished in an annual or triennial research programs "Highlights" document or a "Symposium" publication grouping the best program presentations of the annual or triannual research review meetings.

Two workshops, the first to be held in Year Two, will identify priority research programs for women and formulate recommendations for incorporation of these priorities into the research planning process. While many of the high priority research activities of the long term plan (including those supported by SPARC) are of substantial benefit to women, the criteria on which IER's planning process was undertaken were gender-neutral. An explicit examination of where research conducted by IER could most directly benefit women will therefore assist to further refine the research planning process. Short-term WID technical assistance may be called in to assist at the workshops.

b. Monitoring and Evaluation

During the first year of the project, PC and PD, in collaboration with ISNAR, will begin designing a Monitoring and Evaluation (M&E) Program. The system will: be based on mechanisms that track the quality of research projects (research design and data analysis) in terms of best use of limited resources; track technology transfer and adoption; facilitate end-user feedback into program evaluation and planning; and track overall research programs accomplishments and progress toward short- and long-term objectives.

The M&E program will be designed consistent with IER's regionalization and decentralization. It will enable IER administrators and managers to evaluate the effectiveness of the new research planning and implementation procedures at the regional, station, departmental and national levels, and to evaluate the impact of technology development and transfer at the farm level. The Research Planning, Management and Monitoring Analysis (Annex F-1) presents a description of the conceptual structure and functioning of a proposed M&E program.

c. Financial Management System

A SPARC financial management system, certifiable by the USAID Controller's Office, will manage and track USAID funds going to IER in support of the SPARC project. Designing, operating, and expanding the system will be a major project undertaking because of the several different objectives associated with the system, which are as follows:

- Safeguarding and tracking USAID-provided funds and assets consistent with sound accounting and control procedures
- Providing a basis for research program budgetting and use of financial information by IER managers in their resource allocation decisions
- Providing the capacity for IER to manage a broader range of financial resources through a single financial system (as opposed to the current multiplicity of donor-managed systems)

Prior to disbursement of USAID SPARC funds for local operating expenses, TAMU TA together with the head of the IER General Services Bureau will have designed a system to manage and track USAID-provided operating expenses, and the system will have been certified by the USAID Controller. The

system will be located within the General Services Bureau (GSB) of IER. The Head of the GSB and the Financial Management Specialist (FMS) will work closely with a short-term TAMU Financial Management Design Specialist, the PD and the PC to ensure that the financial management system is designed to generate the fiscal and budgetary information required for effective research planning, and for input into the monitoring system.

As co-signatories on the IER account designated for the SPARC project, the head of the General Services Bureau and the project FMS will exercise financial control over the project operating costs. Their control will be subject to program authorization by the PC and PD. At least one other senior IER administrator will have signatory authority for these funds, in order to avoid disbursement bottlenecks in the absence of the other signatories.

From the Bamako-based IER SPARC account, research program operating costs, based on approved program budgets, will be transferred by the GSB into a local "IER account" at the bank most convenient to the regional research center at which the research is to be conducted. This account will be managed by the IER regional center accountant, under authorization of appropriate IER regional authorities (either program leaders or director of the regional center). Researchers will be responsible for program budget expenditures according to their planned and approved research program financial levels. Based on monthly budget and expenditure reports and vouchers, one of the IER account signatories will visit each regional center or station once a month and authorize replenishment of the regional "IER/SPARC account."

The operating expense budget presented in Annex F-4 (Research Programs Analysis) provides an indication of levels of USAID funding through SPARC for IER research programs, based on estimated AID and GRM contributions and on ISNAR's estimates of costs per researcher to conduct effective agricultural research in Mali. Actual budget levels by specific research activity, for both AID and GRM support, will be determined through the new research planning and approval process to be implemented beginning in 1992. Budgets for specific research projects and commodity and other programs will be submitted by IER research teams (with input from the PD and PC), reviewed and modified within IER, and approved by IER. A Project Implementation Letter (PIL) from AID to IER will then commit the SPARC project funds required to undertake the approved research activities.

The first two years of the project will see an incremental increase in SPARC support for operating expenses. In Year One (1992 production campaign), support will be provided only for some of the activities in the Cereal and Legume program, primarily those at locations which can be capably served by the financial management capacity in place at the time of project start-up. During Year One, planned SPARC activities in support of socio-economics and animal production research will be the subject of detailed workplanning and consultation between IER program researchers, the PC and PD, and client groups. The outcome of these consultations will be detailed and justified research proposals for consideration by IER for funding in Year Two. In addition, remaining SPARC support for activities of the Cereals and Legume Program not funded in Year One could commence in Year Two.

Operating expense support from SPARC for production systems research in the Koulikoro and Mopti regions will commence only in 1995. However, it is expected that well before the end of the FSR/E project, the financial management of those FSR/E Project USAID-funded operating expenses for the two production research teams will be conducted by the IER financial management system set up by SPARC. This will permit economies of scale in the financial management of the two principle USAID-funded

research projects, will permit IER to draw upon the strengths and personnel of the FSR/E project for broader financial management responsibilities, will provide a demonstration to IER that its system can adapt to several sources of funding, and will lead to interest on the part of other donors to channeling their resources through IER rather than outside of IER's own financial control system.

The initial idea at the time of the PID was for a two-track approach to financial management. It was planned that while the project would start out with a temporary, independent, AID-certifiable financial management system, at the same time, over a period of two to three years, TAMU and IER would work together with other donors to develop a broader more useful system for IER. When that IER system was developed and certified by AID, the temporary SPARC system would disappear, and AID funds would flow into the IER system designed under the project, with other donors to follow suit.

It became clear to IER, AID, TAMU, and the World Bank during the course of project design that a much more promising approach was -- from the beginning -- to design the SPARC financial management system in a way that it could be later be expanded to include other sources of IER funding. Hence, the SPARC financial management system will be an integral part of the IER's GSB from the first day of the project. The system will be designed from the beginning taking account of the financial requirements and reporting procedures of both IER and other donors who may later provide their funding through the system. The scope of work for the design of the system appears at the end of Annex F-3 (Financial Management and Accounting).

Support under the project will be provided in several steps. The first step will involve the RMS, short term TAMU TA, and GSB staff gaining familiarity with the financial management systems, charts of accounts, and tracking and reporting requirements of those donors and agencies currently supporting IER operations and research activities. This will permit the SPARC system to be designed consistent with requirements and procedures of the major sources of funding for IER. For IER to fully participate in and manage this process will require IER to identify a highly-trained IER financial administrator to work with a short-term technical assistant in reviewing requirements of the GRM and other donors.

The next step will be to assist IER to synthesize reports from key sources of funding into something resembling a consolidated programs budget document. While this "budget" will be an amalgam of a number of separate and independent financial reporting and control systems, it will nevertheless give IER for the first time an Institute-wide overview of all sources and uses of funds in a way to permit some long term planning of resource allocation.

The next step will be to design a workable, USAID-certifiable financial management and program budgetting system consistent with requirements and accounting procedures of the several major sources of IER funding. The system will also have to be designed taking account of existing and prospective personnel levels. This step will be time-consuming and complex, involving three different regional centers presiding over five specific research locations, as well as central operating expenses.

Short-term technical assistance in the first year of the project will be used to design and implement the system. It is also likely that short-term TA will be required during the first year to assist the long-term Financial Management Specialist in resolving system design problems that may arise after the system becomes operational. Assistance will also be useful in developing and conducting short-term training courses in system operation and in general accounting and financial management principles for IER financial and accounting staff.

The final "step" is really a process which could take several years, although it can start as soon as the system is operational. This is the evolution of the SPARC financial management system to include sources of IER research funds in addition to SPARC. This process is likely to start only after IER and other donors are confident that the SPARC system can meet their needs, based on performance over one or more full fiscal years.

One of the first projects beyond SPARC which will come under the IER financial management system will likely be the AID Farming Systems Research and Extension Project (FSR/E). This is a logical next step, not only because it is the other AID-funded source of major support to IER, but also because its activities and expenditures take place in two of the three regional centers to be supported under SPARC (Sotuba and Mopti). The World Bank is likely to also rely on the IER financial system created under SPARC, which also makes sense geographically, since initial World Bank support for IER will be provided to Niono, the other regional center to be supported through SPARC. Well before the Year Five departure of the RMS technical assistant, IER, USAID, and other donors will need to determine the extent to which a replacement TA, to be funded by another donor, would be desirable within the financial management system.

From the beginning, and throughout the LOP, the success of the financial management system will depend most importantly on the numbers and expertise of the financial and administrative staff at all levels. IER has only a small cadre of career financial and accounting staff, and others under various contractual arrangements. IER administrators are already aware of the constraint that personnel can pose to otherwise functional financial management systems. IER staff have also communicated with neighboring countries who have tried unsuccessfully to implement Institute-wide financial management systems with objectives similar to those of SPARC. The key factor responsible for failure is that the demands of the system exceeded the capability of the limited number of skilled personnel on the Institutes' payroll.

Evolution of IER towards an independent or "autonomous" status may require additional short-term financial system design expertise to adapt the IER consolidated financial management system to reflect changes in IER institutional rights and responsibilities, including budgeting and accounting procedures and personnel management.

In support of IER's reorganization to improve institutional and research program management, SPARC will provide long-term academic training to the MS degree level in Public Finance/Accounting through a School or Program in Public Administration which also permits coursework in business management. If an appropriate PhD-level degree program is identified, one of the two degree programs may be for an MS-level candidate to complete a PhD program.

3. Training

SPARC will support nineteen IER research scientists in long-term academic training programs in the U.S. or third countries. It is anticipated that nine Thomas Jefferson Fellows will depart during Project Year One. A second wave of Fellows will be slated for departure during Project Year Two, and a third and final group in Project Year Three. According to this schedule, the first MS degree graduates will return to the project in Year Four.

Short-term training requirements to support research programs will be identified in the annual workplan. These short courses might include in-country training in Biometrics/experimental design and data analysis, socioeconomics, research station management, and workshops and conferences, as well as short-courses, workshops or conferences outside of Mali. Short-term training will be provided for IER technical and support staff as well as professional and scientific staff. All long-term degree training programs will include participation in at least one short-course appropriate to the training program focus.

4. Research linkages

SPARC will produce stronger and more functional linkages with other Malian research institutions and extension and development agencies, as well as with U.S., regional, and international institutes. Through TA, short-term training, collaboration with CRSP's, better documentation and publications, and a more rational consultative and decision process in research planning, effective links with other research and technology transfer groups will be developed and strengthened. This will happen in particular through the following means:

a. Annual Regional Research Planning Sessions to Strengthen Research and Extension Links

The PC and PD will assist other IER staff to ensure that these sessions bring together interdisciplinary commodity team researchers and managers, farming systems researchers and managers, agents of regional extension organizations, and farmer representatives to collaboratively define problems and plan programs. These meetings will improve two-way flow of information between farmer and researcher and between extension agent and researcher, and will significantly improve IER's capability to monitor and evaluate on-farm impact of technologies IER develops. National program review meetings may draw on independent research reviewers every three years coming from project short term TA.

b. Strengthened Multi-locational Testing and Collaboration Between On-farm and Station Researchers

The PD and PC will assist research program leaders, research station staff, and Regional Center Directors to implement the decentralized, regional approach to multi-locational trials and on-farm pre-extension tests. As discussed in the Technology Transfer summary, these trials will not only promote better problem-solving collaboration between researchers themselves (from various commodity programs and production systems researchers), but between the research station and its clients, farmers and extension organizations.

The multi-locational trials program will be undertaken within a limited radius of each center, thereby reducing transportation costs associated with the program and rendering it relatively inexpensive compared to the current multi-locational trials program. Experienced and trained off-station research technicians will staff stations and sub-stations and conduct the trials with collaborating farmers. Trial design, procurement of supplies, data analysis and reporting will be coordinated through the regional center.

c. Expansion of Linkages with IARCs and CRSPs

IER's long-standing linkages with such IARCs such as ILCA, ICRISAT, ILRAD, ICIPE and IITA will be maintained and strengthened through interactive mechanisms such as short-term technical assistance, short-term training, and research conference participation. Opportunities for expansion of these linkages to include other IARCs will be identified and pursued.

IER participation in the INTSORMIL, Peanut, TROPSOILS, and will continue, and additional ties with existing (eg. Small Ruminant) and proposed (eg. SANREM and IPM) CRSPs will be optimized through the life of the project. CRSP linkages will provide excellent sources of experienced technical assistance, access to peer scientists for long-term linkages in collaborative research programs, and locations for academic and non-degree training.

d. Links with the Private Sector

Private sector technology transfer opportunities will be identified for pesticides, seed varieties, natural phosphates, innovative milling and new food products. In addition, short term TA will assist IER in seeking partnerships with private sector international agribusiness firms, or foundations affiliated with them, for support to IER research.

e. Links with ONGs

The PC and PD, together with some short term TA, will assist IER to expand the limited relationships it has established with ONG's. They will promote a dialogue between ONG's and IER regarding technology development and transfer with a view to promoting ONG's as another "client" of IER research programs, one which is articulate enough to be a source of valuable information and feedback. They will assist IER in including ONG's in discussions leading up to the development of research plans at regional level.

E. Project Outputs

The following outputs will result from SPARC support to IER:

1. An Operational and Sustainable National Agricultural Research System

The system will be characterized by improved planning, management, monitoring, and relevancy of research programs, personnel, and financial resources, and the quality of communication of finished technologies. The specific elements of this output include a long-term functional research planning and approval cycle; improved research management structure; consolidated financial management system for IER permitting it control over major sources of funds; and a research monitoring system.

2. Strengthened Research Units

These research units will be better able to integrate station and farm research, natural resources management, crop and livestock research, and they will improve research/ extension linkages. The specific units to be strengthened as a SPARC output are:

- Four commodity research teams (for sorghum, millet, cowpeas, and forages/animal nutrition) working out of three Regional Centers (Sotuba, Niono, and Mopti) in five principle locations (Sotuba, Niono, Cinzana, Mopti, and Koporo);

- The Food Technology Laboratory, in its capacity for varietal screening, new product development, and private sector marketing analyses;

- The applied socio-economics research program of IER, located in the Department of Planning and Rural Economy, in its capability to evaluate marketing bottlenecks; farm level technology adoption constraints; appropriate communications strategies; and the availability and impact of on-farm and value added technologies;

- Beginning in 1995, farming systems teams in those areas (Sotuba and Mopti) of SPARC project activity where no other farming systems support is forthcoming. (Support to FSR teams in these two areas will follow the completion of the current FSR/E project, terminates in 1995.) These teams will continue the regional, integrated approach to encouraging closely coordinated on-station and on-farm research.

3. Trained Scientists and Technicians

SPARC will increase the capabilities of IER scientists, technicians, and support staff to manage and conduct IER core research programs to achieve usable on-farm results. Ten IER scientists will have received Master's (or equivalent) degrees and nine will have received PhD (or equivalent) degrees in fields that match IER's long-term planning priorities with those of the project. In addition, approximately 105 IER scientists, technicians, or professional staff will have participated in third country training or workshops, and an equivalent number of staff at all levels in in-country training programs.

4. Research Linkages

Linkages between IER staff and US, regional, and domestic research institutions and with local extension agencies will have been developed or strengthened, and will have contributed to program coordination, technology development, and information exchange.

F. Administrative Arrangements

USAID, IER, and TAMU have had significant experience in the management of long term technical assistance teams in agricultural research. Based on this experience, all three parties determined during the course of project design that a crucial aspect of project design was to define in some detail the administrative arrangements, relationships and responsibilities of TAMU TA, IER staff, and AID as regards reporting, supervision, consultation, and problem solving. These are defined below:

1. Titles for Key Personnel Within IER/SPARC Context

Project Coordinator: The long-term on-site research management TA who is responsible for contract implementation.

Project Director: The Malian IER employee appointed by the IER Director-General to direct the implementation of the project with the project coordinator.

Project on-campus Coordinator: The U.S. TAMU based person responsible for backstopping the project and for liaison between IER/SPARC and the contract ad-hoc consortium.

Project Officer: The AID employee responsible for sound management and implementation of SPARC, and for AID liaison with IER and TAMU on project-related business.

2. Relations, Responsibilities and Role for Long-term TA

- GRM Working Regulations: The two long term TAs will be fully integrated into the IER personnel structure. Both TAs will follow IER work regulations with regard to GRM working hours (7:30am-2:30pm M-Th and Saturday; 7:30am-12:30am on Fridays), travel approval, meeting attendance, etc.

- TA Offices: The Long Term TA will be housed in proximity to their IER counterparts. Offices for the project coordinator, project administrative assistant, and one project secretary will be located close to or on the same level as the office for the Project Director. These offices will also house the project communication equipment (phone, fax, telex, and e-mail). The office for the Financial Management Specialist (FMS) will be located within the Office of General Services.

- IER/TA Relations: The Long term TA, in their capacity as integral IER administrative personnel will be available to IER higher administrators (Chef SAF, PS, DDG, and DG) to represent IER when necessary and to implement specific tasks related to project objectives. Internal disputes between long term TA and their national counterparts will be resolved between the IER DG and the USAID ADO. Long term TA will be requested to provide input for the annual evaluation of appropriate IER personnel working with them; long-term TA will be evaluated annually by their immediate IER supervisors together with the AID project officer.

- Project Planning and Reporting: The FMS will report to the PC and PD for workplan and progress report development. Annual workplans for all SPARC activity will be developed by the PC and PD for review by AID/Mali and US Consortium Committee and to the IER Director for final approval. Progress reports will be developed by the PC every six months with the first report written in a brief format highlighting activity in major areas to be used primarily for use in AID project monitoring. The second, annual activity report, will encompass a more detailed analysis of annual activities with emphasis on progress constraints identification and recommendations for alleviation of constraints to progress. The six month brief report will be

distributed to AID and the US Consortium whereas the annual report will be submitted to all SPARC partners, including ISNAR and the World Bank. (The workplan and annual report will together serve as the basis for the annual budget allocations of AID to both the TAMU group for the TA and training contract and to IER for operating expense.)

3. In-Country Project Support Staff

TAMU will employ one local-hire secretary and one local-hire administrative assistant. IER, through its USAID/SPARC administrative and management operating cost budget, will hire an additional secretary. Both secretaries will be sufficiently experienced and trained to provide significant administrative support to the PD, PC, and FMS. TAMU and IER will be full participants in the hiring of all three of these personnel, with IER participating in the recruitment of the TAMU secretary and administrative assistant, and TAMU participating in the recruitment of the IER secretary. Support staff will be assigned on the basis of project need, not source of funding (TAMU vs. IER).

4. Project Oversight and Special Issues Considerations

AID staff will have full access to project-related documents, records, and research sites for oversight and monitoring purposes.

Project Steering Committee: A Project Steering Committee will be set up at the start of the project to provide special guidance and oversight. The committee will be composed of the following individuals:

- IER Director-General
- Project Director
- Project Coordinator
- Chief of the General Services Bureau
- Project Financial Management Specialist
- AID Project Officer
- AID Agricultural Development Officer

The committee will also include out-of-country members and attempt at least one meeting per year with these individuals when the opportunity arises:

- TAMU On-campus Coordinator
- ISNAR representative
- World Bank representative

The purpose of the committee will be to:

- Resolve any issues relating to discrepancies between the SPARC needs and PP provisions.
- Evaluate general progress and performance
- Identify gaps and project oversight
- Review annual workplans and make recommendations

G. Project Financial Plan

USAID will obligate through a grant to the GRM $19.6 million in support of the GRM's program of long term agricultural research and improved research organization. The two major commitments under the grant will be for a TAMU Technical Assistance and Training contract and for GRM operating expenses in support of IER core research programs and research organization. In addition, support through construction, equipment procurement, project support, ISNAR advisory program, audit, and evaluation will be provided. Tables II-5 through II-9 below, together with the Tables in Annex C, detail the USAID contribution to SPARC.

The GRM will make available 1.9 billion CFA francs (approximately $6.6 million) to support the program. The GRM contribution includes construction (220 million CFA francs) and new equipment purchases (80 million CFA francs) to be earmarked and disbursed from the GRM special investment budget. In addition it includes salaries and other operating expenses from the IER operating budget provided by the GRM in support of those IER research activities or stations and regional centers which are part of the SPARC project. Tables II-6 (below) and Annex C Tables 2,6,7,8, and 13 detail the GRM contribution to the SPARC project.

Since the purpose of the SPARC project is to strengthen IER's overall capacity to develop better technologies to increase the welfare of farmers and consumers, trends in IER's overall budget weigh heavily in the success of the SPARC project. In this regard, and in addition to the specific host country contribution which IER makes to the SPARC project, the GRM will covenant to maintain or increase the overall GRM budget in support of IER, which has received two substantial increases in the past four years.

Table II-5: Summary Cost Estimate and Financial Plan (in U.S. $000)

ITEM	USAID			GOV'OF MALI			TOTAL		GRAND TOTAL
	FX	LC	TOTAL	FX	LC	TOTAL	FX	LC	
I. Technical Assistance	5,992	41	6,033	0	0	0	5,992	41	6,033
II. Construction	0	230	230	0	759	759	0	989	989
III. Commodities	872	814	1,686	0	276	276	872	1,090	1,962
IV. Training	3,848	0	3,848	0	0	0	3,848	0	3,848
V. Project Support Costs	1,558	70	1,628	0	0	0	1,558	70	1,628
VI. Audit	140	0	140	0	0	0	140	0	140
VII. Evaluation	250	0	250	0	0	0	250	0	250
VIII. Operating Costs	0	4,725	4,725	0	5,690	5,690	0	10,415	10,415
IX. Contingency	463	463	926	0	0	0	463	463	926
Total Project	13,123	6,343	19,466	0	6,725	6,725	13,123	13,068	26,191

Table II-6: Summary USAID Project Budget by Year ($000)

Year	1	2	3	4	5	6	7	Total
Tech.Asst	911	922	954	1,010	1,013	658	563	6,032
Construction	130	100	0	0	0	0	0	230
Commodities	913	70	71	517	51	42	23	1,686
Training	482	871	1,009	819	458	208	0	3,848
Project Support	200	210	221	232	243	255	268	1,628
Audit	15	25	15	25	15	15	30	140
Evaluation	0	0	125	0	0	0	125	250
Operating Expenses	475	575	675	775	775	775	675	4,725
Contingency	156	139	154	169	128	98	84	927
TOTAL	3,282	2,912	3,225	3,546	2,683	2,051	1,768	19,466

Table II-7: USAID Obligation Schedule ($000)

FY 92	FY93	FY 94	FY 95	FY 96	FY 97	FY 98	TOTAL
2,300	3,000	4,000	4,000	4,000	2,166	0	19,466

Annual commitments of funds will be made by USAID to IER and to TAMU. The SPARC workplan, submitted by IER to USAID, will provide the basis on which USAID approves and commits annual funding for both IER and TAMU. The mechanism will be as follows:

The IER Project Director (PC) and the TAMU Project Coordinator (PC) will work with IER research program leaders and TAMU in-country long-term and short-term TA in preparing an annual IER SPARC project workplan. The workplan will be composed of the same IER research program plans and budgets (for the areas supported by SPARC) which will have earlier been presented to, and modified and approved by, IER's new research planning and approval structures. Parallel to the IER workplanning process (in which he will be a key participant), the TAMU PC will also prepare a report of the year's activities. Upon USAID agreement to the workplan (which will be contingent on a satisfactory USAID determination of the efficacy of the IER internal approval process leading to the selection of research programs and budgets) USAID will commit project funds to the GRM through a PIL. Management and tracking of these funds will be conducted through the SPARC/IER financial management system described in Annex F-3 and in Section III.D. (The specific method of funding is discussed in the next paragraph.) Upon USAID agreement to the workplan and acceptance of the TAMU PC's annual report, USAID will earmark funds for TAMU through a PIO/T to be committed by the Regional Contracting Officer in Abidjan.

The standard mechanism by which USAID/Mali provides financing to host country agencies is the advance/justification mode of financing. The justification for this mechanism is the GRM's lack of financial resources with which to prefinance project activities. The GRM has insufficient cash to pay

many day-to-day project needs. Without the provision for operating expenses fund advances, it would be impossible to implement project activities. Cash advances should be calculated to cover immediate disbursing needs of up to 30 days from the date of the project's receipt of the advance until it is expended. This requirement will necessitate the projection, on a monthly basis, of project financial needs over the ensuing ninety (90) days, due to required processing time from the date of the request for funds to the actual receipt of the check from the USAID Controller's Office.

Each month an advance request will be prepared for the fourth monthly period and will include the two remaining months of the previous 90 days submission. Project cash on hand at the beginning of the period and previous advance requests covering the first and the second months of the projected period will be considered. Allowing for the normal processing time sixty (60) days, the advances will be made available to the project at the beginning of each month to cover O.E. needs over the following 30 days. However, due to the required processing time, the initial advance will include the project disbursing needs for the first 90 days of project activities. Prior to the release of advance checks subsequent to the initial advance, the project must submit justification for prior advances. Unjustified or disallowed expenditures must be repaid to USAID in order to fully liquidate the prior advances, if necessary, before the release of subsequent advances.

The project will deposit cash advances in an interest bearing bank account at the highest legal rate of interest available. Interest or any other earnings from the use of funds advanced to the project by USAID shall be payable to USAID as earned, without any offset or adjustment, but not less than quarterly. Procedures to be used to decrease the vulnerability of the funds will be: (a) qualification under AID accounting system certification provisions, (b) use of financial management expert technical assistance and (c) regular monitoring of project management systems including review of advances and justifications vouchers.

TABLE II-2: METHODS OF IMPLEMENTATION AND FINANCING

USAID/GRM Contribution

Item	Method of Implementation	Method Of Financing	Amount (in $000 US)	AID	GRM
I. Technical Assistance	AID Direct Contract	Direct Payment	5,823	5,823	0
	AID Direct Grant **	Direct Payment	210	210	0
Subtotal			6,033	6,033	0
II. Construction	Host Country Contract	Direct Payment	989	230	759
Subtotal			989	230	759
III. Commodities	AID Direct Contract (US)	Direct Payment	872	872	0
	AID Direct Contract (local)	Direct Payment	814	814	0
	Host Country Procurement	Direct Reimbursement	276	0	276
Subtotal			1,962	1,686	276
IV. Training	AID Direct Contract	Direct Payment	3,848	3,848	0
Subtotal			3,848	3,848	0
V. Project Support Costs	AID Direct Contract	Direct Payment	1,628	1,628	0
Subtotal			1,628	1,628	0
VI. Audit	AID Direct Contract	Direct Payment	140	140	0
Subtotal			140	140	0
VII. Evaluation	AID Direct Contract	Direct Payment	250	250	0
Subtotal			250	250	0
VIII. Operating Recurrent Costs	Host Country Procurement	Direct Reimbursement (Advance/Justification)	10,415	4,725	5,690
Subtotal			10,415	4,725	5,690
VIII. Contingency	AID Direct Contract	Direct Payment	926	926	0
Subtotal			926	926	0
		Grand Total	26,191	19,466	6,725

** ISNAR GRANT amounts to 210 US $

Estimated Project Inputs/Outputs
(IN $ 000 US)
USAID Contribution

Inputs	Outputs				
Items	Operational and Sustainable National Ag. Reasearch System	Strengthen Research Units	Trained scientists and Technicians	Research Linkages	Total
I. Technical Assistance	4,479,379	1,207,780	172,540	172,540	6,032,239
II. Construction	23,000	207,000	0	0	230,000
III. Commodities	842,968	842,968	0	0	1,685,935
IV. Training	0	0	3,493,168	354,733	3,847,899
VIII. Operating Recurrent Costs	1,653,750	2,835,000	0	236,250	4,725,000
Subtotal	6,999,097	5,092,748	3,665,708	763,523	16,521,073
Percentage of total costs	42%	31%	22%	5%	
V. Project Support Costs	689,866	501,967	361,310	75,257	1,628,400
VI. Audit	59,311	43,158	31,083	6,470	140,000
VII. Evaluation	105,912	77,064	55,470	11,554	250,000
IX. Contingency	392,709	285,747	205,677	42,840	926,974
Total Project	8,246,894	6,000,682	4,319,227	899,644	19,466,447

Footnotes:

I. Technical Assistance	TAMU/LT TA-100% TAMU/ST TA-10% ISNAR/ST TA-100%	TAMU/ST TA-70%	TAMU/ST TA-10%	TAMU/ST TA-10%
II. Construction	10 %	90%	0%	0%
III. Commodities	50%	50%	0%	0%
IV. Training	0%	0%	LT TRNG-100% ST TRNG-50%	ST TRNG-50%
V. Operating Costs	35%	60%	0%	5%

III. SUMMARY OF ANALYSES

A. Research Planning, Management, and Monitoring

Until now, IER has planned, monitored and evaluated research through a centralized national annual "Technical Commission". Although this process has met some of IER administrative and management needs, it has also left some significant gaps. In addition, the new IER Long Term Strategy calls for major institutional restructuring, effectively decentralizing operations and thus changing the role of the "Technical Commission."

SPARC plans to assist IER restructuring through the establishment and implementation of institutional processes that facilitate the improved conduct of user driven and clientele oriented agricultural research. In addition to support to financial management and program budgetting, discussed elsewhere, SPARC will focus its research management assistance on research planning and research monitoring.

1. Research Planning

Planning agricultural research is a critical component of the research process. Even slight deviations from good initial planning efforts result in years of costly research operations that miss targeted impact objectives. SPARC will work closely with IER administrators and researchers to facilitate IER development of effective planning processes at two levels: the regional commodity team level and the national program level.

At regional level, the research planning process will revolve around the annual Regional Research Planning Meetings. Research planning in preparation for these meetings will emphasize two principles: (1) maximizing farmer and other clientele participation and input into regional research meetings and other endeavors and (2) forming commodity groups or "teams" in which commodity researchers and key clientele of different disciplines work together in the development of new regional technologies.

The PC and PD will assist regional researchers to manage two contradictory tendencies at this level in order to ensure successful and collaborative regional planning sessions: The high degree of interest and competence by farmers, extension agencies, and sometimes local administration in "problem definition" and final results, and their very low level of interest and expertise in the actual research methods which are needed to ensure that sound research gets designed to solve those problems. Research plans which are reviewed and approved at this level will be forwarded to the national "programs" level in the planning process.

The national, "programs" level of research planning involves the national commodity program leaders, their respective department heads, and higher IER technical administration. Emphasis at this level will concentrate on the scientific merit and feasibility of commodity program research. In addition, guidance will be provided in the planning process at this stage which ensures reconciliation of disparate regional plans and the achievement of national goals. Research proposals which are approved at this level will be approved for, and have allocated to them, funds to carry out the research existing funding.

These general shape of these new planning activities has already been decided by IER. Where SPARC will assist is in providing help to implement the decisions in the way most conducive to sound, results-oriented field research. In addition to the counsel and participation of the PD and PC, SPARC will support the process through short term TA to regional centers for short courses in research planning and budgeting; helping research teams focus efforts on the "end-user" product of research, through on-farm trials and "etudes filieres" rather than on the research process itself; involving all relevant research expertise in the planning process, including local scientists not affiliated with IER as well as international experts through short term technical assistance; and encouraging and where appropriate funding the participation of commodity CRSPs, IARCs, and other representative research organizations in the planning process either directly or indirectly through proposal reviews or triennial research program review.

2. Research Monitoring

A knowledge of the breadth and depth of research activity occurring throughout Mali under the decentralized structure of IER will be essential for effective IER management. SPARC will assist IER track research activities at the Regional Centers over time through the development of a computerized research monitoring system. The major objective of Research Monitoring System will be to provide IER administrators and researchers with the necessary research management tools for effective decision-making capability at all levels of research activity: operational, regional, commodity, departmental, and national.

Technology development rarely involves a single eureka-type breakthrough, but rather a process encompassing many different stages of research, testing and fine-tuning. To effectively monitor and evaluate research activity, research must be viewed as a process and monitored within discrete evolutionary stages of development. Throughout the process, an effective monitoring system must be able to track the flow of activity occurring in each discrete phase through sets of indicators which reflect the quality, volume, rate, and probability of meeting the particular research objective. A simplified generic diagram of these stages and the process and a detailed description of the research process, the stages, and some initial indicator variables can be found in Annex F-1.

Feasibility and effectiveness require that the research monitoring system:

- Be simple and not overburden the researcher with meaningless paperwork
- Meet multidonor needs without duplication of effort
- Be linked to the research budget and planning process
- Respond to the management needs of both the researcher and administrator
- Emphasize end-user response to technology and act as a vehicle for end-user feedback to the researcher
- Allow cost-benefit analyses to be performed on any single research operation/objective
- Ultimately provide a continually self-enhancing mechanism for research planning and prioritization.

The system will be pilot tested in one of the three Regional Centers for the commodity programs covered under the project and then expanded to cover other commodities and regions receiving SPARC support. SPARC's assistance to IER in implementing its planning and monitoring system, initially for the activities receiving AID support and then more broadly, will enable IER to more effectively manage the personnel, financial, and physical resources it controls in order to produce better technology farmers can use. In addition, the monitoring system will be a source of encouragement to researchers and administrators as it documents the impacts of research, and will allow IER to make a strong case to the GRM that support to research is an investment in improved productivity at farm level and national level.

B. Institutional Analysis Summary

The capacity to generate and disseminate improved technology that responds to the needs of the country's resource-poor farmers has been an explicit program concern within the IER for almost 20 years. In the late 1970s a major, West Africa regional colloquium on rural production systems research held in Bamako emphasized the significance of farm-level, multidisciplinary research and helped to launch a series of research activities which eventually led to the establishment of the Institute's farming systems research department.

Encouraged by the results of farming systems research and the constructive relations with some of the country's rural development organizations, the Institute initiated an internal discussion and review in the early 1980s on encouraging more client-oriented research and improving relations with the country's agricultural development services. By 1985 this discussion led to a request to the FAO for a diagnostic survey and review of the Malian national agricultural research system. ISNAR followed this survey with a country review mission in 1988 and a subsequent commitment to continue its advisory services in support of improved IER research programming and management.

Throughout this period external funding increased significantly, but was largely allocated through financially and administratively autonomous research projects. In 1989 approximately 25 donor agencies were financing approximately 50 separate research projects. It is currently estimated that the IER manages less than 5% of the total financial resources used by IER research scientists.

Parallel with the FAO and initial ISNAR studies was an increasing unease on the part of Malian researchers and research administrators with the way in which research was planned and conducted. Required to spend substantial periods of time in preparation for, and sitting in on, the annual national research planning meetings, they saw only limited benefits to their research programs in terms of control of funds, better extension liaison, or coordination with other researchers doing related work. Senior researchers recognized poor quality in some research protocols or analyses, but -- with no recognized means to ensure soundness of statistical design or analysis -- were unable to help colleagues improve them unless specifically requested to. Programs were evaluated on a person-by-person year-by-year basis, discouraging both multi-year research planning and team based research programs.
The most serious problem recognized by the researchers was the centralization of the research system. By keeping most staff and responsibility in Bamako and nearby Sotuba, regional initiative to identify and solve regional problems was not encouraged. At the same time, the centralization of most functions in Bamako encouraged very strong scientific divisions, while making it difficult for field level staff of those departments to work most productively together.

When the Institute was reorganized in 1990 to incorporate the former Institute for Animal Science, Forestry and Water Resources Research, IER managers also decided to introduce a new system of research management and organization to address the problems outlined above. However, even before the reorganization, over the past several years researchers have been out front in beginning to resolve these problems. For example, sorghum and millet researchers have for the past several years taken a multi-disciplinary team-based approach to their commodity research activities. Thematic researchers and production systems researchers, despite their affiliation with separate departments, have developed close collaboration on soils management and cropping systems problems recently. Concern on the part of numerous researchers has prompted IER, with AID support through both the Livestock and Farming Systems projects, to provide short-courses for large numbers of researchers in statistical analysis and experimental design.

However, the initiative of individual researchers can only go so far in resolving institutional problems. The new organization plan is based on current perceptions of IER's problems and of the most appropriate ways to overcome them. IER Research Programs and Regional Centers are the two principal elements of this new system. Each of the seven research programs (e.g., Cereals and Legumes, Natural Resources Management, or Production Systems and Rural Economy) is comprised of a number of projects, ranked in priority order, which are carried out through activities that are based at the Regional Centers. Each program is managed by a coordinator who will be located at that Regional Center from which it is most reasonable to carry-out a program's major research activities.

New Regional Centers will be established as the principal mechanisms to effectively regionalize IER research in each of the country's major agro-ecological regions. Instead of having IER research represented through a variety of independent projects, the "Center Team" of scientists will be recognized as that critical mass of IER researchers who are charged to address priority national and regional research questions. This "team" would be composed of commodity, animal and natural resources scientists, plus rural production systems researchers with specific responsibility for multidisciplinary pre-extension testing. The Regional Center teams will enable IER to establish more effective and permanent relations with regional extension programs and improve the client orientation of its research programs, including its capacity to respond to local demands for research services.

The IER, however, currently lacks both the financial and program management capacity to implement this new, regionalized research system. The government's budgeting and financial procedures are ill-suited to the effective implementation of research activities in diverse locations throughout the country. Moreover, with an inheritance of separate, independent and externally-funded donor projects, IER's accountants and finance managers have little or no experience with assuring the timely flow of resources to researchers working in decentralized programs. Similarly, but with periodic support from ISNAR, IER senior scientists and managers are just beginning to grapple with the complexities of national, long-term strategic research planning and programming.

Clearly, the IER needs a new financial management and accounting system in order to make its regionalized research system work. Such a system will permit IER more control in allocating its resources to the priority research projects in the IER long term plan. Designing such a system will have to overcome institutional constraints discussed in the Financial Management Analysis section regarding differing accounting and reporting requirements of different funding sources, including those of the GRM itself.

As regards the funds it receives from the GRM, IER currently depends wholly on the cumbersome requirements of the Ministry of Agriculture, Environment, and Livestock's finance and administrative department (the DAF). As an "attached service" ("service rattache"), IER does have the right to more flexibility than the current system: Under its current status, for example, IER could have its own bank account, and sever the relationship with the DAF, creating a direct relationship with the Ministry of Finance. It would still face, however, cumbersome procedures, which may lead IER to seek a more independent statute, such as a type of "public establishment" which permits some autonomy in financial management and the introduction of a commercial accounting system.

A new administrative statute may be required in order for the IER to have the autonomy of financial management needed to implement the regionalized research programs and gain more control over its multiple sources of funding. At the same time, a new statute has important implications for: research scientist recruitment, evaluation and advancement, and pay scales. In other words, the move toward a public establishment must be balanced with the administrative needs to assure and sustain the scientific capacity of the Institute.

IER's reorganized and regionalized system offers several opportunities to promote and enhance the link between IER research and Malian development policy and programs. At the national level, the National Committee for Agronomic Research (CNRA) has the mandate to promote and enhance IER's institutional relations with national policy-makers. At the regional level, the proposed Regional Technical Committees (CTR) should help to reinforce the client orientation of research programs while strengthening the research and development link. In fact, these program review committees may represent a relatively unique Malian contribution to the process of linking research priorities with local development needs and interests.

The proposed system also raises several important administrative issues. As the IER puts its new program structure in place, research managers will need to give special attention to balancing the need to respond to regional demands with the need to maintain the integrity of national research programs. Moreover, experience elsewhere in Africa suggests that IER managers will need to pay special attention to managing and balancing the program concerns of researchers with the administrative concerns of Center administration. In addition, IER management must be sensitive to the recurrent costs of establishing and maintaining regional centers.

A new system of financial management which separates research program budgeting requirements from the administrative and financial system for site operations may be one means to assure the integrity of research programs and the availability of financial resources to meet the administrative and logistic support costs of the Centers. An annual review of the evolving relationship between program implementation and Center administration during the first 2-3 years of the project would be a useful means of tracking how the IER deals with these issues and their implications for the achievement of project objectives.

Several international research activities and other donor projects in support of IER complement the SPARC project and will contribute to the achievement of project objectives. IER has been selected as a Sahelian pilot national research agency for the multi-donor Special Program for African Agricultural Research (SPAAR). In this context, the World Bank recently completed a preparation mission for its planned Mali National Agricultural Research Project (NARP). This mission reviewed the IER Strategic Plan and reached agreement with the GRM on the first steps in preparation of an agricultural research

project. The Bank is giving special attention to improving IER research programming and management, human resources planning and management, station management and support, and financial management and accounting. It is expected that some pre-project funding will be used to continue selected work of the preparation mission prior to a pre-appraisal mission during mid- to late 1992.

As part of its strategic plan in support of national agricultural research systems, ISNAR too has decided to concentrate its West Africa program efforts in Mali. This means that ISNAR will continue its valuable collaboration with IER to improve on-going research planning and programming in the context of the long-term Strategic Plan. The introduction of a management information system and continued assistance in the implementation of the Institute's reorganization and decentralization plan will be especially complementary to the SPARC Project.

Closer relationships with several other national activities and activities could enhance the impact of IER research. The faculty at the Rural Polytechnic Institute offer the most important opportunities for closer and regular research relationships with the IER. Fairly regular exchange already takes place, but some collaborative research activities could be designed in the course of project implementation. Other research opportunities with scientists at the National Public Health Research Institute (INSP) and the National Teachers Training School (ENSUP) should be explored. Relationships with several other donor-funded international and regional programs, such as the Sahel Institute, ICRISAT and the CRSPs are expected to enhance the quality of the research supported under the SPARC project.

SPARC-supported research programs are expected to both build upon, and be strengthened by, several continuing research projects. Involvement in the SAFGRAD networks has enhanced the professional skills and performance of several IER scientists and AID's continued investment in these networks (which is just now beginning to pay off) will complement several SPARC research programs. Similar collaboration is expected with the IRAT-ICRISAT regional sorghum and millet programs. In addition, project-supported research will build upon the farming systems work under the Dutch (Royal Tropical Institute) and USAID farming systems projects, as well as the more specific commodity (millet) research financed by the Ciba-Geigy Foundation at Cinzana research station.

Efforts should be made early in the life of the project to see how relations with Mali's NGO community might enhance the effectiveness of project-financed research activities. Mali benefits from a fairly large, active and well-organized NGO Community in which many members concentrate on action-research village land management programs that would complement project research activities.

The current organizational initiatives of IER respond to perceived needs of IER researchers, and many of its partners in extension and other organizations, going back several years. Researchers themselves are already responding to some of these problems. SPARC assistance to the organization changes will help the researchers in developing more effective, decentralized, and problem oriented research programs responding to regional needs.

C. Financial Analysis Summary

IER's current financial management system is inadequate to the needs of a functioning research institute. Indeed, IER has two separate systems, neither one of them suitable to maintaining a coherent and focused research program. The first system is the GRM system for releasing and tracking GRM funds supporting IER research. This system is not sufficiently well designed to warrant USAID financial certification while at the same time so cumbersome as to make it very difficult to use in support of field level research

programs. In particular it requires close supervision by the DAF (Division Financière et Administrative), and four-fold controls for each transaction. Combined with lateness in the availability of funds most fiscal years, this renders the system very unresponsive to the needs of field researchers operating under strict time constraints in order for their research to succeed.

Due to the weaknesses of the IER system, donor projects supporting IER research have each set up their own financial management systems. This has been the case with AID projects. Both the Farming Systems Research and Extension Project and the Semi-Arid Tropics Crops Research Project established separate financial management units to manage and track USAID funds provided to IER in support of project research programs. These donor-supported systems are well designed for the safeguard of finances and assets, and are also capable of mobilizing funds in a timely fashion, thereby overcoming two principle weaknesses of the IER system.

However, neither the IER system nor the several donor financial management systems provide IER with a good tool for establishing and maintaining research priorities and ensuring that high priority programs receive adequate funding. Neither system permits IER control over its overall research agenda, nor is either system used for the kinds of program budgetting and cost accounting that would permit IER to begin to actively manage the resources it has access to through both the GRM and donors.

The SPARC financial management system will ensure sound management of USAID-provided funds and assets supporting IER. At the same time it will provide a model and mechanism for IER to use with other donors in managing non-AID resources supporting IER research programs. The purpose of setting up a project financial management system which IER and other donors could choose to use as a broader IER financial management system is to respond to the problems set out above. There are five specific reasons for IER, with SPARC assistance, setting up such a system:

- Provide a basis for program budgetting and research program planning and monitoring
- Ensure smooth flow of funds to support research programs
- Provide a means acceptable to IER and donors of IER better tracking and controlling donor financial contributions to agricultural research
- Generate useful financial information
- Safeguard project funds and assets

The SPARC project will design and install a new financial management and accounting system in the General Services Bureau (GSB). The Head of the GSB and the Financial Management Specialist will work closely with the short-term Financial Management Analyst to ensure that the financial management system is designed to generate the fiscal and budgetary information required for research planning, and for input into the monitoring/evaluation systems.

Since the project will have a multiplicity of goods and services to be delivered under strict timing constraints and aggravated by the remoteness of project sites, poor roads and communications and generally low level of training of field personnel, short-term technical assistance and action training will be made available at the time the implementation gets under way. The short term TA will train IER financial staff and research program managers and administrators in how to use the new system, and will assist in ensuring that the system is responding to the needs of IER.

The system will be designed from the beginning to respond to three set of criteria:

- The system will permit, for the USAID funds supporting operating expenses of IER, safeguard of funds, tracking of expenditures, and program budgetting and cost accounting. The system will also ensure sound inventory and asset management for goods and equipment provided with AID funding.

- The system will be designed based on thorough examination of reporting and control requirements of the several other donors likely to provide financial support for implementing IER's long term research plan, in order for the system to be capable of expanding to manage such financing.

- The system will be designed taking account of IER's current relationship with the Treasury and Ministry of Agriculture as well as the likely future evolution in this relationship, so that eventually the system could assist in the management of GRM funds supporting IER's long term plan.

As a public service, IER must conform to all civil service regulations and governmental financial management procedures. As an "attached service" ("service rattache"), however, IER can establish a parallel and independent budgetting system (see Institutional Analysis Annex). This stipulation allows for the use of cash advance and revolving fund mechanisms. This type of mechanism may be very useful in setting up a prototype IER financial management system under the SPARC project.

Existing accounting software packages appear to meet the requirements of the USAID Controller, IER, and eventually other donors, and can handle codification for multiple donors. The new system should allow knowledge at any time of the exact situation of acquired financing, its spending and its level of implementation by category/line item and so on. At all times, managers should be able to know the exact and precise situation of all financing by activity, by research program, by convention and by donor.

It is important for the system to be designed based on experience in other countries and institutions, and based on understanding of the personnel requirements to make such a system fully functional. Recent trips by IER financial and administrative staff to neighboring countries' research systems have pointed out that installing software and producing reports for donors is relatively easy compared to the tasks of actually getting a new system to function to respond to the needs of IER in its own budgetting, research planning, and monitoring activities. Major staffing constraints in neighboring countries have prevented "well-designed" systems from serving the accounting and financial planning needs of the institutions they were designed to assist. An examination of IER staffing requirements in finance and administration, together with serious attention to meeting IER staffing requirements in these areas, will be required for the new financial management system to function.

D. Research Programs Analysis Summary

IER's core program, described in detail in the IER Long Term Plan approved in December 1991 by the GRM Council of Ministers, is made up of seven programs. The SPARC project will provide support in particular to high priority elements of the Cereals and Legumes program, as well as some support to the Animal Production and Production Systems Programs. Annex F-4 includes tables outlining each of these core IER programs in more detail, and highlighting for the Cereals and Legumes program those activities which will receive support from the SPARC project. Table VD-1 shows those IER core research

activities to receive support at specific research stations and Regional Centers. The socio-economics research program of IER, run out of the Production Systems and Rural Economy Department in Bamako, will receive support as well but does not appear on the table because it is not based in the regions and that part of its program supported by SPARC will be defined during Year One of the project.

1. Cereals and Legumes Program

Production research on millet, sorghum, and cowpeas

The SPARC project will support research on sorghum, millet and cowpea within the Cereals and Legumes Program of IER. The method by which specific research activities within these commodities was arrived at is as follows: The highest priority sorghum, millet, and cowpea Research Projects in the Long-Term Plan's priority listing were chosen, eliminating Projects which already had funding from other sources, until a budget constraint was reached. The constellation of stations receiving support for sorghum, millet, and cowpea research reflects the choice of the highest priority unfunded Research Projects in the Cereals and Legume Program.

Other significant factors used as general guidelines for SPARC support to the selected programs and operations are as follows:

- selection of a limited set of commodities was necessary, especially in the first years of the project, to ensure success in instituting improved research planning, management, and monitoring procedures
- major sources of funding are available for research in some other commodities, i.e. irrigated rice
- the sorghum and millet programs, in particular, are currently the most advanced in terms of team-based research, providing a sound basis and a model of better research management and planning
- consideration of limited financial support for research operations under SPARC activity
- the Cereals and Legumes program is among the most important of the seven in terms of numbers IER researchers, potential beneficiaries, potential impact on rural well-being and food security, and impact on income and economic growth
- USAID has a history of project support to these programs since the 1970s (SAFGRAD, ICRISAT, INTSORMIL, etc.) which have produced significant results and accomplishments

Project support will include research operations support and short term technical assistance. As progress is made in these three sets of commodity research activities, the model they provide can be extended to other commodities with other sources of funding.

Table III-1 summarizes the on-station and on-farm multi-locational research to be supported under SPARC in IER's Cereals and Legumes Program and the Animal Production Program. Specific details for each of the several Research Projects to be supported were arrived at in November 1991 utilizing input from those IER researchers and managers responsible for planning and implementing research for each of the three commodities. One of the important and innovative features of the SPARC project is that it will support IER's recent decisions regarding responsibility and location for on-farm multi-locational trials, discussed in the technology transfer section.

Table III-1: Thematic Research Supported by SPARC

REGIONAL CENTER	STATION	COMMODITY	ACTIVITY	RESEARCHER	RESEARCH-YEARS		
					Activ.	Stat.	Ctr
SOTUBA							8.50
	Sotuba					8.50	
		Sorghum	IPM and stability of long season sorghum [1] (project # 7)	Entomologist Pathologist Weed Sci. Total	0.50 0.50 0.50 1.50		
			Sorghum breeding [1] (project #6)	Breeder	0.50		
			Intensification of sorghum production (project #3)	Breeder Entomologist Pathologist Food Tech Weed Sci Agronomist Total	1.00 0.50 0.50 0.50 0.50 1.00 4.00		
		Cowpeas	Food technology in cowpeas (project #11)	Food Tech.	0.50		
		Soils	Anti-erosion and cult. practices (project #3)	Soil physic. Agronomist Total	0.50 0.75 1.25		
		On-farm trials	Multi-locational on-farm trials	Agronomist.	0.75		
NIONO							4.75
	Niono					1.75	
		Forage/An. nut	Forage for anim. trac/sm.ruminants	Agronomist An. Nutrit. Total	1.00 0.25 1.25		
		On-farm trials	Multi-locational on-farm trials.	Agronomist	0.50		

REGIONAL CENTER	STATION	COMMODITY	ACTIVITY	RESEARCHER	RESEARCH-YEARS		
					Activ.	Stat.	Ctr
	Cinzana					2.00	
		Millet	Intensification of long season millet (project #3)[2]	Agronomist	0.75		
		Sorghum	Intensification of sorghum production (project #3)	Breeder physiologist Total	0.50 0.50 1.00		
		On-farm trials	Multi-locational on-farm trials	Agronomist	0.25		
MOPTI							6.00
	Mopti					4.50	
		Cowpeas	Cowpea production systems (project #11)	Enthomologist Breeder Weed sci Agronomist Total	1.00 1.00 0.50 0.25 2.75		
		Forages	Forage improvement	Agrononist	1.00		
		Soil	Conservation/Eros (project #10)	Soil Physic.	0.25		
		On-farm Trials	Multi-locational on-farm trials	Agronomist	0.50		
	Koporo					1.50	
		Millet	Cropping systems (project #10)	Agronomist Entomologist Total	0.75 0.75 1.50		

1. Includes support to some research at Longorola, managed by Sotuba sorghum program.
2. To be conducted at N'Tarla station, managed by Cinzana and Niono center.

Food Technology Research

In addition to the station research and multilocational trials to be supported in this IER Program, SPARC will also strengthen the research capacity and impact of the Cereals Technology Laboratory. This Laboratory, located at Sotuba, is responsible for cereal variety food property testing and the integration of women's consumption and processing concerns into the research process. This has been important in the success of IER sorghum and millet programs and represents a critical link among research, processing, and small private sector enterprises. Under SPARC, the Laboratory will continue to receive the support required to conduct practical research activities related to varietal improvement. In addition, the Laboratory will take a more active extension role and client orientation vis-a-vis rural and urban consumers, new food products, and private sector extension operators.

Year One support will be provided for start-up of long-term training, continuing the varietal testing role, and developing a longer term research plan in new product development and testing and private sector extension linkages. Following IER approval, this longer term research plan will receive SPARC funding for research operating expenses.

The implementation of the research in food technology will build upon already existing personnel and products that are partially developed and need further testing. Technical assistance through the combination of SPARC and INTSORMIL will be provided. The food technology program will develop three or four new or modified food products from cereals and legumes. Information on process and products will be distributed to potential users in the private sector.

2. Animal Production Program

SPARC will provide support to some core research activities of the IER Animal Production Program. The emphasis of SPARC support will be on activities in the areas of animal nutrition since animal nutrition is the key constraint on productivity in the livestock sector. In addition, integration of livestock and crops production for more sustainable agricultural systems requires greater attention to animal feeding. Finally, technology related to animal nutrition and feed sources are probably the most important livestock-related technical needs of two current or planned USAID projects (the Farming Systems Research and Extension Project and the Animal Productivity and Export Projects).

Emphasis may be placed on forage research and research on alternative sources of processed or semi-processed animal feed or supplements based on agricultural by-products. Most of the top priority Research Projects comprising the Animal Production Program are in the area of animal nutrition. Activities during the first year will be limited to developing more detailed research plans based on the Projects elaborated in the Long-Term Research Plan.

3. Production Systems Program and Rural Economy Program

Socio-Economics:

IER recognizes the need for integrating economists and sociologists with technical scientists on production systems teams to monitor and evaluate technology adoption. The role of economics research is threefold: evaluate the profitability of technology adoption; conduct market studies of key inputs required for the respective technologies, specifically their availability, quality and costs; and conduct market studies of output markets, specifically demand, distribution, transport costs, and potential for market expansion. The subsector research program, currently being initiated by IER, will support such research areas during SPARC implementation.

At least one PhD-level agricultural economist, a PhD-level anthropologist/sociologist, and an MS-level anthropologist/sociologist will have been trained by SPARC and will have participated in the applied socio-economic research undertaken with SPARC support.

IER is committed to its social scientists in the Department of Planning and Rural Economy (DPER) developing a more active long term research program in support of technology development research conducted by other parts of IER. They have been constrained in the past not only by budget, but by the lack of a mandate and clear overall program guidance, and by the need to conduct short term studies for a number of clients within and outside the GRM. With completion of the Long-Term Plan and creation of the DPER, they now have the mandate to engage in research in support of technology research activities in specific commodity areas. Just as important, there is a demand among both IER administrators and technical scientists for the support of social scientists in several areas which are closely related, and constitute the essential elements of the "Subsector Approach" ("Approche Filiere") that IER has begun to follow in its socio-economic studies.

As is the case with SPARC support to food technology and animal production research, IER during Year One of the project will specify a set of research activities, consistent with the long term IER research plan, which SPARC will support. These activities will be built in part on the maize subsector study and related farm level adoption studies which DPER is currently conducting for the next several months with outside funding. In addition, the research activities to be specified will include DPER's role in managing adoption studies and participating in IER research monitoring.

The key activities to take place with SPARC support during year one are:

- the preparation of a research plan, based on the on-going maize study experience, for subsequent years' research work, and
- a baseline study of technology adoption in areas where SPARC will support significant technology research.

Production Systems:

More rapid and effective technology development and transfer demands a farmer oriented systems approach to technology development, where social and technical scientists can work together to identify farmer constraints and possible technical solutions to them. In addition, in a major step forward in strengthening research and extension linkages, IER recently gave to its production systems researchers the mandate for the final research phase, "pre-extension", before extension agencies takes over.

SPARC research in support of sorghum, millet, cowpeas, and animal production requires support from production systems researchers in order to most effectively develop and transfer technology. In each of the geographic areas where core IER technical research is to be supported under SPARC, a companion IER production systems research activity is planned or underway. In the Segou Region, the World Bank is about to fund it. In the Mopti and Koulikoro Regions, the activities are funded by USAID under the FSR/E project.

USAID support to the FSR/E project ends in late 1994 . IER's core program in sorghum, millet, and cowpea research, as well as in animal production, will be substantially more effective with continued support from production systems researchers beyond that time. The SPARC project will fund a modest level of operating costs for production systems research in the Mopti and Koulikoro Regions beginning in 1995. However, funding through SPARC will be less than half current operating expenses in those regions for budgetary constraints. This level of support should be adequate to ensure the continuation of linkages between farmer and station required for effective technology development and transfer.

E. Technology Transfer Analysis Summary

For the past decade Mali has had an uneven technology transfer system, which is now rapidly changing. During much of the 1980's certain privileged zones (such as the CMDT and OHV zones) had well financed, competent extension agencies, as part of regional rural development organizations (ODR's). Other zones had less effective ODR's. Still other zones were served by the GRM extension service, with very few resources to do extension.

The role of research and on-farm testing in the technology transfer process varied widely by zone. In the case of CMDT for example, a true partnership has developed between the research system and the extension agency, with joint planning meetings and contractual financial relationships where the CMDT funds research by IER on problems of importance to CMDT farmers. In other cases, the situation is evolving towards such partnership, with OHV and DRSPR for example, having joint planning meetings and conducting joint on-farm trials, and with the Cinzana research station and the IFAD agricultural production project collaborating on research and extension themes. In other areas either extension or research lacked the resources or institutional incentives to engage in technology transfer partnership.

Two changes are currently occurring which build on and extend the strengths of the existing technology transfer system. The first is a major strengthening of extension services in Mali, and the second a clarification and renewed mandate for the role of on-farm testing within IER.

The GRM began, one year ago, a National Agricultural Extension Program (PNVA), with World Bank funding. This program is focusing on those areas in the most need of broader extension services. These are 1) the areas with ODR's which can benefit from technical assistance and new approaches in extension, and 2) especially those areas where there is no ODR and very weak or non-existent extension. Mopti

(including Koporo) is one SPARC area where there has been no effective dryland crop extension system for several years, and where dramatic improvements have already occurred as a result of the PNVA in the quality of technology transfer. With the PNVA in place, and with several effective ODR's working in other zones served by SPARC, an important element in ensuring rapid technology transfer is assured.

The current reorganization of IER is designed in part to strengthen its capacity to facilitate technology development and dissemination from on-station experiments to on-farm trials. The Institute's commitment to regionalized programming is a key element in this process. As part of the regionalization of IER, several important developments have occurred to make on-farm testing play a more effective role. "On-farm testing" includes a range of activities, from "researcher managed trials" on farmers fields, to "farmer managed trials" or "pre-extension," to "demonstration plots". The critical distinction relative to current functions in IER is between researcher-managed multi-locational trials on farmers fields and "pre-extension."

For many years, the Multilocational Trials unit of the former Oilseeds and Food Crops Section at the Sotuba station was the principle means to carry-out multi-locational researcher managed on farm trials. The trials were centrally planned at Sotuba and transferred to local level extension and research personnel in the Regions. Transfer of improved varieties, some of them new widely adopted, has been facilitated by this process. However, in many cases the experimental designs, varieties, and other technologies proposed for multi-locational testing have been inappropriate to regional agro-climatic zones or have not responded to regionally defined problems. Because of these problems, other units within IER, including the DRSPR, have undertaken on-farm research trials because in some cases it was the best way to ensure that certain technologies were adequately tested at this level. As a result, on-farm testing has been a less effective and more expensive instrument of technology transfer than it could have been.

In practice and policy, this situation has now been changed at IER. IER has decentralized the researcher-managed multi-locational on farm trials, so that the responsibility for these trials lies with the research station staff. As an integral part of the Regional Center based research projects, on-farm trials will be researcher-managed and designed to verify the suitability of technologies primarily in the agroecological zone covered by the Center. Most of these trials will be conducted on farmers' fields and, as a result, will require close collaboration between the researchers, farmers, and extension personnel. A major advantage of decentralizing this function away from Sotuba is that it puts the scientists and technicians responsible for multi-locational trials in close day-to-day contact with the station researchers who have developed the technologies entering into the trials. Better and faster feedback to station researchers from farm level tests will result.

In addition, IER has clarified the role of farming systems researchers with respect to on-farm trials. Farming systems researchers will now be responsible for "pre-extension" trials on farmers fields, where technologies which have already gone through the researcher managed multi-locational trials then undergo their first phase of active promotion and extension. This pre-extension function integrates agronomic, socio-economic and institutional parameters in on-farm testing. Cases of active and competent extension involvement in these trials are increasing.

With a strong extension system (based on a combination of the PNVA and ODR's); working linkages between extension agencies and researchers; a regional focus to ensure appropriate technology choice as well as regional collaboration; a clear and workable method of researcher-managed multi-locational trails; and a regionally based pre-extension function within IER, the current technology transfer system has all the elements in place to effectively target efforts on viable technical improvements, verify their impact in farmers fields, and get them out to large numbers of farmers to adopt.

F. Social Soundness Analysis Summary

Analysis of the social soundness analysis of the SPARC project is based on considerations of the socio-cultural context, socio-cultural feasibility of project objectives and interventions, replicability and spread effects of project activities, and the pattern of impact on project beneficiaries.

Socio-cultural context

Beneficiaries of the SPARC project span a number of different ethnic groups, three principal geographic areas, and several production systems. Ethnicity and culture, social situation, and production system are important variables in Malian agriculture, and hence in the way the SPARC project may affect and be affected by the local social situation in different areas.

The project's principal zones of direct intervention will be three regions: the Mopti Region (based in Mopti and Koporo), Koulikoro Region (based in Sotuba), and Segou Region (based in Cinzana and Niono). In addition, some interventions, managed from the Segou Region (at Cinzana), will take place in the Sikasso region. Production systems in the zones of intervention are principally the following, listed in general from North to South:

- Transhumant pastoral systems with regular seasonal migration of herding groups and cattle, following seasonal availability of pasture and water. Key features of this system are the heavy reliance on perennial grasses in the Niger Inland Delta for dry season grazing, and the trading of animal products for grain as the basis of economic well-being and survival. This system is important in the Inland Delta during the dry season, and in northern zones during the remainder of the year.

- Agro-pastoral production system, where raising of small stock and cattle is a principle economic activity, a complement to grain production, and generally the primary source of revenue, often used to purchase grain when local supplies are inadequate. This is a principal production system in the Mopti and Segou zones.

- Grain based production system in rainfed areas, where raising of small stock receives some attention, but the emphasis is on grain production (rather than income for the purchase of grain). This system is the least flexible, with no major sources of cash income, outside of cereal production, and with the fewest number of emergency alternatives to ensure continued well being when there is inadequate rain and grain crops do poorly. This system is the primary one among non-cotton farming households in the southern Koulikoro zone and the Sikasso zone.

- Intensive cotton-cereal production system, developed in zones of the CMDT and widely practiced in the Sikasso Region, and in parts of the Segou and Koulikoro Regions. Due to a combination of agro-ecological location and high income provide by cotton, this system is the most secure and remunerative, providing farming households sufficient grain supplies as well as a means to earn substantial cash incomes.

The major ethnic groups in the project zones of intervention are Bambara, Malinke, Peulh, Dogon, and Songhai. In addition, pastoral herders, such as the Touareg and Maures, will benefit from some work in Mopti, and Senoufo and Minianka in the Sikasso Region will benefit from project activities there.

The ways in which culture, ethnicity, and production system may affect project benefits are complicated and intertwined. For example, within the intensive cotton-cereals production systems which characterize the wealthier parts of southeastern Mali, obligations of husbands and wives for providing grain for the household vary by ethnic group. At the same time, within a given ethnic group, the production system will have important effects on sources of livelihood and the likely impacts of better agricultural research. For example, Bambara in the intensive cotton zones have quite different sources of income, and prospects for household well-being, than Bambara farmers outside of those zones who are engaged in agro-pastoral or cereals-based production systems with no cultivation of an important cash crop.

Socio-cultural Feasibility

The SPARC project will enhance IER's capacity to develop technologies that farmers, herders, and food processors can use to improve their income, food production, and well-being. IER already does this job, and there are an impressive number of cropping practices, food varieties, livestock techniques, and cotton varieties used by farmers which have come out of the Malian research system. Malian farmers in all major ethnic groups and production systems have changed their methods or crop varieties relatively fast when convinced that something new will leave them better off. The principle issues of feasibility, therefore, have to do with the participation and communication strategies required to ensure that IER do its job better and more efficiently than in the past, and that it target its research activities on real farmer problems with a good understanding of the constraints farmers operate under.

The issue of feasibility, therefore, is largely one of institutional feasibility. Is it feasible for IER to establish better ways of understanding and reaching farmers, and what kind of farmer participation, and two way communication, is needed for this to happen? IER's reorganization, which SPARC will assist in implementing, is directed towards this problem. The regionalization of responsibility and management for research was decided upon by the GRM based on a concern that an overly centralized IER could not understand or respond to farmers' problems as well as a regionally-based Institute.

Regionalization will enable the key groups of researchers responsible for a region to work as a team on identifying problems and finding solutions. Whereas in the past farmer feedback to, for example, researchers responsible for multi-locational trials, may sometimes have never reached station researchers because the trials were managed from Bamako rather than the region, such feedback is now much more likely to get to the station and affect subsequent research plans. At the same time, farming systems researchers (who may be the most important contact point between farmer ideas, concerns, and feedback and the rest of the research system) will now be working together with station based researchers in the same region to provide them information on farmer concerns. Similarly, improved extension links with research, already well underway in CMDT and OHV zones, and progressing fast in the national PNVA, will be strengthened through SPARC's assistance to IER to regionalize research, planning and management.

Perhaps the most important new initiative of IER to be supported by the SPARC project is the annual research planning meeting to be conducted in each region. The major purpose of these meetings will be consultations between researchers and their clients regarding research priorities and results. Not only extension organizations but farmer representatives, and presumably other groups such as NGO's, will participate actively in these meetings. Because the meetings will take place under the authority of the Regional Governor, they will provide a great deal of weight to the directions, concerns, and feedback expressed by farmers vis a vis the IER researchers.

Existing relations between IER and extension organizations (in all project zones), and between IER and NGO's and farmers' groups (around the Cinzana station), demonstrate that proposed project interventions are feasible. Their achievement will require resolve and seriousness of purpose in ensuring that the Regional Meetings and even better research-extension links indeed take place in the most effective manner to ensure continued participation and communication on all sides.

Project Beneficiaries and Impact

Most project benefits will accrue to rural producer households in the agro-pastoral, rainfed cereal-based, and cotton based production systems in the Mopti, Segou, and Koulikoro Regions. These producers are likely to be primarily Bambara, Malinke, Peulh, Dogon, and Songhai. These benefits will come primarily in the form of improved millet and sorghum varieties and cropping practices which provide greater food security in relatively poor rainfall years or years of serious pest infestation; improved animal feed sources and practices for small ruminants; and better cowpea varieties and practices. In addition, new marketing outlets or ways of processing food crops will have provided benefits to these farmers as well.

Additional benefits of a smaller order of magnitude will accrue to the following groups:

- Pastoral households in the Mopti region, who will benefit from improvements or increases in cover of perennial grasses (bourgou in particular) in the Delta, as well as from greater availability of grain which they will gain in barter for their animal products.

- Senoufo and Minianka households in the Sikasso Region working either in intensive cotton or rainfed cereals-based production systems, who will benefit from more suitable longer-cycle sorghum varieties and from improved cropping practices.

- Traders and commercial food processors who may gain from lower grain production or processing costs.

- Consumers (both rural and urban households) who may benefit from lower cost or more accessible grain processing techniques, as well as -- over the long term -- from relatively lower cost grain.

Within the beneficiary groups outlined above, there will likely be differential impacts from the project, however, related primarily to geographic location, socio-economic situation, and gender. Geographically, the highest impact within any production system or ethnic group is likely be in areas which are either:

- Close to a research station,
- The site of multi-locational trails,
- The site of pre-extension tests,
- Served by a strong extension effort, or
- The site of strong village organization, such as an AV.

The following section, on replicability and spread effects, discusses how project impacts can nevertheless be expected to spread beyond these initial high impact areas.

Socio-economic status will affect differential beneficiary impact in two major ways. First, as concerns "communication" with and "participation" by farmers, these concepts often abstract from the very real social stratification present in most rural areas in Mali. IER researchers, as well as extension workers, are likely to receive more feedback from, and work more closely with, rural people who are leaders, influential, and articulate. At the same time, it is those who are most influential and articulate who will be most successful in ensuring that the annual Regional Meetings for research planning are aware of and take into account their particular concerns. Often techniques developed for a given production system in a given geographic zone will apply to people across the board, but this will not always be the case. IER can mitigate this differential impact to a certain extent through ensuring that its farming systems researchers, in identifying sample populations, do so with an eye to social situation.

An equally important social factor in differential impact has to do with specific socio-economic situation of the rural household. IER and other researchers have tried for some time to categorize socio-economic strata within existing production systems, ethnic groups, and geographic areas. The categories have ranged from "equipped" versus "non-equipped" (with plowing equipment), to the size of the parcel or household, to the food security situation of the household. It is this latter categorization, according to relative food security, which has proved to be most useful to date as an indicator of household well-being and socio-economic situation. Because even the best endowed rural families prefer to produce as much of their own grain consumption as possible (and rely on a risky and capricious market as little as possible), success in attaining this household objective is an important basis for categorizing rural families. Families that rely on the market for grain consumption are poorer than those who do not. With the exception of animal traction-based techniques, most of the varieties and recommendations to be supported by the SPARC project are likely to be appropriate to both "food-secure" and "food-insecure" households. The differential impact is likely to come not from the appropriateness of the recommendations and techniques but from the fact that "food-insecure" households may be less willing to take the perceived risk of adopting new techniques until they have seen them work on other farmers' fields. The poorer households then are likely to benefit more slowly from techniques developed under the project by virtue of being "late adopters".

Gender is the other factor which may make for differential benefits under the project. In approaching the differential benefits by gender, it is probably most useful to discuss the specific ways in which SPARC will benefit women.

The most important benefit to women from the SPARC project is through its effect on developing techniques which increase grain and cowpea production. This will be the case not primarily due to the impact of new techniques used in women's grain fields (whose importance varies by ethnic group and production system), although this is an important consideration. The more important benefit from increased grain production derives from the complex relationship between household food production and women's income.

"Food secure" households, with adequate grain for the family coming from the household's production, are able to use some resources (land and family labor) to produce income over and above subsistence food needs. "Food-insecure" households struggling just to survive have very little resources or income to devote to other things. The implication of this, carefully documented in the cereal-based and agro-pastoral production systems of the OHV zone, is that women in food-secure households are able to use their labor and -- when they have access to it -- their land to produce income for themselves and their children which goes beyond basic subsistence requirements.

For example, women in food secure households in the OHV zone devote much more of their time to relatively higher income producing activities (such as preparation and sale of processed foods, or making shea butter) than women in food-insecure households. They are also able to use more of their fields for market sales, or more of the income from their fields for purchases of things other than basic food products, than are the women from food insecure households. By providing the means for households to increase their food security, SPARC will reduce the pressure on women in food insecure households to devote most of their resources to basic survival, and enable them access to some supplementary income over and above basic subsistence needs.

Other SPARC benefits to women are as follows:

- Forage and animal nutrition work will benefit women as major producers of small ruminants. (In the Mopti region, women own 70% of goats, for example.)

- SPARC support to the Grain Technology Laboratory will ensure that any new grain varieties are consistent with women's consumption and processing requirements and constraints.

- SPARC support may lead to development of techniques to ease the burden of grain processing on women.

- SPARC support for long-term and short-term training for women IER staff, together with two workshops for IER to better define an explicit research agenda targeting women, will have indirect effects on women farmers and consumers throughout the Institute.

Replicability and Spread Effects

Replicability merits discussion at two levels, the beneficiary/producer level, and the national research-extension system level. At the level of beneficiaries, there is -- up to a certain point -- a formal process of replicability which can work and has often in the past worked well. This is the process of station research results to multi-locational on farm trials to pre-extension tests to extension. A number of varieties and some cropping practices have been widely spread this way, and this is the process over which the formal research and extension system exerts some management control. However, with or without that system, there is also substantial spread of new agricultural technology from farmer to farmer.

Such spread can precede by years the formal technology diffusion process, as when, for example, the Cinzana research station workers began taking home seeds from a highly productive cowpea variety, and within three years hectarage and production had seen major increases. Embouche paysanne, the stall fattening of sheep or cattle, has also been spread from farmer to farmer quite rapidly. When the process from station to extension is functioning well, and good techniques are being developed, they will spread far beyond the initial beneficiaries of the pre-extension and extension phases.

The second level of replicability is the institutional level. The SPARC project will support a number of institutional changes in the way the research system relates to farmers and extension agencies. These are changes already decided upon by IER, where SPARC will assist with implementation, initially in certain key research areas. For SPARC to be successful in achieving its purpose however requires these improvements to be replicated throughout IER, so that better collaboration and problem identification on the part of researchers, and more productive links with both farmers and extension, ensure that technologies farmers can use get out to them faster.

G. Economic Analysis Summary

Economic benefits to investments in research and extension under SPARC will be heavily influenced by three factors: yield improvements associated with new technologies generated under the project; the economic cost of the technologies and market conditions (prices and access) affecting their profitability; and rate of diffusion of the improved technologies measured by area covered and speed of adoption. The greatest social benefit will accrue to investments in those sectors where Mali holds a comparative advantage (i.e. commodities in which Mali is a low-cost producer relative to the rest of the world). Profitability is the most important factor affecting speed of adoption (farmer demand). Potential size of crop area is important for spreading the costs of technology development.

Structural changes that have taken place with respect to price reforms, Mali's comparative advantage in cereals and agricultural processed products, the importance of millet and sorghum nationwide, and income multiplier effects on the non-farm economy raise a number of implications for the project:

a. Production of millet, sorghum, fonio and maize have been highly erratic over time. Technical research aimed at stabilizing yields during poor years would have important benefits for reducing storage costs and price fluctuations.

b. An emphasis on millet/sorghum, although having lower yield improvement potential, would have important equity benefits by benefiting a larger proportion of the farming population.

c. Improvement in millet/sorghum striga resistance and drought tolerance would help to stabilize yields and prices. Demand for coarse grains and prices should remain firm or strengthen due to rising incomes, population growth, lower rainfall, and increased demand for meat.

d. Considerable technology potential already exists in the CMDT region. Economics research under SPARC will emphasize marketing studies that seek to improve marketing efficiency and to enhance demand and trade.

e. Economic studies of the economic profitability of those rice production systems based on deepwater and floating rice should be undertaken to evaluate the economic viability and appropriate targeting of this aspect of rice commodity research.

f. Emphasis on improved legume rotations, socio-economic studies emphasizing gender, improved forage technologies, and a refocusing of extension and on-farm testing on women's concerns, could collectively generate important benefits to women under the SPARC project.

Benefit-Cost Analysis

Benefits to the SPARC project are of two types: those that are difficult to quantify and thus difficult to include in rate of return calculations given existing data and time constraints; and those with benefits that can be numerically quantified. Assumptions used to estimate the latter benefits are discussed shortly. The following benefits will be generated by investments under SPARC, but are not captured in rate of return calculations:

- Millet-cowpea flour composite. The benefits derive from introducing a millet/cowpea composite flour to improve the nutrition of very young children. This benefit is important but is applicable to only a small proportion of the total population.

- Milling technology. This technology could potentially ease the work load of women. Benefits in the aggregate are offset by the fixed cost of milling equipment, operating costs, and the extra time that women must devote to other activities to generate revenue to pay for the service. Benefits would be small compared with the production impacts below.

- Intensive forage production. Introducing forages in the farming system would benefit small ruminant production, and improve nutrition of animal traction animals. However, as intensive forage systems in Mali are now very rare, any increase in area would imply a reduction in acreage of other crops. The proportion of SPARC research going to this activity is small, and net benefits would be small in the aggregate.

Net benefits (gross benefits less variable and fixed costs) of yield improvements on millet, sorghum, and cowpea, plus minor yield improvements on remaining commodities to capture spill-off benefits resulting from improved institutional capacity, are used to calculate the rate of return to the SPARC investment using two measurements. The Net Present Value (NPV) is the present value of all future flows of capital discounted by the opportunity cost of capital, assumed in this analysis to be 12 percent. Net benefits from the project are discounted over a 25 year time horizon. A positive NPV would indicate under perfect certainty that the project has positive net benefits. The Internal Rate of Return (IRR) is the discount rate that just equates the present value of the stream of positive net benefits, with the stream of negative net benefits.

The rate of return on investment in agricultural research and extension depends fundamentally on four factors: (1) yield improvement over existing technology; (2) output prices; (3) area covered by the technology; and (4) speed of adoption.

The results in Table 1 examine the base case rate of return to the SPARC project with simulations on five levels of yields: 20% below base yield improvements, 10% below, base improvements, 10% above, and 20% above. The project's rate of return based on base model assumptions is around 14% with a positive NPV of $3,526 (thousand). If the government had to borrow money at a real rate of 12% to finance the project, it would find it profitable to do so given model assumptions. However, the project's rate of return is quite sensitive to changes in yield improvements. At yield improvements 80% or less of current predictions, the project ceases to be profitable. Conversely, if yields exceed current predictions by 20%, the NPV increases to $9,201 (thousand) and the IRR increases to 16.9%.

The simulations in Table 2 evaluate the sensitivity of the project's return to alternative assumptions about the initial scope and speed of adoption. Columns (1) to (3) assume that for reasons of low profitability, poor extension service, etc., the technology is initially accepted on only 5% of the extension domain. Columns (4) to (6) assume that due to high demand by farmers, good input distribution and good extension support, the technology is initially accepted on 10% of the extension domain. Under each of these scenarios, three rates of speed of adoption are examined: slow (area under improved technologies grows 5% per year), moderate 15%, and rapid 25%.

A slow rate of adoption in terms of initial scope and speed results in disastrous returns for the project. Under the scenario of 5% initial scope and 5% growth in rate of adoption, NPV is -$5,6[illegible] (thousand) with an IRR of 6.3%. Millet/sorghum technology is ultimately adopted on only 5% of the area in the

north and 10-12% of the area in the central and south regions. When the rate of adoption is increased to 25%, however, the NPV rises to $20,598 (thousand), the IRR to 20.3, and improved technology is adopted throughout the entire extension domain. Rates are even more robust if one assumes that, due to solid returns from investments in extension, on-farm testing, and socio-economic and marketing studies, the initial scope of adoption is 10%. Under the moderate speed of adoption scenario, NPV is $19,492 (thousand) and the IRR 21.1%.

Price levels of cereals have been an important concern of technical scientists. Yield improvement in face of declining marketing prices would decrease project benefits. Prices may fall due to robust supply response relative to demand, or because marketing studies under the project fail to improve market efficiency or to enhance market volumes. Conversely, the relatively plentiful rains of the last several years cannot be expected to continue. Returns to less then favorable rainfall would imply lower aggregate production and higher real prices, other things equal. The results in Table 3 examine three price scenarios: prices change by -3%, -2%, -1%, +1%, 2% and 3%.

Table III-2
SPARC Project NPV and IRR Calculations, Yield Simulations

	.80	.90	Base Yields	1.10	1.20
NPV (discount rate = 12%)	-2,148	690	3,526	6,364	9,201
IRR	10.5	12.4	14.1	15.6	16.9

Table III-3
SPARC Project NPV and IRR Calculations, Area Simulations

A:	.05	.05	.05	.10	.10	.10
B:	.05	.15	.25	.05	.15	.25
NPV (discount rate=12%)	-5,690	3,527	20,598	1,729	19,492	37,430
IRR	6.3	14.1	20.3	13.4	21.1	26.1
Area Under Improved Technology (%):						
North: Millet	5	28	100	10	56	100
Sorghum	5	28	100	10	56	100
Cowpeas	0	0	0	0	0	0
Center: Millet	12	68	100	24	100	100
Sorghum	12	68	100	24	100	100
Cowpeas	13	71	100	25	100	100
South: Millet	10	57	100	20	100	100
Sorghum	10	57	100	20	100	100
Cowpeas	0	0	0	0	0	

A = Initial area established with improved technology; B = rate of growth in area.

Table III-4
SPARC Project NPV and IRR Calculations, Output Price Simulations

pjm =	-3%	-2%	-1%	1%	2%	3%
NPV	-3,841	-1,683	760	6,663	10,221	14,258
IRR	8.6	10.7	12.5	15.6	16.9	18.2

A downward trend in real price levels would place heavy pressure on the economic rate of return of the project. A 1% annual decline in real prices for all commodities would decrease the NPV to $760 (thousand). If prices declined at an average annual rate of 3%, a very unlikely scenario, the NPV would decline to -$3,841 (thousand). A more like set of scenarios is that real prices will increase slightly on average over time. A 1% annual increase in prices would increase the project's rate of return to around 16% and the NPV to $6,663 (thousand). A 2% annual increase would increase the IRR to 17% and the NPV to $10,221.

Results of the benefit-cost analysis have a number of implications for the target objectives of the project. For the project to break even:

a. Technologies need to be rolling off the station and onto farmers fields by around the 6th year of the project.

b. Yield levels at least 90% of those assumed in the base model need to be achieved based primarily on low input agriculture (low emphasis on fertilizers and biological chemicals).

c. The rate of return depends crucially on the speed of adoption and on the success of agricultural extension. At a minimum, at least 5% of the extension domain needs to be improved in the 6th year of the project, and grow at a 15% annual rate thereafter.

d. Marketing studies must increase market efficiency and sufficiently expand market demand to ensure that real prices remain stable, or at least do not decline.

Conversely, should yield improvements be higher than expected, should adoption be higher than expected, and should real prices rise slightly over time, the SPARC project offers substantial potential pay off to investment in agricultural research and extension.

IV. IMPLEMENTATION PLAN

Because project design and implementation are in the Title XII Collaborative Assistance Mode, and because a number of IER initiatives to be supported under SPARC are ongoing, there is no clear break between project design and implementation in the SPARC project. For this reason, the Implementation Plan includes a number of activities to be implemented before the first obligation and commitments under the project.

Pre-obligation:

- IER/ISNAR continue development of Long Term IER Plan
- IER proposes detailed modest station development workplan to AID for funding and implementation
- TAMU/Mitchell Group arranges short-term Financial Management TA to develop Financial Management System
- TAMU/CG identifies and proposes long-term TA to IER and AID, who review and approve
- TAMU arranges participation of long-term TA candidates in IER 1992 research planning discussions and/or annual technical committee meetings
- IER identifies long term training candidates and begins preliminary process of applications, medical, and TOEFL
- AID works with GRM to exempt SPARC activities from duty taxes
- AID funds research operation costs for sorghum/millet 'SPARC related research' allocated from SPARC obligation to IER through the FSR/E financial management system
- TAMU/AID/IER release personnel announcements for long term administrative assistant and secretaries
- TAMU/CG identification of long term on-campus coordinator executed and prepares on-campus contract management office
- IER requests formation of Research Management Coordination Committee to coordinate SPARC, WB, and ISNAR within IER plan; IER donors roundtable takes place
- AID/Mali selects and assigns PSC project manager to SPARC

Year 1-First Quarter

- Team research initiated, with funds flowing through FSR/E system, in Millet, Sorghum, and Cowpea research activities

- TAMU arranges short term visit for Long term TA PC to arrive in Mali to arrange all preliminary logistics for SPARC and for LT TA team: fax lines, IER office preparation, local furniture, houses, etc.

- PC places orders for initial vehicles and commodities

- AID/TAMU order locally available commodities as outlined in PP and the Commodity procurement contractor purchases and confirms shipment of U.S. origin commodities as outlined in PP.

- Long term financial analyst overlaps with short term financial TA and participates in final design stages of system development

- IER final identification of 9 first year long term trainees; CG participant training contractor arranges placement of first year long term participants

- PC/PD interview candidates for administrative assistants and secretaries to be recruited and nominated by IER for SPARC activities

- IER calls first meeting of Research Management Committee

- IER calls first meeting of Project Steering Committee

- IER sets up project local currency account

- PD, PC, FMS, and Chief of GSB develop vehicle management plan for project vehicle matriculation and maintenance

- IER with assistance from ST TA assesses IER computer status and develops long term plan for computer support (including possible LAN)

- PD and PD have initial workshops/presentations with research teams in one station or regional center, and with IER headquarters and scientific staff in Bamako

- FMS and GSB staff introduce financial management system to staff in one or more regional centers

- IER assigns financial management and accounting staff to the SPARC/IER financial management system

Year 1-Second Quarter

- TAMU arranges travel and necessary advanced funds for long-term TA team to arrive and implement logistical project start-up needs
- Long-term TA installed in project houses and offices
- Long-term training participants arrive in U.S. for language training and/or first semester graduate school
- IER project staff, long-term TA, administrative assistants, and secretaries on-board in equipped offices
- AID Semi-Annual Project Implementation Review (SAPIR)
- Delivery of initial vehicles

Year 1-Third Quarter

- Short term TA for cereals and economic research arrive to assist with research plans and protocols
- IER with PD and PC input develops Regional Technical Committee meeting agendas
- PD and PC work with Millet, Sorghum, Cowpea research teams in reviewing seasons activities results and analysis, and in developing activity and program plans and budgets (for IER technical meetings and for SPARC project workplan).
- DPER plans long term subsector research program
- DPER develops baseline farm-level adoption information and plans long term adoption studies for M and E system
- Animal production scientists and food technology scientists prepare initial research program for consideration during upcoming year
- IER annual regional and technical meetings refine and modify research plans of Millet, Sorghum, and Cowpea teams
- PD and PC develop and submit 1st year workplan to DG, AID, and CG
- PC/PD submit first semi annual progress report for review by AID and CG
- USAID review of workplan and progress report; commitment of IER funds for Year 2 through PIL and earmark of TAMU contract funds through PIO/T for RCO
- Monitoring and evaluation system initiated within SPARC activities at first regional center

- FMS transferred to at least one center and transition mechanism to cover funding at other centers
- Initial commodity orders received
- Computers installed
- IER-wide audit and inventory conducted with outside funding

Year 1-Fourth Quarter

- RCO executes first increment to TAMU contract
- In country workshop for support staff enhancement conducted
- PD and PC prepare first annual report and 2nd annual workplan for review by AID and TAMU CG
- Second year long term training participants identified and processed for August departure
- Selected short term TA support visits occur
- PC and PD monitor field activities
- USAID Semi-Annual Project Implementation Review

Year 2-First Quarter

- IER calls meeting of Research Management Committee and Project Steering Committee
- PD and PC coordinate selection and logistics of short-term TA support visits
- PD and PC plan Biometrics workshop and other related training activities
- FMS installs Financial Management System set up in other centers and trains necessary staff
- Interdepartmental research programming workshop planned
- DPER conducts farm-level adoption studies
- Grant to ISNAR executed by USAID/Mali
- Second year of Millet, Sorghum, and Cowpea research initiated; pilot subsector studies, adoption studies, animal production research, and food technology research initiated according to new program budgetting and team-based modalities

Year 2-Second Quarter

- USAID audit
- Biometrics workshop held
- Interdepartmental research programming workshop held
- Semi-annual progress report prepared
- Short-term institutional analyst conducts feasibility study on decentralization
- Baseline DPER technology adoption report and database
- Food tech group test products among Bamako women and enhance private sector contacts
- DPER baseline technology adoption report for SPARC areas and commodities completed
- USAID Semi-Annual Project Implementation Review
- Agreement with IER and World Bank on logistics of World Bank funding for IER operating expenses being managed through IER/SPARC financial management system

Year 2-Third and Fourth quarters

- Workshop to define IER process for including gender considerations in research planning organized
- Preliminary IER report on priority research activities to benefit women farmers and consumers
- USAID Semi-Annual Project Implementation Review (fourth quarter)
- Research program leaders present results and next year's research plans for review by Regional Technical Committee and National Technical Committee
- IER presents SPARC Workplan, TAMU PC and PD present annual report, USAID review, approval, and commitment of IER funds and earmark of TAMU funds for coming season
- Integration of all FSR/E operating expenses for IER into SPARC/IER financial management system, and FSR/E accounting staff into SPARC/IER system

Year 3-All Quarters

- USAID Semi-Annual Project Implementation Reviews
- PD and PC participating in and managing Annual Regional and National Program Planning Meetings
- PD and PC prepare IER annual SPARC workplan, and biannual reports, for AID review, approval and commitment/earmark of funds for IER and TAMU
- Full research programs underway in Millet, Sorghum, Cowpeas, Animal Production, Socio-Economics, and Food Technology
- Regular meetings of Research Management Committee and Project Steering Committee
- DPER report on adoption of IER technologies completed
- Mid-term project evaluation
- Discussions with Dutch, Ciba-Geigy, and Swiss on how to operationalize their financing IER research through the SPARC/IER financial management system
- IER, TAMU, and USAID reevaluate uses of SPARC/AID support to IER operating costs in light of need to take over some operating costs of production systems research subsequent to close-out of AID FSR/E project in Year 4.

Year 4-All Quarters

- SPARC begins funding some FSR/E operating costs in Mopti and Sotuba regional centers
- IER initiates discussion with other donors regarding need for expatriate financial manager for IER system after departure of USAID FMS in Year 5
- USAID Semi-Annual Project Implementation Reviews
- PD and PC participating in and managing Annual Regional and National Program Planning Meetings
- PD and PC prepare IER annual SPARC workplan, and biannual reports, for AID review, approval and commitment/earmark of funds for IER and TAMU
- Full research programs underway in Millet, Sorghum, Cowpeas, Animal Production, Socio-Economics, and Food Technology
- Regular meetings of Research Management Committee and Project Steering Committee
- PD and PC with other IER and TAMU assistance prepare report on progress and results to date after first three years of long-term plan

- FSM and chief of GSB prepare report on IER financial management system and review cost accounting information in preparation for revision of budgetting procedures and recurrent cost problems to discuss during three year program review

- IER triennial National Committee for Agronomic Research review of results of first three years under IER long-term plan

- Procurement of replacement commodities by USAID and TAMU

Year 5 -All Quarters

- USAID Semi-Annual Project Implementation Reviews

- PD and PC participating in and managing Annual Regional and National Program Planning Meetings

- PD and PC prepare IER annual SPARC workplan, and biannual reports, for AID review, approval and commitment/earmark of funds for IER and TAMU

- Full research programs underway in Millet, Sorghum, Cowpeas, Animal Production, Socio-Economics, and Food Technology

- Regular meetings of Research Management Committee and Project Steering Committee

- Departure of long term FMS TA

Year 6-All Quarters

- USAID Semi-Annual Project Implementation Reviews

- PD and PC participating in and managing Annual Regional and National Program Planning Meetings

- PD and PC prepare IER annual SPARC workplan, and biannual reports, for AID review, approval and commitment/earm[illegible] [illegible] funds for IER and TAMU

- Full research programs underway in Millet, Sorghum, Cowpeas, Animal Production, Socio-Economics, and Food Technology

- Regular meetings of Research Management Committee and Project Steering Committee

Year 7-All Quarters

- USAID Semi-Annual Project Implementation Reviews
- PD and PC participating in and managing Annual Regional and National Program Planning Meetings
- PD and PC prepare IER annual SPARC workplan, and biannual reports, for AID review, approval and commitment/earmark of funds for IER and TAMU
- Full research programs underway in Millet, Sorghum, Cowpeas, Animal Production, Socio-Economics, and Food Technology
- Regular meetings of Research Management Committee and Project Steering Committee
- PD and PC with other IER and TAMU assistance prepare report on progress and results to date after second three years of long-term plan
- FSM and chief of GSB prepare report on IER financial management system and review cost accounting information in preparation for revision of budgetting procedures and recurrent cost problems to discuss during three year program review
- IER triennial National Committee for Agronomic Research review of results of first three years under IER long-term plan
- Final evaluation, based in part on three year review reports
- Project close-out

V. PROJECT MONITORING AND EVALUATION PLAN

A. Background to Monitoring

SPARC monitoring will involve a combination of information sources. Some will be institutionalized within IER with SPARC support. Others will be more ad-hoc project arrangements serving project management needs, but fairly independent of IER capacity or needs. Because SPARC Logframe Objectively Verifiable Indicators (OVI's) include both institutional and farm-level information, the M and E system will include information at both levels.

At the level of IER institutional management and planning, monitoring will be conducted primarily by USAID project management staff, in particular the agricultural research PSC and FSN. Their monitoring, however, will be based on project reporting by IER and TA staff, including the following:

- Annual and triannual research reports by IER
- Annual IER workplan prepared by with TA input
- Annual USAID field visits to review research planning progress
- Interviews with private and public sector IER client agencies and supporters
- Discussions within IER-donors group for Malian agricultural research
- Bi-annual research review meetings involving IER, TA, and USAID staff
- Reports by ISNAR and Institut du Sahel

Monitoring of the institutional and management aspects of IER performance under SPARC will be based in part on the recent MSI agricultural research indicators study. First and foremost, monitoring of these aspects will rely on the continuing close relationship with IER of USAID staff.

An additional aspect of IER monitoring at institutional level merits mention here. This aspect is the support SPARC will provide to IER for monitoring the development of various research activities, from program conception to budgetting, to experimental design and write up of research results. Improving IER's capacity in monitoring the entire process of research is an important aspect of improved IER research management. The information generated by this process (discussed in Annex F-1, "Research Planning, Management, and Monitoring," is critically important for IER management and research leaders.

Farm-level monitoring of project performance indicators will rely more directly on IER's own internal farm-level monitoring system. This system will be developed and supported by SPARC. The system will be based primarily on a systematic assessment and tracking of the technology adoption studies conducted by other agencies (eg, PNVA, ODR's, national seed production agency), with strategic IER adoption studies to fill in the geographic or technology holes where ODR's or others have not done the tracking required to assess the impact of significant IER research programs supported by SPARC. The farm level monitoring system to be developed by SPARC at IER serves first and foremost IER's own needs to better assess the "bottom-line" performance of its research programs: their ability to get more productive technology to farmers. This IER need is identical to USAID's project management need to be able to track SPARC impact at farm level.

Currently, three different sets of farm level technology adoption information are available:

- ODR's, the National Agricultural Extension Program (PNVA), the FAO-supported seed production facility, and a few ONG's gather information on farm level technology adoption and use, in particular use of improved crop varieties.

- DPER's predecessor unit (DET) conducted several variety adoption studies in collaboration with, or with funding from, the FAO or USAID in the context of specific project preparation or evaluation studies.

- DRSPR has developed and begun to implement a series of farm level adoption studies in the villages in which it works.

SPARC will assist IER to develop a plan to systematize the available sources of information and identify critical gaps where a program of on-farm technology adoption studies is required. These on-farm adoption studies may build on the DRSPR method developed under the FSR/E project, but extending it to a broader range of farms, villages, and technologies, possibly using the sample already being used for the annual national farm production survey. The first step in this process will be to identify all available sources of information in a baseline technology adoption report, to serve as the basis for later adoption studies and reports to measure research progress at farm level.

It is at the level of on-farm monitoring, however, that SPARC confronts some competition for scarce personnel. The same IER personnel with the expertise in on-farm adoption studies are exactly those personnel whose social science and farm level perspective is critical in guiding technical research through other studies. For example, DPER researchers are in the initial stages of a year long maize subsector study (supported by central AID/W funding unrelated to SPARC), which may lay the basis for SPARC support to subsector and marketing studies in the commodities supported by SPARC. Hence the research required to support better targeting of technology generation efforts (marketing and subsector studies) is in direct competition for time and personnel with the research required for better evaluation of the impact of such research. This is, however, a competition which can be managed by appropriate phasing, as follows:

Year One: Completion of maize subsector studies

Review of lessons learned in maize studies, and planning for next set of subsector studies, to be supported by SPARC

Planning for early baseline adoption report and possible on farm studies

Year Two: Initiation of first SPARC-supported subsector studies
Initiation of baseline adoption synthesis and studies

B. Monitoring Plan

1. Monitoring the Program Goal

The goal of SPARC is to promote sustainable economic growth. Monitoring of goal achievement will be done by USAID's "Policy Reform for Economic Development" Project (PRED), and by ADO and PRM staff, in particular in tracking changes in incomes, exports, and rate of economic growth.

2. Monitoring the Project Purpose

The purpose of SPARC is to strengthen the capacity of the national agricultural research system to develop and disseminate sustainable, productive, income-generating technologies for small farmer use. Key indicators of purpose achievement are as follows:

- Increases in on-farm yield or area, as well as farm income, as a result of farmer adoption of IER-developed technologies
- Increases in the number of suitable technologies and recommendations developed by the research system.
- Declines in on-farm soil degradation and erosion.
- Production technologies adapted to site-specific conditions.

Information on these indicators will come primarily from IER's own internal monitoring system, including in particular specific on-farm adoption studies. In addition, ADO project management staff will make periodic assessments of the flow of new technologies from IER through various extension agencies to farmer adoption.

3. Monitoring Project Outputs

Output 1: An operational and sustainable national agricultural research system characterized by improved planning, monitoring, and relevancy of research programs, personnel, and financial resources, and the quality of communication of finished technologies.

Indicator 1a: Annual research plans for commodity research following national 3-year program and integrating farm and station research results.

Indicator 1b: Retention of quality scientific staff increased; unproductive staff retrained or released.

Indicator 1c: Financial resources made available to researchers on a timely basis, based on approved annual research plans.

Output 2: Strengthened research units which integrate station and farm research; natural resources management; crop and livestock research; and which improve research-extension linkages.

- Four commodity research teams (for millet, sorghum, cowpeas, and forages/animal nutrition) working at five principal locations (Sotuba, Mopti, Koporo-Kenieba, Niono, and Cinzana).
- The food technology laboratory in its capacity for varietal screening, new product development, and private sector marketing analysis
- The applied socio-economics research program of IER, located in the Department of Planning and Rural Economy, in its capacity to evaluate marketing bottlenecks, and the availability and impact of on-farm and value added technologies.
- Beginning in 1995, farming systems teams in those areas (Sotuba and Mopti) of SPARC activity where no other farming systems support is forthcoming.

Indicator 2a: Interdisciplinary commodity teams developing technologies in targeted research units.

Indicator 2b: Technology packages (crop varieties and cultural practices) are based on adaptive research.

Indicator 2c: Regular meetings between researchers and extension agents to review plans and carry out follow-up activities.

Indicator 2d: At least 4-5 environmentally sound innovative technologies across zones (either drought resistant varieties, striga resistance, pest resistance, improved agronomic or natural resource practices, and/or food processing) will have reached farmer extension.

Indicator 2e: Consumption of processed food or feed products which are developed by research.

Indicator 2f: Commodity teams reporting on adoption rates and costs/benefits of relevant technologies.

Indicator 2g: Applied economic analysis generating useable information on markets for value added food technologies.

Output 3: Trained scientists and technicians capable of carrying out research.

Indicator 3a: A critical mass of scientists working in disciplines and research units targeted as priority in the research program

Indicator 3b: Updated human resources development plan tied to research priorities

Output 4: Linkages with US, regional, and domestic research institutions, and development agencies which contribute to program coordination, technology development, and information exchange.

Indicator 4a: Regular meetings involving relevant Ministry department staff, US/Regional scientists, and IER staff to assess and plan commodity research programs.

Indicator 4b: IER scientists visiting relevant country programs, attending network meetings, and holding consultations to exchange information which advances their research.

C. Evaluation

In addition to ongoing monitoring of various aspects of project performance by IER and USAID management, two periodic evaluations will be undertaken. These will each be outside evaluations conducted under short-term contracts. At the same time, however, they will involve substantial participation by IER management personnel, ISNAR and TAMU TA staff, and -- to the extent possible -- Institut du Sahel and SPAAR Secretariat staff knowledgeable of the evolution and progress of IER. These evaluations, in addition, will both need to be informed by lessons learned and experience of similar projects in Kenya, Burkina Faso, and southern Africa (with SACCAR support). The mid-term evaluation will take place at the end of Year 3. The mid-term evaluation will need to assess the following:

- Progress made in IER's own reorganization as it affects research planning and management
- Preliminary technology adoption on farm resulting from project activities
- Performance of TA under the project
- USAID and IER success in creating a form of project support integrated into ongoing and evolving IER functions rather than having a separate and non-sustainable identity
- Most appropriate method to phase in SPARC support to the production systems research formerly supported by the FSR/E project

The second evaluation will be a final project evaluation.

VI. CONTRACTING AND PROCUREMENT PLAN

Three contract and grant instruments will constitute a substantial portion of project activities. These are a contract with the Contractor Group led by TAMU, a grant to ISNAR, and a PSC for project management. In addition, some contracting for construction and rehabilitation will be undertaken. Major remaining project costs (for research and project operating expenses) will be committed through PIL's (Project Implementation Letters) directly to the GRM.

A. Contract with Contractor Group led by TAMU

AID will execute the TAMU Contractor Group implementation contract in the collaborative assistance mode under Title XII, based on the TAMU Contractor Group participation in the project design and its collaborative working relationship with IER. The contract will include long- and short-term technical assistance, long- and short-term US and third country training, and commodity procurement. Grey Amendment requirements for the project and the contract will be respected through participation by three of the TAMU subcontractors: the Mitchell Group, American Manufacturers Export Group (AMEG), and Prairie View A & M University. This contract will be negotiated between TAMU and the RCO at REDSO/WCA, Abidjan, and managed by USAID/Bamako Agricultural Development Office.

Commodity procurement in Years One and Four, the two major procurement years, will include direct USAID procurement of some vehicles and possibly 220-volt, 50-cycle appliances and equipment not readily available in the U.S. Other procurement, as well as long- and short-term US and third country training will be done through the long term TAMU contract.

B. Grant to ISNAR

A grant will be made to strengthen ISNAR's program of short term research advisory support to IER in the areas of research organization and management. This grant will permit IER and ISNAR to continue the strong and productive collaborative relationship of the past three years which has provided some of the basis for progress in IER organization, planning, and management to date. ISNAR, TAMU, and IER personnel will coordinate closely in project implementation. The ISNAR grant will be negotiated by USAID/Bamako in collaboration with IER.

C. Personal Services Contract (PSC)

An offshore PSC will be negotiated for project management services to cover the project duration. The PSC contractor will be employed as a USAID staff member and project manager, representing AID in project discussions. The contract will be negotiated by the RCO, REDSO/WCA, Abidjan, and managed by the USAID/Mali Agricultural Development Office.

D. Contracts for Construction Rehabilitation and Upgrading

One or more small contracts will be negotiated with local firms for rehabilitation and upgrading of facilities critical to project start up or early implementation. These contracts will be host country contracts, each under $100,000, based on pre-implementation specifications to be developed by IER in collaboration with USAID's ADO and Engineering Staff. A separate construction supervision contract will probably be negotiated by USAID with GRM to oversee this work. The GRM usually assigns such construction supervision contracts to Génie Rural.

VII. CONDITIONS PRECEDENT

The following conditions precedent to disbursement will be included in the grant agreement between AID and the GRM.

A. First Disbursement

Except for technical assistance, prior to the first disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Grantee will, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(1) An opinion of counsel acceptable to A.I.D. that this Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Grantee, and that it constitutes a valid and legally binding obligation of the Grantee in accordance with all of its terms;

(2) A statement of the name of the person holding or acting in the office of the Grantee, and of any additional representatives, together with a specimen signature of each person specified in such statement;

(3) Evidence of the establishment of a separate bank account to deposit all operating funds received from A.I.D. under the Grant.

B. Additional Disbursement

Prior to disbursement under the Grant for construction services carried out through Host Country Contracting, or to issuance by A.I.D. of documentation pursuant to which disbursement will be made, for any purposes other than to finance the services referred to in Section A.1, the Grantee will, except as the parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Invitations for bids or requests for proposals for procurement of construction services estimated to exceed $100,000, including any local currency portion, prior to their issuance; and

(b) Contracts financed under the Grant in excess of $100,000, including any local currency portion, prior to their execution by the Grantee.

C. Notification

When A.I.D. has determined that the conditions precedent to first disbursement have been met, it will promptly notify the Grantee.

Terminal Dates for Conditions Precedent

If all of the conditions precedent to first disbursement have not been met within 120 days from the date of this Agreement, or such later date as A.I.D. may agree to in writing, A.I.D., at its option, may cancel the then undisbursed balance of the Grant, to the extent not irrevocably committed to third parties, and may terminate this Agreement by written notice to the Grantee.

ANNEX A: LOGICAL FRAMEWORK MATRIX

Project Title & Number:
Strengthening Research Planning and Research on Commodities
(688-0250)

Life of Project: FY '92 to FY '99

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Goal: To promote sustainable economic growth in Mali. **Strategic Objective:** To increase incomes in areas of high productive potential.	1. Per capita GDP and Income Figures. 2. Growth rates of small rural enterprises, agro-industrial firms and rural employment. 3. Multiplier reflecting impact on national income from an increase in overall farm income. 4. Average annual rate of food grain and course grain imports.	1. GRM statistics. 2. IBRD, IMF and AID annual reports. 3. Food import statistics. 4. Household, employment, and micro-enterprise surveys in rural areas. 5. DNSI regional statistics.	1. Economic and financial stabilization programs are implanted by GRM. 2. No serious climatological changes. 3. Mali production costs remain competitive with landed price of imports. 4. Export markets accessible to Malian products. 5. Continued progress in private sector development. 6. Increased productivity leads to greater aggregate production.
Purpose: To strengthen the capacity of the national agricultural research system to develop and disseminate sustainable, productive, income-generating technologies for small farmer use.	1. Increases in on-farm yield or area, as well as farm income, as a result of farmer adoption of IER-developed technologies. 2. Increase in the number of suitable technologies and recommendations developed by the research system. 3. Declines in on-farm soil degradation and erosion. 4. Production technologies adapted to site-specific conditions.	1. IER, DRV, DRSP, and ICRISAT village surveys; CMDT/DRSP/NGO monitoring of the natural resource base. 2. ODR/DNA/DNSI/OSCE annual reports; IER research reports. 3. Project and IER M&E reports.	1. Developments in seed production and in restructuring agricultural ODRs and extension mechanisms facilitate wide adoption of improved technologies. 2. Policy and grain market developments permit adopting farmers to increase their incomes.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Outputs			
1. An operational and sustainable national agricultural research system characterized by improved planning, monitoring and relevancy of research programs, personnel and financial resources, and the quality of communication of finished technologies.	1A. Annual research plans for commodity research following national 3-year program and integrating farm and station research results. 1B. Retention of quality scientific staff increased; unproductive staff retrained or released. 1C. Financial resources made available to researchers on a timely basis, based on approved annual research plans.	1. IER and ODR reports	1A. IER decision to integrate station and farm research through assignment of on-farm testing to FSR is implemented. 1B. There are adequate incentives for quality scientists to remain within the IER research network. 1C. GRM authorizes and IER adopts necessary personnel reforms. 1D. IER financial management is improved; IER receives AID financial management certification.
2. Strengthened research units which integrate: station and farm research; natural resources management, crop and livestock research; and which improve research/extension linkages. 2A. Four commodity research teams (for millet, sorghum, cowpeas, and forages/animal nutrition) working at five stations (Longorola, N'Tarla, Mopti, Niono, and Sotuba). 2B. The Food Technology Laboratory, in its capacity for varietal screening, new product development, and private sector marketing analyses.	2A. Inter-disciplinary commodity teams developing technologies in targeted research units. 2B. Technology packages (crop varieties and cultural practices) are based on adaptive research. 2C. Regular meetings between researchers and extension agents to review plans and carry out follow-up activities.	2A. IER reports. 2B. Village/Household surveys and rapid appraisals; meetings with extension personnel.	2A. IER installs interdisciplinary commodity teams at research stations. 2B. Coordination is institutionalized among IER, ODRs, and other relevant extension agencies/organizations. 2C. World Bank extension project strengthens existing extension capabilities. 2D. Sufficient on-farm testing staff assigned by IER.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Outputs (continued)			
2C. The applied socio-economics research program of IER, located in the Department of Planning and Rural Economy, in its capacity to evaluate marketing bottlenecks and the availability and impact of on-farm and value added technologies. 2D. Beginning in 1995, farming systems teams in those areas (Sotuba and Mopti) of SPARC project activity where no other farming systems support is forthcoming.	2D. At least 4-5 environmentally sound innovative technologies across zones (either drought resistant varieties, *Striga* resistance, pest resistance, improved agronomic or natural resource practices, and/or food processing) will have reached farmer extension. 2E. Consumption of processed food or feed products which are developed by research. 2F. Commodity teams reporting on adoption rates and costs/benefits of relevant technologies. 2G. Applied economic analyses generating useable information on markets for value added food technologies.		2E. Extension agents/service is able to effectively disseminate technologies over a wide domain. 2F. Rapid technology adoption once the technology is established. 2G. Marketing research will enable access to technology inputs. 2H. Rainfall remains at reasonable levels for production throughout project period. 2I. There will be demand for processed food products. 2J. GRM/IER will provide adequate financial and human resources for socio-economic research.
3. Trained scientists and technicians	3A. A critical mass of scientists working in disciplines and research units targeted as priority in the research program. 3B. Updated human resources development plan tied to research priorities.	3A. IER reports. 3B. Review of IER staffing patterns, specifically for research units, and relative to its research program.	3A. GRM/IER will make available sufficient numbers of qualified scientists for training in priority disciplines. 3B. Trained scientists will be assigned to commodity teams based on their expertise and complementarity skills
4. Linkages with U.S., regional, and domestic research institutions, and development agencies which contribute to program coordination, technology development and information exchange.	4A. Regular meetings involving relevant MRDE department staff, U.S./regional scientists, and IER staff to assess and plan commodity research programs. 4B. IER scientists visiting relevant country programs, attending network meetings, and holding consultations to exchange information which advances their research.	4A. IER and Contractor reports of trips, meetings, etc. 4B. Number of exchange visits among IER, U.S. and other scientists involved in collaborative research.	4. GRM/IER will encourage scientific collaboration and release scientists for regional international visits.

Inputs	Budget
	($000)
Technical Assistance	6,033
Construction	230
Commodities	1,686
Training	3,848
Project Support Costs	1,628
Audit	140
Evaluation	250
Operating Costs	4,725
Contingency	926
TOTAL	19,466

ANNEX B

PID APPROVAL CABLE

UNCLASSIFIED STATE 249811/01

ACTION: ADD-2 INFO: AMB DCM ECON

FILE COPY - SPA PID

VZCZCDKA792TAA068
PP RUTABM
DE RUEHC #9811/01 2120010
ZNR UUUUU ZZH
P 310005Z JUL 90
FM SECSTATE WASHDC
TO AMEMBASSY BAMAKO PRIORITY 1606
BT

LOC: 063
31 JUL 90 0910
CN: 24186
CHRG: AID
DIST: AID

UNCLAS SECTION 01 OF 03 STATE 249811

AIDAC

ACTION TAKEN:
DATE
INITIALS

E.O. 12356: N/A
TAGS:
SUBJECT: PID FOR SUPPORTING RESEARCH PLANNING AND RESEARCH ON COMMODITIES (SPARC) 688-0250

1. THE PROJECT COMMITTEE MET TO REVIEW SUBJECT PID ON JULY 10, 1990. THE REVIEW WAS ATTENDED BY AFR/SWA, AFR/TR, AFR/PD/SWA, S AND T/AGR, AND FIFAD. USAID/BAMAKO WAS REPRESENTED BY DAVID ATWOOD, ADO.

2. THE COMMITTEE EITHER RESOLVED THE ISSUES AND CONCERNS RAISED, OR EXPRESSED SATISFACTION THAT THEY WOULD BE RESOLVED IN THE COURSE OF PP PREPARATION. THE COMMITTEE THEREFORE RECOMMENDED APPROVAL OF THE PID, AND OF A DOA TO THE MISSION TO PREPARE THE PP, WITHOUT A MEETING OF THE ECPR. FOLLOWING IS A RESUME OF ISSUES AND CONCERNS DISCUSSED AND THE CONCLUSIONS REACHED. THE MISSION SHOULD PROCEED WITH PP DEVELOPMENT PURSUANT TO THE GUIDANCE OUTLINED HEREIN.

3. NEED FOR THE PROJECT:

THE PROPOSED SEVEN-YEAR, DOLS 18 MILLION PROJECT FOLLOWS AN ALREADY LENGTHY PERIOD OF AID INVOLVEMENT IN MALI CROP RESEARCH DATING BACK TO AT LEAST 1978. THE NEED FOR FURTHER ASSISTANCE IS JUSTIFIED BY: (A) THE EVIDENCE PRESENTED OF SIGNIFICANT ADVANCES IN DEVELOPMENT AND ADOPTION OF IMPROVED CROP VARIETIES AND FARMING PRACTICES AS A RESULT OF AID- AND OTHER-DONOR-ASSISTED AGRICULTURAL RESEARCH IN MALI; (B) THE PROGRESS MADE IN REORGANIZING THE MALIAN AG RESEARCH STRUCTURE AND IN SETTING PRIORITIES, AND THE NEED TO BUILD UPON THIS PROGRESS TO IMPROVE MANAGEMENT AND ESTABLISH AN INTERDISCIPLINARY COMMODITY APPROACH; (C) THE LEADERSHIP ROLE IN AGRICULTURAL RESEARCH THAT AID HAS PLAYED AND WHICH BOTH THE GRM AND USAID WISH TO SEE CONTINUED; (D) THE ASSISTANCE FURNISHED BY OTHER DONORS WHICH, THOUGH SIGNIFICAT, IS LIMITED IN SCOPE AND DOES NOT ADDRESS, OR ADDRESSES ONLY PARTIALLY, THE AREAS COVERED B SPARC; AND (E) THE IMPORTANCE ATTACHED TOIDENTIFYING AND PAVING THE WAY FOR NON-TRADITINAL SOURCES OF FUNDING TO SUSTAIN MALI'S RESEARCH PROGRAM OVER THE LONG TERM.

DUE 8/05
ACTION ADD
INFO DIR D/DIR PROG DEO MGT CONT ADO GDO JAD/DIR

UNCLASSIFIED STATE 249811/01

4. RELATINSHIP OF SPARC TO OTHER AG RESEARCH PROJECTS ANDTO THE MISSION'S OVERALL PROGRAM:

A. VERALL FROGRAM: SPARC IS CONSISTENT WITH THE MISSION'S STRATEGIC OBJECTIVES OF LONG-TERM INCREASES IN PRODUCTIVITY AND FOOD SECURITY. HOWEVER, THE MISSION STILL NEEDS TO SUBMIT THE PROGRAM LOGFRAME WHICH WILL ESTABLISH SPARC'S PLACE THEREIN. REQUEST MISSION PROVIDE LOGFRAME BY MID-AUGUST. (APPROVAL OF THE PID DOES NOT HINGE ON LOGFRAME SUBMISSION.)

B. OTHER AID AG RESEARCH PROJECTS: THE FARMING SYSTEMS RESEARCH/EXTENSION PROJECT, WHICH SUPPORTS ON-FARM RESEARCH, WILL CONTINUE UNTIL LATE 1994. SPARC WILL RELATE TO FSR/E THROUGH ON-STATION RESEARCH. MOREOVER, BETWEEN NOW AND THE TIME SPARC IS LAUNCHED, FSR/E WILL PROVIDE TRAINING AND ADVISORY SERVICES RELATED TO BOTH FSR/E AND SPARC, THEREBY ADVANCING THE TIMEFRAME SHOWN IN THE PID FOR MEETING SPARC OBJECTIVES. THREE CRSPS ARE MAKING AN IMPORTANT CONTRIBUTION TO AG RESEARCH IN MALI. TO ENSURE THEIR CLOSE RELATIONSHIP WITH SPARC, THE MISSION IS REQUESTED TO EMPHASIZE IN THE REI AND SOW FOR THE COLLABORATIVE PP DESIGN THAT THE SPARC IMPLEMENTATION TEAM IS EXPECTED TO TAKE ADVANTAGE OF THE BEST RESEARCH EXPERTISE AVAILABLE, INCLUDING IN PARTICULAR THE CRSPS.

C. COORDINATION WITH OTHER DONORS AND REGIONAL RESEARCH CENTERS: SPARC'S MANAGEMENT AND PLANNING SUPPORT WILL BE COORDINATED WITH DUTCH ON-FARM AND SOILS RESEARCH SUPPORT, WORLD BANK PROGRAMS (TO BE DEFINED), AND OTER-DONOR ASSISTANCE. SPARC WILL HELP MAINTAIN AND STRENGTHEN LINKAGES AND DIVISION OF LABOR BETWEEN MALIAN NATIONAL AG RESEARCH EFFORTS (NARS) ON THE ONE HAND AND OTHER-COUNTRY NARS AND REGIONAL RESEARCH CENTERS ON THE OTHER. AT THE SAME TIME, THE REGIONAL STRATEGY WORK OF RESEARCH NETWORKS AND OF THE WORLD BANK-INITIATED SPECIAL PROGRAM FOR AFRICAN AGRICULTURAL RESEARCH (SPAAR) WILL PROMOTE GREATER COORDINATION OF BOTH DONOR COMMITMENTS AND RESEARCH PROGRAMS. AFR/TR WILL BE COMMUNICATING WITH THE MISSION AS SPAAR WORK UNFOLDS OVER THE NEXT FEW MONTHS.

5. RELATIONSHIP BETWEEN SPARC AND GRM AGRICULTURAL RESEARCH STRATEGY-SETTING:

CONCERN WAS EXPRESSED THAT SPARC MIGHT BE LAUNCHED PREMATURELY IN RELATION TO THE AG RESEARCH STRATEGY AND RELATED ACTION PLAN BEING DEVELOPED BY THE RURAL ECONOMIC INSTITUTE (IER). THE MISSION REPRESENTATIVE EXPLAINED THAT MISSION STAFF AND AID AG RESEARCH PROJECT

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PERSONNEL ARE HELPING IER IN VARIOUS WAYS TO DEVELOP THE STRATEGY AND ACTION PLAN; AID IS WORKING IN COORDINATION WITH ISNAR WHICH IS PLAYING A MAJOR ROLE. THE STRATEGY IS EXPECTED TO BE ESSENTIALLY COMPLETED BY THE END OF 1990. CRITICAL SPARC DESIGN DECISIONS, E.G., THE PRIORITY TO BE GIVEN TO DIFFERENT COMMODITY RESEARCH PROGRAMS, WILL NOT BE FINALIZED UNTIL THE SHAPE OF THE STRATEGY IS CLEAR. ONCE SPARC IS IN PLACE, IT WILL ASSIST IN IMPLEMENTING THE STRATEGY AND ACTION PLAN THROUGH ACTIVITIES IN FINANCIAL AND ADMINISTRATIVE MANAGEMENT, PROGRAM BUDGETING, RESEARCH COORDINATION, AND DEVELOPMENT OF RESEARCH/FARM LINKAGES. THE PROJECT COMMITTEE SUPPORTED THIS APPROACH.

6. EVIDENCE OF IMPACT OF PAST AG RESEARCH PROGRAMS IN MALI:

THE COMMITTEE CONCLUDED THAT THE EVIDENCE PRESENTED IN THE PID AND ITS ANNEXES, BASED ON RECENT PROJECT EVALUATIONS AND OTHER MISSION ANALYSES, AMPLY DEMONSTRATES THE IMPACT WHICH AG RESEARCH, INCLUDING AID-SUPPORTED EFFORTS, HAS HAD ON THE DEVELOPMENT AND ADOPTION OF IMPROVED CROP VARIETIES AND FARMING PRACTICES IN MALI. THE COMMITTEE ENCOURAGES THE PP DESIGN TEAM TO FOLLOW THROUGH ON THE PID DISCUSSION REGARDING THE IMPORTANCE OF ESTABLISHING A SYSTEMATIC IMPACT MONITORING PROGRAM WITHIN IER THAT WOULD TRACK RESEARCH FINDINGS TO END-USERS, RECORDING IMPACT ON MEASURES SUCH AS PRODUCTION, PRODUCTIVITY AND/OR INCOME, AS APPROPRIATE.

7. EXTENT TO WHICH SPARC CAN DRAW ON PAST EXPERIENCE IN PROMOTING IMPROVED RESEARCH MANAGEMENT AND AN INTERDISCIPLINARY APPROACH:

THE APPROACHES TO BE USED UNDER SPARC HAVE BEEN DEVELOPED IN RESEARCH PROGRAMS IN ASIA BUT ARE SOMEWHAT NEW TO AFRICA. THEY HAVE BEEN APPLIED ON A SMALL SCALE IN MALI UNDER THE SEMI-ARID TROPICS RESEARCH II PROJECT. THE MISSION MIGHT LOOK AT DOCUMENTS ON SELECTED RESEARCH PROGRAMS IN AFRICA FOR POTENTIALLY RELEVANT LESSONS LEARNED -- E.G., ZAIRE WITH REGARD TO PRIORITY-SETTING, AND MALAWI FOR ORGANIZATION OF COMMODITY GROUPS.

8. NEED FOR LONG-TERM PERSONNEL AND THE FEASIBILITY OF INCLUDING A NON-PROJECT ASSISTANCE (NPA) COMPONENT:

THE COMMITTEE QUESTIONED THE NEED FOR 17 PERSON/YEARS OF LONG-TERM TA (THE REMAINING 43 P/Y BEING FOR SHORT-TERM TA), ON THE GROUNDS THAT IT MAY BE DIFFICULT TO ATTRACT WELL-QUALIFIED LONG-TERM TA TO MALI, WHEREAS INTERMITTENT SHORT-TERM TA VISITS WOULD ENCOURAGE HOST COUNTRY COUNTERPARTS TO ASSUME FULL RESPONSIBILITY SOONER. THE MISSION REPRESENTATIVE NOTED THAT USAID HAD BEEN ABLE TO ATTRACT QUALIFIED LONG-TERM AG RESEARCH ADVISORS IN THE PAST. HE SAID A BIOMETRICIAN,

ECONOMIST, CROP SYSTEMS AGRONOMIST AND FINANCIAL ADVISOR WILL BE NEEDED FULL-TIME DURING THE EARLY YEARS OF THE PROJECT TO WORK WITH QUALIFIED MALIAN SCIENTISTS WHO ARE INEXPERIENCED IN STATISTICS AND IN THE TEAM-BASED COMMODITY APPROACH. EACH ADVISOR WILL WORK WITH SEVERAL TECHNICIANS RATHER THAN WITH ONLY ONE COUNTERPART, THUS ENCOURAGING EARLY APPLICATION OF THE NEWLY TRANSFERRED SKILLS. TOWARD THE END OF THE PROJECT, IER SKILLS WILL HAVE REACHED A LEVEL PERMITTING THE STAFF TO BENEFIT FROM A GREATER PROPORTION OF SHORT-TERM TA. THE COMMITTEE ALSO QUESTIONED WHY NPA COULD NOT BE USED FROM THE OUTSET TO ENCOURAGE GRM TO FIND WAYS TO MEET ITS RECURRENT COSTS FOR AG RESEARCH. THE MISSION BELIEVES IER REQUIRES PROJECT ASSISTANCE, INCLUDING GUIDED OE SUPPORT, TO ACHIEVE THE MANAGEMENT OBJECTIVES OF THE PROJECT. HOWEVER, THE UTILITY OF NPA CAN BE REVIEWED IN YEAR 3 AS PART OF THE MID-TERM EVALUATION. THE COMMITTEE CONCURRED IN THE MISSION APPROACH ON BOTH ISSUES.

9. RETENTION OF PARTICIPANT TRAINEES IN IER RESEARCH PROGRAM:

THE COMMITTEE ASKED WHETHER SPECIAL STEPS WERE NEEDED TO ENSURE RETENTION. THE MISSION REPRESENTATIVE REPLIED THAT THE RETENTION RATE OF MALIAN SCIENTISTS IN DONOR-SUPPORTED AG RESEARCH PROGRAMS IS GOOD; HENCE ONE CAN EXPECT SPARC TRAINEES TO RETURN TO IER AND CONTRIBUTE TO THE INSTITUTIONALIZATION OF ITS RESEARCH CAPACITY. THE MORE EFFICIENT, FOCUSED AND WELL-FUNDED IER BECOMES DURING THE COURSE OF SPARC, THE MORE MOTIVATED THE RESEARCHERS WILL BE. MOREOVER, ONE OF THE OUTPUTS OF THE PROJECT WILL BE TO IMPROVE PERSONNEL POLICIES AND INCENTIVES FOR SCIENTIFIC STAFF. FINALLY, THERE ARE FEW ALTERNATIVE EMPLOYMENT OPPORTUNITIES IN MALI FOR AG RESEARCH SCIENTISTS.

10. OTHER CONCERNS:

A. VALIDITY OF EMPHASIS ON FOOD CROPS, AND THE ROLE OF EXPORT CROPS: THE 1989 MISSION PAPER, "ECONOMIC GROWTH, FOOD CROP RESEARCH, AND AGRICULTURE IN MALI," ESTABLISHES THE BASIS FOR SPARC'S EMPHASIS ON FOOD CROPS, INCLUDING COARSE GRAINS, FOR WHICH THERE IS A GROWING MARKET. OTHER ELEMENTS OF THE MISSION'S PROGRAM, INCLUDING THE LIVESTOCK SECTOR II AND DHV PROJECTS AND THE POLICY REFORM PROGRAMS, REFLECT THIS EMPHASIS WHILE ALSO PROMOTING AGRICULTURAL EXPORT DEVELOPMENT. LIKEWISE, SPARC WILL CONCENTRATE ON FOOD CROPS AND IN ADDITION PROVIDE SUPPORT TO EXPORTS THROUGH MODEST LEVELS OF RESEARCH ASSISTANCE IN FORAGE AND/OR HORTICULTURAL CROPS. OTHER DONORS ARE ASSISTING RESEARCH ON TRADITIONAL EXPORT CROPS, E.G., THE FRENCH ON COTTON.

B. INSTITUTIONAL LINKAGE BETWEEN AG RESEARCH AND EDUCATION: THIS IS NOT ADDRESSED IN THE PP. MISSION IS ENCOURAGED TO DO SO, PERHAPS BY PROVIDING IN THE PP FOR COLLABORATIVE RESEARCH GRANTS TO BE UTILIZED JOINTLY BY IER AND BY STAFF AND STUDENTS OF THE AGRICULTURAL EDUCATION INSTITUTE AT KATIABOUGOU.

C. IEE: THIS IS BEING REVISED BY AFR/TR AND GC/AFR TO PROVIDE FOR A NEGATIVE DETERMINATION RATHER THAN A CATEGORICAL EXCLUSION. WHEN COMPLETED, A COPY WILL BE FAXED TO THE MISSION FOR REVIEW AND DIRECTOR APPROVAL.

D. MAINTAINING A LEAN, AFFORDABLE RESEARCH INSTITUTION: WITH A NUMBER OF DONORS ADDRESSING VARIOUS ASPECTS OF AG RESEARCH IN MALI, THERE IS THE DANGER OF EXPANDING RESEARCH ENDEAVORS TO A POINT EXCEEDING MALI'S CAPACITY TO SUSTAIN. IT IS THEREFORE ESSENTIAL THAT RESEARCH PRIORITIES BE CLEARLY ESTABLISHED AND FOCUSED ON TOPICS WHERE POTENTIAL BENEFITS ARE HIGHEST. THE COMMITTEE IS ENCOURAGED BY THE PROGRESS BEING MADE IN CONSOLIDATING MALI'S AG RESEARCH STRUCTURE AND PRIORITIZING ITS RESEARCH AGENDA. THE COMMITTEE LOOKS TO SPARC TO GIVE ADDED MOMENTUM TO THE PROCESS THROUGH ITS EMPHASIS ON MANAGEMENT AND COST RECOVERY.

E. PROJECT LOGFRAME: THE LOGFRAME IN THE PID IS WELL-CONSTRUCTED. THE PURPOSE AND OUTPUT INDICATORS SHOULD BE QUANTIFIED WHEREVER APPROPRIATE IN THE PP LOGFRAME. THE EOPS INDICATORS, IF ACHIEVED, WILL REFLECT AN AG RESEARCH SYSTEM OPERATING WITH GREATER PRODUCTIVITY. GIVEN THIS FACT AND THE IMPORTANCE WHICH BOTH DFA AND SPAAR ATTACH TO INCREASED PRODUCTIVITY OF AGRICULTURAL RESEARCH, RECOMMEND THAT THE PURPOSE STATEMENT BE REARTICULATED ACCORDINGLY. KIMMITT

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ANNEX C

SUPPLEMENTARY FINANCIAL TABLES

TABLE C-1

ESTIMATED USAID PROJECT COSTS BY YEAR AND BY COMPONENT

Estimate Project Inputs by Year and by Component
USAID Contribution

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
I. Technical Assistance	911,004	922,206	954,251	1,010,285	1,013,173	657,971	563,349	6,032,239
1.1 LONG TERM T/A								
Research Management Specialist (84 p/m)	200,000	210,000	220,500	231,525	243,101	255,256	268,018	1,628,400
Financial Management Specialist (60 p/m)	200,000	210,000	220,500	231,525	243,101	0	0	1,105,126
Administrative Assistant	15,000	15,750	16,538	[illegible]	0	0	0	47,288
Secretary (2)	20,000	21,000	22,050	23,172	24,308	25,522	26,798	162,850
Driver (2)	5,000	5,250	5,513	5,788	6,078	6,381	6,700	40,710
Long Term T/A subtotal	440,000	462,000	485,101	492,010	516,588	287,159	301,516	2,984,374
1.2 SHORT TERM T/A								
Short term Specialist (1)	259,450	242,225	270,900	287,850	287,850	207,275	169,850	1,725,400
ISNAR (5 Years Grant with Int'l Organizations)	42,000	42,000	42,000	42,000	42,000	0	0	210,000
Short Term T/A subtotal	301,450	284,225	312,900	329,850	329,850	207,275	169,850	1,935,400
1.3 Campus Support								
Intern'l Project Manager (48 p/m)	91,520	48,048	50,450	52,974	55,623	58,403	61,323	418,341
Staff Assistant (36 p/m)	16,474	17,297	18,162	19,070	20,024	21,027	0	112,054
Student Worker (36 p/m)	7,630	8,012	8,413	8,835	9,278	9,741	0	51,909
Technical Backstopping at partner location ?	16,800	42,000	42,000	42,000	42,000	8,400	0	193,200
Domestic Travel and per diem (8 persons @ 4 days x 8)	22,880	24,024	25,225	26,486	27,810	29,200	30,660	186,285
Foreign travel and per diem (3 persons @ 10 days X 3)	0	24,600	0	27,060	0	29,766	0	81,426
Campus Support Subtotal	155,304	163,981	144,250	176,425	154,735	156,537	91,983	1,043,215
1.5 Indirect Cost on Sub-contracts	14,250	12,000	12,000	12,000	12,000	7,000	0	69,250
Indirect Cost Subtotal	14,250	12,000	12,000	12,000	12,000	7,000	0	69,250

Footnote: (1) Some short-term training will be provided by S-T TA

(cont'n) Estimate Project Costs by Year and by Component
USAID Contribution

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
II. Construction	130,000	100,000	0	0	0	0	0	230,000
Construction	130,000	100,000	0	0	0	0	0	230,000
III. Commodities	912,735	69,900	71,800	517,000	50,500	41,500	22,500	1,685,935
3.1 US procurement	360,200	68,900	70,800	190,950	49,500	40,500	21,500	802,350
3.1.1 Equipment								
Major furnitures (3 sets)	20,000	0	0	14,000	0	0	0	34,000
Office Furnitures (6 sets)	30,000	0	0	0	0	0	0	30,000
Computers and Programs (30)	100,000	0	0	50,000	0	0	0	150,000
Printers and accessories	30,000	0	0	15,000	0	0	0	45,000
Field research equipment	5,000	15,000	16,000	17,000	10,000	19,000	10,000	100,000
Food technician Laboratory Equipment	5,500	15,000	15,000	5,000	5,000	0	0	45,500
Subtotal Equipment	190,500	30,000	31,000	101,000	23,000	19,000	10,000	404,500
3.1.2 Shipping costs								
Estimated Shipping costs	48,800	8,900	8,800	26,000	3,500	2,500	1,500	100,000
subtotal Shipping costs	48,800	8,900	8,800	26,000	3,500	2,500	1,500	100,000
3.1.3 Overhead charges								
Overhead Computers/Printers	55,900	0	0	27,950	0	0	0	83,850
Overhead other equipment	65,000	30,000	31,000	36,000	23,000	19,000	10,000	214,000
subtotal Overhead	120,900	30,000	31,000	63,950	23,000	19,000	10,000	297,850
3.2 In-country Procurement	552,535	1,000	1,000	326,050	1,000	1,000	1,000	883,585
3.2.1 Equipment								
4X4 vehicles & Spare parts (15 cars)	289,800	0	0	231,840	0	0	0	521,640
Motorcycles & Spare parts (18 moto)	23,460	0	0	14,100	0	0	0	37,560
Mobylettes & Spare parts (9)	6,900	0	0	4,180	0	0	0	11,080
Generators & spare parts (5)	71,875	0	0	0	0	0	0	71,875
Photocopiers (lg) (2)	30,000	0	0	36,000	0	0	0	66,000
Photocopiers (sm) (3)	25,000	0	0	15,000	0	0	0	40,000
Fax machine (2)	2,000	0	0	2,400	0	0	0	4,400
Typewriters (4)	2,700	0	0	950	0	0	0	3,650
Refrigerators (3)	3,000	0	0	1,800	0	0	0	4,800
Freezers (3)	2,500	0	0	1,500	0	0	0	4,000
Stoves (3)	2,400	0	0	1,440	0	0	0	3,840

(cont'n) Estimate Project Costs by Year and by Component
USAID Contribution

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
In-country Procurement (cont'n)								
Air conditionners (20)	14,000	0	0	7,200	0	0	0	21,206
Washing machines (4)	3,000	0	0	3,600	0	0	0	6,600
Dryers (4)	2,200	0	0	2,640	0	0	0	4,840
Minor furnitures	2,000	0	0	2,400	0	0	0	4,400
Food Tech Lab Equipment (misc.)	500	500	500	500	500	500	500	3,500
Field Research Equipment (misc.)	500	500	500	500	500	500	500	3,500
Transformer for Sotuba (1)	70,000	0	0	0	0	0	0	70,000
Small office refrigerator for IER	700	0	0	0	0	0	0	700
Subtotal equipment	552,535	1,000	1,000	326,050	1,000	1,000	1,000	883,585
IV. Training	481,982	871,221	1,009,439	818,587	458,272	208,397	0	3,847,899
4.1 Long-term								
4.1.1 M.S (10)	228,025	430,968	502,796	263,968	55,433	0	0	1,481,190
4.1.2 Ph. D (9)	165,332	347,197	410,126	430,633	251,202	52,753	0	1,657,243
Sub total Long-Term (includes 5% inflation)	393,357	778,165	912,922	694,601	306,635	52,753	0	3,138,433
4.2 Short-term (1)								
4.2.1 Short term third country (30 participants)	65,925	69,221	72,682	76,316	80,132	84,139	0	448,416
4.2.2 Workshops or conferences (55 participants)	22,700	23,835	23,835	47,670	71,505	71,505	0	261,050
Subtotal Short-term	88,625	93,056	96,517	123,986	151,637	155,644	0	709,466

Footnotes: Additional short-term training is included as part of the short-term technical assistance budget, since short-term TA will provide some in-country training courses.

. (cont'n) Estimate Project Costs by Year and by Component

USAID Contribution

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
V. Project Support Costs (1)	200,000	210,000	220,500	231,525	243,101	255,256	268,018	1,628,400
1.5 Personal Service Contract								
Project Support Costs	10,000	10,000	10,000	10,000	10,000	10,000	10,000	70,000
P.S.C (72 p/m)	190,000	200,000	210,500	221,525	233,101	245,256	258,018	1,558,400
Project Support Costs subtotal	200,000	210,000	220,500	231,525	243,101	255,256	268,018	1,628,400
VI. Audit	15,000	25,000	15,000	25,000	15,000	15,000	30,000	140,000
5.1 Audit	15,000	25,000	15,000	25,000	15,000	15,000	30,000	140,000
Subtotal Audit	15,000	25,000	15,000	25,000	15,000	15,000	30,000	140,000
VII. Evaluation	0	0	125,000	0	0	0	125,000	250,000
7.1 Evaluation	0	0	125,000	0	0	0	125,000	250,000
Subtotal Evaluation	0	0	125,000	0	0	0	125,000	250,000
VIII. Operating Expenses	475,000	575,000	675,000	775,000	775,000	775,000	675,000	4,725,000
6.1 Research Operating Expenses	200,000	300,000	400,000	500,000	500,000	500,000	400,000	2,800,000
6.2 Administrative Operating Expenses (2)	275,000	275,000	275,000	275,000	275,000	275,000	275,000	1,925,000
Operating Expenses Subtotal	475,000	575,000	675,000	775,000	775,000	775,000	675,000	4,725,000
Project Subtotal	3,125,721	2,773,327	3,070,990	3,377,398	2,555,046	1,953,124	1,683,867	18,539,473
IX. Contingencies	156,286	138,666	153,549	168,870	127,752	97,656	84,193	926,974
Contingencies at 5 Percent	156,286	138,666	153,549	168,870	127,752	97,656	84,193	926,974
Project Grand Total	3,282,007	2,911,994	3,224,539	3,546,267	2,682,798	2,050,780	1,768,061	19,466,447

TABLE C-2

PROJECT COSTS BY COMPONENT: USAID AND GRM CONTRIBUTIONS

Estimate Detailed Project Costs and Financial PLan by Component (in $000 US)

USAID/GRM Contribution

Item	USAID FX	USAID LC	GRM FX	GRM LC	Total FX	Total LC	Total Project
I. Technical Assistance	5,991,529	40,710	0	0	5,991,529	40,710	6,032,239
1.1 LONG TERM T/A							
Research Management Specialist (84 p/m)	1,628,400	0	0	0	1,628,400	0	1,628,400
Financial Management Specialist (84 p/m)	1,105,126	0	0	0	1,105,126	0	1,105,126
Administrative Assistant	47,288	0	0	0	47,288	0	47,288
Secretary (2)	162,850	0	0	0	162,850	0	162,850
Drivers (2)	0	40,710	0	0	0	40,710	40,710
Long Term T/A subtotal	2,943,664	40,710	0	0	2,943,664	40,710	2,984,374
1.2 SHORT TERM T/A							
Short term Specialist (26 p/m)	1,725,400	0	0	0	1,725,400	0	1,725,400
ISNAR (6 Years Grant with Int'l Organizations)	210,000	0	0	0	210,000	0	210,000
Short Term T/A subtotal	1,935,400	0	0	0	1,935,400	0	1,935,400
1.3 Campus Support							
Intern'l Project Manager (48 p/m)	418,341	0	0	0	418,341	0	418,341
Staff Assistant (36 p/m)	112,054	0	0	0	112,054	0	112,054
Student Worker (36 p/m)	51,909	0	0	0	51,909	0	51,909
Technical Backstopping at partner location ?	193,200	0	0	0	193,200	0	193,200
Domestic Travel and per diem (8 persons @ 4 days x 8)	186,285	0	0	0	186,285	0	186,285
Foreign travel and per diem (3 persons @ 10 days X 3)	81,426	0	0	0	81,426	0	81,426
Campus Support Subtotal	1,043,215	0	0	0	1,043,215	0	1,043,215
1.5 Indirect Cost on Sub-contracts	69,250	0	0	0	69,250	0	69,250
Indirect Cost Subtotal	69,250	0	0	0	69,250	0	69,250
II. Construction	0	230,000	0	758,621	0	988,621	988,621
Construction	0	230,000	0	758,621	0	988,621	988,621

. Continuation

Estimate Detailed Project Costs and Financial Plan by Component (in $000 US)

USAID/GRM Contribution

Item	USAID FX	USAID LC	GRM FX	GRM LC	Total FX	Total LC	Total Project
III. Commodities	872,350	813,585	0	275,862	872,350	1,089,447	1,961,797
3.1 US procurement	802,350	0	0	275,862	802,350	275,862	1,078,212
3.1.1 Equipment							
Major furnitures (3 sets)	34,000	0	0	0	34,000	0	34,000
Office Furnitures (6 sets)	30,000	0	0	0	30,000	0	30,000
Computers and Programs (30)	150,000	0	0	0	150,000	0	150,000
Printers and accessories	45,000	0	0	0	45,000	0	45,000
Field research equipment	100,000	0	0	0	100,000	0	100,000
Food technician Laboratory Equipment	45,500	0	0	0	45,500	0	45,500
Various GRM equipment	0	0	0	275,862	0	275,862	
Subtotal Equipment	404,500	0	0	275,862	404,500	275,862	404,500
3.1.2 Shipping costs							
Estimated Shipping costs	100,000	0	0	0	100,000	0	100,000
subtotal Shipping costs	100,000	0	0	0	100,000	0	100,000
3.1.3 Overhead charges							
Overhead Computers/Printers	83,850	0	0	0	83,850	0	83,850
Overhead other equipment	214,000	0	0	0	214,000	0	214,000
subtotal Overhead	297,850	0	0	0	297,850	0	297,850
3.2 In-country Procurement	70,000	813,585	0	0	70,000	813,585	883,585
3.2.1 Equipment							
4X4 vehicles & Spare parts (16 cars)	0	521,640	0	0	0	521,640	521,640
Motorcycles & Spare parts (18 moto)	0	37,560	0	0	0	37,560	37,560
Mobylettes & Spare parts (9)	0	11,080	0	0	0	11,080	11,080
Generators & spare parts (6)	0	71,875	0	0	0	71,875	71,875
Photocopiers (lg) (1)	0	66,000	0	0	0	66,000	66,000
Photocopiers (sm) (2)	0	40,000	0	0	0	40,000	40,000
Fax machine (1)	0	4,400	0	0	0	4,400	4,400
Typewriters (4)	0	3,650	0	0	0	3,650	3,650
Transformer for Sotuba (1)	70000	0	0	0	70,000	0	70,000
Small office refrigerator for IER	0	700	0	0	0	700	700

.. Continuation

Estimate Detailed Project Costs and Financial Plan by Component (in $000 US)
USAID/GRM Contribution

Item	USAID FX	USAID LC	GRM FX	GRM LC	Total FX	Total LC	Total Project
Refrigerators (3)	0	4,800	0	0	0	4,800	4,800
Freezers (3)	0	4,000	0	0	0	4,000	4,000
Stoves (3)	0	3,840	0	0	0	3,840	3,840
Air conditionners (20)	0	21,200	0	0	0	21,200	21,200
Washing machines (4)	0	6,600	0	0	0	6,600	6,600
Dryers (4)	0	4,840	0	0	0	4,840	4,840
Minor furnitures	0	4,400	0	0	0	4,400	4,400
Food Tech Lab Equipment (misc.)	0	3,500	0	0	0	3,500	3,500
Field Research Equipment (misc.)	0	3,500	0	0	0	3,500	3,500
Subtotal equipment	70,000	813,585	0	0	70,000	813,585	883,585
IV. Training	3,847,899	0	0	0	3,847,899	0	3,847,899
4.1 Long-term							
4.1.1 M.S (10)	1,481,190	0	0	0	1,481,190	0	1,481,190
4.1.2 Ph. D (9)	1,657,243	0	0	0	1,657,243	0	1,657,243
Sub total Long-Term	3,138,433	0	0	0	3,138,433	0	3,138,433
4.2 Short-term							
4.2.1 Short term third country (30 participants)	448,416	0	0	0	448,416	0	448,416
4.2.2 Workshops or conferences (55 participants)	261,050	0	0	0	261,050	0	261,050
Subtotal Short-term	709,466	0	0	0	709,466	0	709,466
V. Project Support Costs	1,558,400	70,000	0	0	1,558,400	70,000	1,628,400
5.1. Personal Service Contract							
Project Support Costs	0	70,000	0	0	0	70,000	70,000
P.S.C (72 p/m)	1,558,400	0	0	0	1,558,400	0	1,558,400
Project Support Costs subtotal	1,558,400	70,000	0	0	1,558,400	70,000	1,628,400

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Continuation

Estimate Detailed Project Costs and Financial Plan by Component (in $000 US)
USAID/GRM Contribution

Item	USAID FX	USAID LC	GRM FX	GRM LC	Total FX	Total LC	Project Total
VI. Audit	140,000	0	0	0	140,000	0	140,000
6.1 Audit	140,000	0	0	0	140,000	0	140,000
Subtotal Audit	140,000	0	0	0	140,000	0	140,000
VII. Evaluation	250000	0	0	0	250,000	0	250,000
7.1 Evaluation	250000	0	0	0	250,000	0	250,000
Subtotal Evaluation	250000	0	0	0	250,000	0	250,000
VIII. Operating Expenses	0	4,725,000	0	5,689,655	0	10,414,655	10,414,655
8.1 Local Operating Expenses	0	2,800,000	0	5,689,655	0	8,489,655	8,489,655
8.2 Administrative Operating Expenses	0	1,925,000	0	0	0	1,925,000	1,925,000
Operating Expenses Subtotal	0	4,725,000	0	5,689,655	0	10,414,655	10,414,655
Project Subtotal	12,660,178	5,879,295	0	6,724,138	12,660,178	12,603,433	25,263,611
IX. Contingencies	463,487	463,487	0	0	463,487	463,487	926,974
Contingencies at 10 Percent	463,487	463,487	0	0	463,487	463,487	926,974
Project Grand Total	13,123,665	6,342,782	0	6,724,138	13,123,665	13,066,920	26,190,585

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TABLE C-3: ANNUAL LONG TERM TRAINING SUMMARY BUDGET

Total cost	MS	136,815			PhD	165,332	
Cost per year (approx)		45,605				41,333	
Year	1	2	3	4	5	6	Total
Master's							
Number abroad	5	9	10	5	1		
Cost	228,025	410,445	456,051	228,025	45,605		1,368,152
Cost with 5% inflation	228,025	430,968	502,796	263,968	55,433		1,481,190
PhD							
Number abroad	4	8	9	9	5	1	
Cost	165,332	330,664	371,997	371,997	206,665	41,333	1,487,987
Cost with 5% inflation	165,332	347,197	410,126	430,633	251,202	52,753	1,657,243
Total	393,357	741,109	828,047	600,022	252,270	41,333	2,856,139
Total with inflation	393,357	778,165	912,922	694,600	306,636	52,753	3,138,433

TABLE C-4: MASTER'S DEGREE BUDGET

DESCRIPTION	UNITS	UNIT COST	TOTAL
A. ENGLISH LANGUAGE TRAINING (6 months)			
Tuition (6 months)	6	360	2,160
Maintenance advance	1	975	975
Living allowance (5 months)	5	905	4,525
IRS Withholding 14%			770
Book allowance	5	65	325
Health & Accident Coverage	6	40	240
Administrative fees	5	320	1,600
Subtotal			10,595
B. MASTERS LEVEL TRAINING (36 months)			
Tuition	36	850	30,600
Maintenance allowance	36	779	28,044
IRS Withholding 14%	36	109	3,926
Book allowance	36	65	2,340
Health & Accident Coverage	36	40	1,440
Administrative fees	36	320	11,520
Subtotal			77,870
C. MISCELLANEOUS COSTS			
International travel	2	4,000	8,000
Medical examination	1	100	100
WIC Orientation	1	325	325
Professional Society Membership	1	225	225
Book shipment allowance	1	120	120
Master's thesis	1	400	400
Short courses/professional meetings			10,000
Computer time	36	80	2,880
Subtotal			22,050
D. SPOUSE TRAINING PROGRAM			
Airfare			4,000
Tuition	20	850	17,000
Computer and other miscellaneous			4,000
Book Allowance	20	65	1,300
Subtotal			26,300
TOTAL ESTIMATED BUDGET			136,815

TABLE C-5: DOCTORATE DEGREE BUDGET

DESCRIPTION	UNITS	UNIT COST	TOTAL
A. ENGLISH LANGUAGE TRAINING (6 months)			
Tuition (6 months)	6	360	2,160
Maintenance advance	1	975	975
Living allowance (5 months)	5	905	4,525
IRS Withholding 14%			770
Book allowance	5	65	325
Health & Accident Coverage	6	40	240
Administrative fees	5	320	1,600
Subtotal			10,595
B. DOCTORATE LEVEL TRAINING (48 months)			
Tuition	48	850	40,800
Maintenance allowance	48	779	37,392
IRS Withholding 14%	48	109	5,235
Book allowance	48	65	3,120
Health & Accident Coverage	48	40	1,920
Administrative fees	48	320	15,360
Subtotal			103,827
C. MISCELLANEOUS COSTS			
International travel	2	4,000	8,000
Medical examination	1	100	100
WIC Orientation	1	325	325
Professional Society Membership	1	225	225
Book shipment allowance	1	120	120
Doctoral dissertation	1	2,000	2,000
Short courses/professional meetings			10,000
Computer time	48	80	3,840
Subtotal			24,610
D. SPOUSE TRAINING PROGRAM			
Airfare			4,000
Tuition	20	850	17,000
Computer and other miscellaneous			4,000
Book Allowance	20	65	1,300
Subtotal			26,300
TOTAL ESTIMATED BUDGET			165,332

TABLE C-6: GRM CONTRIBUTION: EQUIPMENT

Projet PARA-IER
Contribution en Equipement du GRM

Année	Description	Montant CFA
I	1 tracteur + accessoirs	20,000,000
II	1 vehicule tout terrain	15,000,000
III	1 véhicule leger 1 lot d'équipement de bureau	8,000,000 2,000,000
IV	Materiels d'expérimentation (champs et laboratoirs)	10,000,000
V	1 véhicule tout terrain	15,000,000
VI	1 véhicule leger 1 lot d'equipement de bureau et Materiels d'expérimentation	8,000,000 2,000,000
VII	-0-	-0-
Total		80,000,000

TABLE C-7: GRM CONTRIBUTION: CONSTRUCTION

Projet PARA-IER
Contribution en Construction du GRM

Année	Description	Cout Total en FCFA
I	Deux (2) Bureaux Deux (2) Logements	60,000,000
II	Un (1) Bureau Un (1) Logement	25,000,000
III	Un (1) Bureau Un (1) Logement	30,000,000
IV	Un (1) Bureau Un (1) Logement	30,000,000
V	Deux (2) Logements	25,000,000
VI	Deux (2) Logements	30,000,000
VII	Deux (2) Logements	20,000,000
Total	16 constructions	220,000,000

TABLE C-8: LOCATION OF GRM CONSTRUCTION

Projet PARA-IER
Répartition Géographique
de la Construction

Stations	Logement	Bureau
Cinzana	2	1
N'Tarla	2	1
Kayes	1	1
Niono	3	1
Sikasso	3	1
TOTAL	11	5

TABLE C-9: SHORT TERM TECHNICAL ASSISTANCE BUDGET

Year	1	2	3	4	5	6	7	Total
Bio-research								
Exist CRSP								
PM	2	3	3	3	3	3	3	19
$	22,900	28,625	34,350	34,350	34,350	28,625	28,625	211,825
New CRSP								
P-M	2	2	2	3	3	2	2	15
$	33,900	25,425	33,900	50,850	50,850	33,900	25,425	254,250
Non-CRSP								
P-M	1	2	2	2	2	1	1	11
$	28,950	43,425	57,900	57,900	57,900	28,950	28,950	303,975
Total people	9	10	12	14	14	10	9	78
Socio-Econ								
P-M	1	2	2	2	2	1	1	11
$	28,950	57,900	57,900	57,900	57,900	28,950	28,950	318,450
Financial								
P-M	4	2	2	2	2	2	1	15
$	115,800	57,900	57,900	57,900	57,900	57,900	28,950	434,250
Other								
P-M	1	1	1	1	1	1	1	7
$	28,950	28,950	28,950	28,950	28,950	28,950	28,950	202,650
Total								
P-M	11	11	12	13	13	10	8	77
$	259,450	242,225	270,900	287,850	287,850	207,275	169,850	1,725,400

Exist CRSP		New CRSP		Non-CRSP TA	
50% of airfare:	2,200	Airfare:	4,400	Airfare:	4,400
Per diem 2 weeks:	2,380	Per diem 2 weeks:	2,380	Per diem 4 weeks:	4,760
Total:	4,580	Total:	6,780	Salary/fringe@$390	10,140
Subtotal 1 p-m	9,160	Subtotal 1 p-m	13,560	Subtotal:	19,300
Total w/ 25% OH	11,450	Total w/ 25% OH	16,950	Total w/ 50% OH	28,950

There will be three categories of short term TA: Those funded on a cost sharing basis with on-going CRSP scientists, in which the scientist examines problems in different zones than his CRSP funded activities; those funded through new CRSP scientists not currently active in Mali; and those funded through the TAMU contractor group directly. Each category has different cost implications. Additive work to on-going CRSP personnel already active in Mali is the least expensive because no salaries are paid under CRSP's, and also because there is cost sharing of the international airfare. The short term TA supplied through new CRSP scientists is also relatively inexpensive because no salary costs are required.

TABLE C-10: SPARC Administration and Management Operating Expense Budget

- Communications (15k-email, 40kfax, 20 tel)	75,000
- Office supplies (paper, pens, diskettes, film, etc)	20,000
- Transportation (fuel, lubricants for 3 veh:=400/mo/veh)	15,000
- Temporary labor (as secs, data entry, maintenance, etc)	10,000
- Another admini. assistance	
- Equipment maintenance contracts (10k/photocop/yr)	20,000
- Vehicle maintenance contracts (2k/veh/yrx9veh) (1)	18,000
- Insurance and fees (1.2k/veh/yrx10vh)*	15,000
- Travel to centers, etc. (3trips/mox3days/tripx20x2p)	5,000
- Documentation and publications (res.rep, pubs.,buls,pres.)	20,000
- Special research and research prize	10,000
- Translation ($10/page x 1000 pages/yr)	10,000
- On-the-job training (in-country staff enhanc) (2)	25,000
- Miscellaneous (3)	31,400
TOTAL	275,000

1. These funds for all vehicles will remain in project administrative budget until centers have been set up to handle these expenses at the center level. Estimated in year 3-4.

2. In-country short-term training costs are included here and in the short-term TA budget (if short-term TA are providing in country training.

3. Includes inter alia shipping cost for as publications or equipment provided gratis to IER by US universities or firms.

TABLE C-11

ANNUAL RESEARCH OPERATING COSTS (in 1000's FCFA) (6)

	ISNAR estimate (1)	Cinzana 1989 (4)	Mopti (88, proposed) (2)	Mopti (89, proposed) (2)	Mopti (89-93, proposed.)
Total annual costs	64,000	75,000	36,738	46,731	60,929
Operating and non-personnel costs	32,000 (5)	34,391	23,864	31,695	37,147
Total personnel costs	32,000	40,609	12,874	15,036	23,782
Scientific/Technical	24,000	17,414	5,894	7,578	13,522
Salaries	-	10,104	5,894	7,578	9,262
Per diem/research incentives	-	7,310	-	-	4,260
Other (manual) labor	8,000	23,195	6,980	7,458	10,260
Ratio personnel to non-personnel costs	1:1	1:1.17	1:1.91	1:2	1:1.60
Number of scientists (3)	4	4	3	5	5
Number of technicians	12	8	4	4	6
Ratio scientists to technicians	1:3	1:2	1:1.33	1:0.8	1:1.20
Ratio scientists/tech. to other labor costs	1:0.33	1:1.35	1:1.2	1:1	1:0.76
Costs per research-year	16,000	18,750	12,246	9,346	12,185

Notes to Table C-11

1. Assumes a station with 4 scientists. ISNAR costs/research-year (in 11 March 89 Note Preliminaire) multiplied by 4.

2. Mopti costs estimated in following way: Scientific/Technical salary costs per person are assumed to be identical to those in Cinzana. All non-personnel costs except major investment items (eg perimeter upgrading) are considered in non-personnel costs.

3. The use of the terms "scientist, "researcher", and Category "A" functionaire can be a source of some confusion. For example, of the category A functionaires currently occupying scientist or researcher positions in Cinzana and Mopti, only 2 and 1 respectively have advanced degrees and therefore the training usually required to provide leadership and oversight in a research program. The manner in which stations and programs compensate for this thinness of staff is important. If Cinzana's 2 B.S./I.T.A. "scientists" in fact manage to competently fill the "researcher" positions they occupy, then the Cinzana "Cost per scientist" and "Ratio scientists to technicians" estimates in the table are accurate. If they do not, but are rather used as technicians, then the cost per scientist would double, and the ratio of scientists to technicians change from 1:2 to 1:5.

4. Cinzana costs may include some costs of other programs since both physical caracteristcs and good station management attract trials from a broad array of other programs not integral to the stations' program.

5. ISNAR estimate of station non-personnel operating costs is based on actual operating costs of several IARC programs in Mali.

6. OVERALL CONCLUSIONS

   A. When budget resources are available, non-personnel operating costs may be quite similar for major stations regardless of location or NARS vs. IARC affiliation.

   B. By contrast, personnel costs vary considerably, with respect to both non-personnel operating costs (with the ratio varying from ISNAR's estimate of 1:1 to Mopti's 1988/89 budget proposal of 1:2) and to non-professional labor costs.

   C. The inclination of researchers unconstrained by budget (eg, the Mopti projections) is to increase scientific staff much faster than technical or non-technical support staff.

   D. None of the cost-per-scientist or cost-per-research year estimates include IER overhead costs:

Table C-12: Short-Term Training Costs, 1991 Calendar Year

	Dollars
Short Courses:	
Training fees ($1,100/week x 6 weeks)	6,600
Stipend/Per-diem (65/day x 30 days / $985/mo x .5 mo)	2,443
Round-trip airfare ($3,000)	3,000
Visas and Medical Exams	500
Books and Equipment	60
HAC Insurance ($63 x 2)	126
Total	$12,729
Seminars, Workshops and Professional Meetings:	
Training Fees ($1,100/week x 1 week)	1,100
Stipend/Per-diem (65/day x 6 days)	390
Round-trip airfare ($2,500)	2,500
Visas and Medical Exams	500
Books and Equipment	60
HAC Insurance ($63/mo)	63
Total	$4,613

TABLE C-13: GRM Operating Expense Contribution by Year

Projet PARA-IER

Contribution par an du Gouvernement du Mali au projet.

A n n é e

(en millier de FCFA)

ELEMENT	I	II	III	IV	V	VI	VII	TOTAL
I. Technical Assistance/ Assistance/ Technique	0	0	0	0	0	0	0	0
II. Construction/ Construction	60,000	25,000	30,000	30,000	25,000	30,000	20,000	220,000
III. Commodities/ Equipement	20,000	15,000	10,000	10,000	15,000	10,000	0	80,000
IV. Training/ Formation	0	0	0	0	0	0	0	0
V. Project Support Costs/Couts de Soutien au projet	0	0	0	0	0	0	0	0
VI. Audit/ Audit	0	0	0	0	0	0	0	0
VII. Evaluation Evaluation	0	0	0	0	0	0	0	0
VIII. Operating Expenses/ Fonctionnement	153,000	205,000	267,000	267,000	267,000	267,000	265,000	1,691,000
II. Contingencies/ Imprévus	0	0	0	0	0	0	0	0
TOTAL Project	233,000	245,000	307,000	307,000	307,000	307,000	285,000	1,991,000

ANNEX D

STATUTORY CHECKLIST

5C(2) - ASSISTANCE CHECKLIST

Listed below are statutory criteria applicable to the assistance resources themselves, rather than to the eligibility of a country to receive assistance. This section is divided into three parts. Part A includes criteria applicable to both Development Assistance and Economic Support Fund resources. Part B includes criteria applicable only to Development Assistance resources. Part C includes criteria applicable only to Economic Support Funds.

CROSS REFERENCE: IS COUNTRY CHECKLIST UP TO DATE?	Yes.

A. CRITERIA APPLICABLE TO BOTH DEVELOPMENT ASSISTANCE AND ECONOMIC SUPPORT FUNDS

1. **Host Country Development Efforts** (FAA Sec. 601(a)): Information and conclusions on whether assistance will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, 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.	(a) indirectly; (b) yes, in both agricultural production and marketing; (c) yes, for cooperatives and village associations; (d) SPARC encourages open competition within a free market structure; (e) yes, thru technology transfer and research (f) N/A.
2. **U.S. Private Trade and Investment** (FAA Sec. 601(b)): Information and conclusions on how assistance 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).	N/A. This is an agricultural research project.

3. Congressional Notification

a. General requirement (FY 1991 Appropriations Act Secs. 523 and 591; FAA Sec. 634A): If money is to be obligated for an activity not previously justified to Congress, or for an amount in excess of amount previously justified to Congress, has Congress been properly notified (unless the notification requirement has been waived because of substantial risk to human health or welfare)?	SPARC was justified to Congress in a Planned Program Summary in the FY 1992 Congressional Presentation (see page 333.)
b. Notice of new account obligation (FY 1991 Appropriations Act Sec. 514): If funds are being obligated under an appropriation account to which they were not appropriated, has the President consulted with and provided a written justification to the House and Senate Appropriations Committees and has such obligation been subject to regular notification procedures?	N/A
c. Cash transfers and nonproject sector assistance (FY 1991 Appropriations Act Sec. 575(b)(3)): If funds are to be made available in the form of cash transfer or nonproject sector assistance, has the Congressional notice included a detailed description of how the funds will be used, with a discussion of U.S. interests to be served and a description of any economic poolicy reforms to be promoted?	N/A
4. Engineering and Financial Plans (FAA Sec. 611(a)): Prior to an obligation in excess of $500,000, 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?	(a) Financial plans have been prepared; engineering plans are not necessary; (b) estimates have been prepared.
5. Legislative Action (FAA Sec. 611(a)(2)): If legislative action is required within recipient country with respect to an obligation in excess of $500,000, what is the basis for a reasonable expectation that such action	No further legislative action is required.

will be completed in time to permit orderly accomplishment of the purpose of the assistance?

6. Water Resources (FAA Sec. 611(b); FY 1991 Appropriations Act Sec. 501): If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)

N/A

7. Cash Transfer and Sector Assistance (FY 1991 Appropriations Act Sec. 575(b)): Will cash transfer or nonproject sector assistance be maintained in a separate account and not commingled with other funds (unless such requirements are waived by Congressional notice for nonproject sector assistance)?

N/A

8. Capital Assistance (FAA Sec. 611(e)): If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability to maintain and utilize the project effectively?

The total estimated construction budget for this project is $230,000.

9. Multiple Country Objectives (FAA Sec. 601(a)): Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, 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.

(a) indirectly; (b) yes, in both agricultural production and marketing; (c) yes, for cooperatives and village associations; (d) SPARC encourages open competition within a free market structure; (e) yes, through technology transfer and research; (f) N/A.

10. **U.S. Private Trade** (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).

N/A. This is an agricultural research project.

11. **Local Currencies**

a. **Recipient Contributions** (FAA Secs. 612(b), 636(h)): 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 host country contribution for contractual and other services is financed entirely by local currency (FCFA); the U.S. owns no other foreign currencies that can be used in lieu of U.S. dollars.

b. **U.S.-Owned Currency** (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?

The U.S. does not own any excess FCFA.

c. **Separate Account** (FY 1991 Appropriations Act Sec. 575). If assistance is furnished to a foreign government under arrangements which result in the generation of local currencies:

Assistance under this project will not result in the generatio of local currencies.

(1) Has A.I.D. (a) required that local currencies be deposited in a separate account established by the recipient government, (b) entered into an agreement with that government providing the amount of local currencies to be generated and the terms and conditions under which the currencies so deposited may be utilized, and (c) established by agreement the responsibilities of A.I.D. and that government to monitor and account for deposits into and disbursements from the separate account?

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(2) Will such local currencies, or an equivalent amount of local currencies, be used only to carry out the purposes of the DA or ESF chapters of the FAA (depending on which chapter is the source of the assistance) or for the administrative requirements of the United States Government?

(3) Has A.I.D. taken all appropriate steps to ensure that the equivalent of local currencies disbursed from the separate account are used for the agreed purposes?

(4) If assistance is terminated to a country, will any unencumbered balances of funds remaining in a separate account be disposed of for purposes agreed to by the recipient government and the United States Government?

12. Trade Restrictions

a. Surplus Commodities (FY 1991 Appropriations Act Sec. 521(a)): 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

b. Textiles (Lautenberg Amendment) (FY 1991 Appropriations Act Sec. 521(c)): Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of N/A

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textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel?

13. **Tropical Forests** (FY 1991 Appropriations Act Sec. 533(c)(3)): Will funds be used for any program, project or activity which would (a) result in any significant loss of tropical forests, or (b) involve industrial timber extraction in primary tropical forest areas? — No.

14. **PVO Assistance**

a. **Auditing and registration** (FY 1991 Appropriations Act Sec. 537): If assistance is being made available to a PVO, has that organization provided upon timely request any document, file, or record necessary to the auditing requirements of A.I.D., and is the PVO registered with A.I.D.? — N/A

b. **Funding sources** (FY 1991 Appropriations Act, Title II, under heading "Private and Voluntary Organizations"): If assistance is to be made to a United States PVO (other than a cooperative development organization), does it obtain at least 20 percent of its total annual funding for international activities from sources other than the United States Government? — N/A

15. **Project Agreement Documentation** (State Authorization Sec. 139 (as interpreted by conference report)): Has confirmation of the date of signing of the project agreement, including the amount involved, been cabled to State L/T and A.I.D. LEG within 60 days of the agreement's entry into force with respect to the United States, and has the full text of the agreement been pouched to those same offices? (See Handbook 3, Appendix 6G for agreements covered by this provision). — This information will be cabled upon signature of the project agreement.

16. Metric System (Omnibus Trade and Competitiveness Act of 1988 Sec. 5164, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance activity use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms?	Yes.
Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate?	Yes.
Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage?	Yes.
17. Women in Development (FY 1991 Appropriations Act, Title II, under heading "Women in Development"): Will assistance be designed so that the percentage of women participants will be demonstrably increased?	Yes. This is an integral feature of the SPARC Project.
18. Regional and Multilateral Assistance (FAA Sec. 209): Is assistance more efficiently and effectively provided through regional or multilateral organizations? If so, why is assistance not so provided? Information and conclusions on whether assistance will encourage developing countries to cooperate in regional development programs.	Assistance is not provided more effectively through regional or multilateral organizations. However, SPARC promotes a high level of cooperation and coordination among regional commodity networks and research institutes. as well as multilateral organizations involved in agricultural research and development activities.

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19. Abortions (FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 525):

a. Will assistance be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?

No.

b. Will any funds be used to lobby for abortion?

No.

20. Cooperatives (FAA Sec. 111): Will assistance help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life?

To some extent. More relevant in the Malian socio-economic contexts are village associations, many of which take on functions of traditional cooperatives.

21. U.S.-Owned Foreign Currencies

a. Use of currencies (FAA Secs. 612(b), 636(h); FY 1991 Appropriations Act Secs. 507, 509): Describe steps taken to assure that, to the maximum extent possible, foreign currencies owned by the U.S. are utilized in lieu of dollars to meet the cost of contractual and other services.

The U.S. owns no other foreign currencies that can be used in lieu of U.S. dollars to meet the cost of these services.

b. Release of currencies (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?

The U.S. does not own any excess FCFA.

22. Procurement

a. Small business (FAA Sec. 602(a)): Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?

Yes. They are part of the Title XII collaborative assistance contract.

b. U.S. procurement (FAA Sec. 604(a)): Will all procurement be from the U.S. except as otherwise determined by the President or determined under delegation from him?

Yes.

c. **Marine insurance** (FAA Sec. 604(d)): If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	N/A.
d. **Non-U.S. agricultural** procurement (FAA Sec. 604(e)): If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)	N/A
e. Construction or engineering services (FAA Sec. 604(g)): Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.)	The construction activities are largely rehabilitative and in all likelihood will procured from the host country.
f. Cargo preference shipping (FAA Sec. 603)): Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates?	No.
g. **Technical assistance** (FAA Sec. 621(a)): If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Will the	**Technical assistance will be procured through a Title XII Collaborative Assistance mode.**

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facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

h. **U.S. air carriers** (International Air Transportation Fair Competitive Practices Act, 1974): If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? — Yes.

i. Termination for convenience of U.S. Government (FY 1991 Appropriations Act Sec. 504): If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? — Yes.

j. Consulting services (FY 1991 Appropriations Act Sec. 524): If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? — Yes.

k. Metric conversion (Omnibus Trade and Competitiveness Act of 1988, as interpreted by conference report, amending Metric Conversion Act of 1975 Sec. 2, and as implemented through A.I.D. policy): Does the assistance program use the metric system of measurement in its procurements, grants, and other business-related activities, except to the extent that such use is impractical or is likely to cause significant inefficiencies or loss of markets to United States firms? — Yes.

Are bulk purchases usually to be made in metric, and are components, subassemblies, and semi-fabricated materials to be specified in metric units when economically available and technically adequate? Will A.I.D. specifications use metric units of measure from the earliest programmatic stages, and from the earliest — Yes.

documentation of the assistance processes (for example, project papers) involving quantifiable measurements (length, area, volume, capacity, mass and weight), through the implementation stage? Yes.

1. **Competitive Selection Procedures (FAA Sec. 601(e)):** Will the assistance utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes.

23. **Construction**

a. **Capital project (FAA Sec. 601(d)):** If capital (e.g., construction) project, will U.S. engineering and professional services be used? N/A

b. **Construction contract (FAA Sec. 611(c)):** If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? Yes.

c. **Large projects, Congressional approval (FAA Sec. 620(k)):** If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the Congressional Presentation), or does assistance have the express approval of Congress? N/A

24. **U.S. Audit Rights (FAA Sec. 301(d)):** If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? N/A

25. **Communist Assistance (FAA Sec. 620(h).** Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? Yes.

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26. Narcotics

a. Cash reimbursements (FAA Sec. 483): Will arrangements preclude use of financing to make reimbursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? N/A

b. Assistance to narcotics traffickers (FAA Sec. 487): Will arrangements take "all reasonable steps" to preclude use of financing to or through individuals or entities which we know or have reason to believe have either: (1) been convicted of a violation of any law or regulation of the United States or a foreign country relating to narcotics (or other controlled substances); or (2) been an illicit trafficker in, or otherwise involved in the illicit trafficking of, any such controlled substance? Yes.

27. Expropriation and Land Reform (FAA Sec. 620(g)): Will assistance preclude use of financing to compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? Yes.

28. Police and Prisons (FAA Sec. 660): Will assistance preclude use of financing to provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes.

29. CIA Activities (FAA Sec. 662): Will assistance preclude use of financing for CIA activities? Yes.

30. Motor Vehicles (FAA Sec. 636(i)): Will assistance preclude use of financing for purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? Yes.

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31. **Military Personnel** (FY 1991 Appropriations Act Sec. 503): Will assistance preclude use of financing to pay pensions, annuities, retirement pay, or adjusted service compensation for prior or current military personnel? — Yes.

32. **Payment of U.N. Assessments** (FY 1991 Appropriations Act Sec. 505): Will assistance preclude use of financing to pay U.N. assessments, arrearages or dues? — Yes.

33. **Multilateral Organization Lending** (FY 1991 Appropriations Act Sec. 506): Will assistance preclude use of financing to carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? — Yes.

34. **Export of Nuclear Resources** (FY 1991 Appropriations Act Sec. 510): Will assistance preclude use of financing to finance the export of nuclear equipment, fuel, or technology? — Yes.

35. **Repression of Population** (FY 1991 Appropriations Act Sec. 511): Will assistance preclude use of financing for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? — Yes.

36. **Publicity or Propoganda** (FY 1991 Appropriations Act Sec. 516): Will assistance be used for publicity or propaganda purposes designed to support or defeat legislation pending before Congress, to influence in any way the outcome of a political election in the United States, or for any publicity or propaganda purposes not authorized by Congress? — No.

37. **Marine Insurance** (FY 1991 Appropriations Act Sec. 563): Will any A.I.D. contract and solicitation, and subcontract entered into under such contract, include a clause requiring that U.S. marine insurance companies have a fair opportunity to bid for marine insurance when such insurance is necessary or appropriate?

Yes.

38. **Exchange for Prohibited Act** (FY 1991 Appropriations Act Sec. 569): Will any assistance be provided to any foreign government (including any instrumentality or agency thereof), foreign person, or United States person in exchange for that foreign government or person undertaking any action which is, if carried out by the United States Government, a United States official or employee, expressly prohibited by a provision of United States law?

No.

CRITERIA APPLICABLE TO DEVELOPMENT ASSISTANCE ONLY

1. **Agricultural Exports** (Bumpers Amendment) (FY 1991 Appropriations Act Sec. 521(b), as interpreted by conference report for original enactment): If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities: (1) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (2) in support of research that is intended primarily to benefit U.S. producers?

The agricultural research activities under SPARC, which are designed to increase production of cereals and certain leguminous crops, will be implemented within a framework of national food self sufficiency. The project does not anticipate export markets for these crops.

The SPARC research activities are targeted to localized ecological settings in the Sahel. They are designed to benefit Malian producers, not U.S. producers.

2. **Tied Aid Credits** (FY 1991 Appropriations Act, Title II, under heading "Economic Support Fund"): Will DA funds be used for tied aid credits?	No.
3. **Appropriate Technology** (FAA Sec. 107): Is special emphasis placed on use of appropriate technology (defined as 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. The technologies to be developed will be low-cost, appropriate technologies that will benefit small farmers and businesses.
4. **Indigenous Needs and Resources** (FAA Sec. 281(b)): Describe extent to which the activity recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	SPARC activities are geographic specific and designed to capitalize on the intellectual and productive capacity of the Mali people. These activities, whic were developed in collaboratior with the end-users/beneficiarie reflect particular needs and de sires of Mali's rural populatic Increased participation at the local level has fostered the democratization process.
5. **Economic Development** (FAA Sec. 101(a)): 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?	Yes. The sustainable developme of agricultural and natural resources is a key feature of thi project. The goal is to promot market-driven economic growth.
6. **Special Development Emphases** (FAA Secs. 102(b), 113, 281(a)): Describe 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, dispersing investment 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 appropriate U.S. institutions; (b) 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	SPARC will directly involve the rural poor in its activites -- they are the primary beneficiar ies of the research and technol gy transfer program. Care will be given to integrating them ir the station-farm network and us ing their feedback to improve t research program. USAID's success in assistaing cooperative village associations will be cc tinued under SPARC. Self-help activities will be further promoted, as will women's producti activities. Special attention will be given to integrating wc men's concerns at the technolog development and extension phase which will improve their partic pation and oversall status. Regional cooperation will be promoted through existing researcl commodity networks.

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and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

7. **Recipient Country Contribution** (FAA Secs. 110, 124(d)): Will the recipient country provide at least 25 percent of the costs of the program, project, or activity 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)?

Despite its status as an RLDC, Mali will provide at least 25% of the project costs for SPARC.

8. **Benefit to Poor Majority** (FAA Sec. 128(b)): If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?

SPARC is designed to increase the institutional capacity of the national agricultural research system through programs of research and technological transfer whose principal beneficiaries are Mali's rural poor majority. This will be closely monitored over the life of project.

9. Abortions (FAA Sec. 104(f); FY 1991 Appropriations Act, Title II, under heading "Population, DA," and Sec. 535):

a. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions?

No.

b. Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations?

No.

c. Are any of the funds to be made available to any organization or program which, as determined by the President, supports or participates in the management of a program of coercive abortion or involuntary sterilization?

No.

d. Will funds be made available only to voluntary family planning projects which offer, either directly or through referral to, or information about access to, a broad range of family planning methods and services?	N/A
e. In awarding grants for natural family planning, will any applicant be discriminated against because of such applicant's religious or conscientious commitment to offer only natural family planning?	N/A
f. Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?	No.
g. Are any of the funds to be made available to any organization if the President certifies that the use of these funds by such organization would violate any of the above provisions related to abortions and involuntary sterilization?	No.
10. Contract Awards (FAA Sec. 601(e)): Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
11. Disadvantaged Enterprises (FY 1991 Appropriations Act Sec. 567): What portion of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, colleges and universities having a student body in which more than 40 percent of the students are Hispanic Americans, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?	At least 10%, and possibly more, of all funds earmarked for the procurement of goods and services will be made available to disadvantaged enterprise HBCU's and minority-owned or controlled private voluntary organizations. This has already been integrated into the Title XII collaborative assistance proposal.

12. Biological Diversity (FAA Sec. 119(g): Will the assistance: (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas?

The GRM is committed to preserving Mali's bilogical diversity. SPARC activities are integrated into other natural resources management and wildlife preservation programs whicl will continue over the long-terr SPARC is not designed to support such surveys in other countries. The project will not engender any degradation of parks or protected areas nor will it introduce any exotic plants/animals.

13. Tropical Forests (FAA Sec. 118; FY 1991 Appropriations Act Sec. 533(c)-(e) & (g)):

a. A.I.D. Regulation 16: Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16?

Yes. See determination of "Categorical Exclusion" in the IEE.

b. Conservation: Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (1) stress the importance of conserving and sustainably managing forest resources; (2) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (3) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (4) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (5) help conserve forests which have not yet been degraded by helping to increase production on lands already cleared or degraded; (6) conserve forested watersheds and rehabilitate those which have been deforested; (7) support training, research, and other actions

The sustainable technologies developed under SPARC are grounded in improved natural resource management practices. Focus is on soils, water, plant: and trees. By focusing on more intensive technologies for agricultural production, there will be minimal if any encroachment on or damage to existing forest The implementing agency (IER) will work closely with forestry agents with a view toward improving farming practices and overall natural resource management. There is no slash-and-burn agriculture in Mali, altho there is an active campaign to control and in some areas prevent brush fires. In this respect there will likely be regeneration of forests on previously degraded lands -- a long-term effort which receives project support from USAID and other donors.

which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (8) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (9) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (10) seek to increase the awareness of U.S. Government agencies and other donors of the immediate and long-term value of tropical forests; (11) utilize the resources and abilities of all relevant U.S. government agencies; (12) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land; and (13) take full account of the environmental impacts of the proposed activities on biological diversity?

SPARC on-station and on-farm activities, which are linked to other farming systems and agro-forestry programs, will promote environmentally sound forestry practices. This research and application will prevent any further degradation and contribute to the identification and preservation of flora and fauna in need of protection. Though there exists already considerabl awareness among all donors on the value of forested areas, the project interventions will add to it. In this regard USAID will further coordinate with other U.S. G. agencies in Mali to promote conservation, specifically the Peace Corps and USIS. SPARC research is aimed at exploring alternative agricultural production techniques with a view toward identifying and diffusing the most productive and sustainable. For this purpose a detailed monitoring system will be put in place, one capable of assessing technology and environmental impact.

c. Forest degradation: Will assistance be used for: (1) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; (2) actions which will significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas; (3) activities which would result in the conversion of forest lands to the rearing of livestock; (4) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undergraded

No.

No.

No.

No.

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forest lands; (5) the colonization of forest lands; or (6) the construction of dams or other water control structures which flood relatively undergraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

No.

No.

d. Sustainable forestry: If assistance relates to tropical forests, will project assist countries in developing a systematic analysis of the appropriate use of their total tropical forest resources, with the goal of developing a national program for sustainable forestry?

SPARC activities are woven into a global framework of natural resources management, of which preservation and improvement of forest resources is a part.

e. Environmental impact statements: Will funds be made available in accordance with provisions of FAA Section 117(c) and applicable A.I.D. regulations requiring an environmental impact statement for activities significantly affecting the environment?

At present there is no expectation that SPARC activities will have any significant effect on the environment. These will monitored closely, however, with funds made available should an environmental assessment be necessary.

14. Energy (FY 1991 Appropriations Act Sec. 533(c)): If assistance relates to energy, will such assistance focus on: (a) end-use energy efficiency, least-cost energy planning, and renewable energy resources, and (b) the key countries where assistance would have the greatest impact on reducing emissions from greenhouse gases?

N/A

15. Sub-Saharan Africa Assistance (FY 1991 Appropriations Act Sec. 562, adding a new FAA chapter 10 (FAA Sec. 496)): If assistance will come from the Sub-Saharan Africa DA account, is it: (a) to be used to help the poor majority in Sub-Saharan Africa through a process of long-term development and economic growth that is equitable, participatory, environmentally sustainable, and self-reliant; (b) to be used to promote sustained economic growth, encourage

(a) Yes

(b) Yes

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private sector development, promote individual initiatives, and help to reduce the role of central governments in areas more appropriate for the private sector; (c) to be provided in a manner that takes into account, during the planning process, the local-level perspectives of the rural and urban poor, including women, through close consultation with African, United States and other PVOs that have demonstrated effectiveness in the promotion of local grassroots activities on behalf of long-term development in Sub-Saharan Africa; (d) to be implemented in a manner that requires local people, including women, to be closely consulted and involved, if the assistance has a local focus; (e) being used primarily to promote reform of critical sectoral economic policies, or to support the critical sector priorities of agricultural production and natural resources, health, voluntary family planning services, education, and income generating opportunities; and (f) to be provided in a manner that, if policy reforms are to be effected, contains provisions to protect vulnerable groups and the environment from possible negative consequences of the reforms?

(c) Yes

(d) Yes

(e) To promote the critical sectoral priorities of agricultural production and natural resources management, as well as income-generating opportunities.

(f) Yes. The monitoring system for this project, as well as that for our ongoing policy reform program, will monitor the effect of any policy reforms on Mali's more vulnerable groups.

16. Debt-for-Nature Exchange (FAA Sec. 463): If project will finance a debt-for-nature exchange, describe how the exchange will support protection of: (a) the world's oceans and atmosphere, (b) animal and plant species, and (c) parks and reserves; or describe how the exchange will promote: (d) natural resource management, (e) local conservation programs, (f) conservation training programs, (g) public commitment to conservation, (h) land and ecosystem management, and (i) regenerative approaches in farming, forestry, fishing, and watershed management.

N/A

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17. **Deobligation/Reobligation** (FY 1991 Appropriations Act Sec. 515): If deob/reob authority is sought to be exercised in the provision of DA assistance, are the funds being obligated for the same general purpose, and for countries within the same region as originally obligated, and have the House and Senate Appropriations Committees been properly notified?

Deob/Reob authority is not being sought under this project.

18. **Loans**

N/A

a. **Repayment capacity** (FAA Sec. 122(b)): Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest.

b. **Long-range plans** (FAA Sec. 122(b)): Does the activity give reasonable promise of assisting long-range plans and programs designed to develop economic resources and increase productive capacities?

c. **Interest rate** (FAA Sec. 122(b)): If development loan is repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter?

d. **Exports to United States** (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 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest?

19. **Development Objectives** (FAA Secs. 102(a), 111, 113, 281(a)): Extent to which activity will: (1) effectively involve the poor in development, by expanding access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from

SPARC, under the Title XII Collaborative Assistance Mode, focuses on improving productive agricultural technologies among Mali's rural poor. Through the continued use of appropriate and cost-efficient technologies, the project will expand access to the local econonmy as well as foster

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; (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (3) support the self-help efforts of developing countries; (4) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (5) utilize and encourage regional cooperation by developing countries?

opportunities for domestic sale and regional trade. USAID's continued success in assisting cooperative village associations will be integrated into SPARC, thus promoting local-level institution building and emergent democratic groups. Self-help activities will be further promote as will women's productive activities. Special attention will b given to incorporating women's concerns at the technology development and extension phases, to improve their participation and overall status. Regional cooperation will be promoted through existing research commodity networks.

20. Agriculture, Rural Development and Nutrition, and Agricultural Research (FAA Secs. 103 and 103A):

a. Rural poor and small farmers: If assistance is being made available for agriculture, rural development or nutrition, describe extent to which activity is specifically designed to increase productivity and income of rural poor; or if assistance is being made available for agricultural research, has account been taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made.

The technology packages develope under SPARC are geared to improv productivity in Mali's grain sector. Increased productivity will result in increaed production and overall incomes of rura households. Field testing for Mali's staple grains has been ongoing for 10 years, with extensive on-station testing in various agro-ecological zones. SPARC will further promote the on-station -- on-farm linkages.

b. Nutrition: Describe extent to which assistance is used in coordination with efforts carried out under FAA Section 104 (Population and Health) to help improve nutrition of the people of developing countries through encouragement of increased production of crops with greater nutritional value; improvement of planning, research, and education with respect to nutrition, particularly with reference to improvement and expanded use of indigenously produced foodstuffs; and the undertaking of pilot or demonstration programs explicitly addressing the problem of malnutrition of poor and vulnerable people.

Mali's grains have great nutritional value. An integral part of SPARC research is analysis of more nutritive processing techniques for sorghum and millet, which will ultimately benefit both grain producers and consumers. Such food technology improvements will be linked to other USAID programs that focus on maternal-child health through nutrition-education-communicatio activities.

c. **Food security:** Describe extent to which activity increases national food security by improving food policies and management and by strengthening national food reserves, with particular concern for the needs of the poor, through measures encouraging domestic production, building national food reserves, expanding available storage facilities, reducing post harvest food losses, and improving food distribution.

SPARC focuses on the food production aspects of food security. Other USAID programs, particularly the Cereals Market Reform Program and the Food and Agricultural Policy Support Project (688-0260), focus on policy and management reforms needed to ensure food security.

21. **Population and Health (FAA Secs. 104(b) and (c)):** If assistance is being made available for population or health activities, describe extent to which activity emphasizes low-cost, integrated delivery systems for health, nutrition and family planning for the poorest people, with particular attention to the needs of mothers and young children, using paramedical and auxiliary medical personnel, clinics and health posts, commercial distribution systems, and other modes of community outreach.

N/A

22. **Education and Human Resources Development (FAA Sec. 105):** If assistance is being made available for education, public administration, or human resource development, describe (a) extent to which activity strengthens nonformal education, makes formal education more relevant, especially for rural families and urban poor, and strengthens management capability of institutions enabling the poor to participate in development; and (b) extent to which assistance provides advanced education and training of people of developing countries in such disciplines as are required for planning and implementation of public and private development activities.

N/A

23. **Energy, Private Voluntary Organizations, and Selected Development Activities (FAA Sec. 106):** If assistance is being made available for energy, private voluntary organizations, and selected development problems, describe extent to which activity is:

a. concerned with data collection and analysis, the training of skilled personnel, research on and development of suitable energy sources, and pilot projects to test new methods of energy production; and facilitative of research on and development and use of small-scale, decentralized, renewable energy sources for rural areas, emphasizing development of energy resources which are environmentally acceptable and require minimum capital investment;	On-station and on-farm research will integrate renewable sources of energy in terms of testing nitrogen-fixing trees and crops, as well as green manure and composting.
b. concerned with technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;	The Title XII network, along with CRSPs and regional commodity networks, are the basis for technical cooperation and development.
c. research into, and evaluation of, economic development processes and techniques;	N/A
d. reconstruction after natural or manmade disaster and programs of disaster preparedness;	N/A
e. for special development problems, and to enable proper utilization of infrastructure and related projects funded with earlier U.S. assistance;	Infrastructure and commodities funded through previous and ongoing agricultural research projects will to a great extent be incorporated into the SPARC program.
f. for urban development, especially small, labor-intensive enterprises, marketing systems for small producers, and financial or other institutions to help urban poor participate in economic and social development.	N/A

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CRITERIA APPLICABLE TO ECONOMIC SUPPORT FUNDS ONLY — N/A

1. Economic and Political Stability (FAA Sec. 531(a)): Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?

2. Military Purposes (FAA Sec. 531(e)): Will this assistance be used for military or paramilitary purposes?

3. Commodity Grants/Separate Accounts (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? (For FY 1991, this provision is superseded by the separate account requirements of FY 1991 Appropriations Act Sec. 575(a), see Sec. 575(a)(5).)

4. Generation and Use of Local Currencies (FAA Sec. 531(d)): Will ESF funds made available for commodity import programs or other program assistance be used to generate local currencies? If so, will at least 50 percent of such local currencies be available to support activities consistent with the objectives of FAA sections 103 through 106? (For FY 1991, this provision is superseded by the separate account requirements of FY 1991 Appropriations Act Sec. 575(a), see Sec. 575(a)(5).)

5. Cash Transfer Requirements (FY 1991 Appropriations Act, Title II, under heading "Economic Support Fund," and Sec. 575(b)). If assistance is in the form of a cash transfer:

a. Separate account: Are all such cash payments to be maintained by the country in a separate account and not to be commingled with any other funds?

b. Local currencies: Will all local currencies that may be generated with funds provided as a cash transfer to such a country also be deposited in a special account, and has A.I.D. entered into an agreement with that government setting forth the amount of the local currencies to be generated, the terms and conditions under which they are to be used, and the responsibilities of A.I.D. and that government to monitor and account for deposits and disbursements?

c. U.S. Government use of local currencies: Will all such local currencies also be used in accordance with FAA Section 609, which requires such local currencies to be made available to the U.S. government as the U.S. determines necessary for the requirements of the U.S. Government, and which requires the remainder to be used for programs agreed to by the U.S. Government to carry out the purposes for which new funds authorized by the FAA would themselves be available?

d. Congressional notice: Has Congress received prior notification providing in detail how the funds will be used, including the U.S. interests that will be served by the assistance, and, as appropriate, the economic policy reforms that will be promoted by the cash transfer assistance?

DRAFTER:GC/LP:EHonnold:5/17/91:2169J

ANNEX E

GRM REQUEST FOR ASSISTANCE

REPUBLIQUE DU MALI
UN PEUPLE - UN BUT - UNE FOI

N° 0222 MA/CAB

Objet: Projet d'Appui à la Recherche Agronomique

Bamako, le - 6 MARS 1990 19

Le Ministre de l'Agriculture

ARSP C-2.1

A Monsieur le Directeur Général de l'US AID
-=- à Bamako -=-

3/09/90

DATE

ACTION

Monsieur le Directeur Général,

J'ai l'honneur de vous informer, par la présente, que des instructions ont été données à l'Institut d'Economie Rurale pour poursuivre l'identification et l'élaboration du Projet d'Appui à la Recherche Agronomique du Mali.

En effet, nous nous sommes engagés dans un exercice de restructuration et de planification à long terme de la recheche gronomique qui revêt une importance capitale pour notre système national de recherche agronomique. le Proje d'Appui à la Recherche Agronomique (PARA) de l'US AID s'inscrit parfaitement dans le cadre des priorités de ce plan à long terme de la recherche dont l'élaboration, avec la collaboration de l'ISNAR et de l'US AID, en est à sa phase finale.

Ce projet couvre non seulement divers domaines prioritaires inscrits dans le plan à long terme de la recherche agronomique, mais aussi se propose de fournir un appui institutionnel à la recherche agronomique tant dans le domaine de la formation et de l'information que dans celui de la gestion. Nous apprécions également le renforcement des recherches collaboratives avec les universités américaines que l'US AID a l'intention de promouvoir avec l'appui de ce projet.

En vous renouvelant toute ma gratitude pour l'appui constant que vous n'avez cessé d'apporter à la recherche agronomique malienne, je vous prie de croire, Monsieur le Directeur Général, l'assurance de ma très haute considération.

p/Le Ministre de l'Agriculture/po
Le Directeur de Cabinet

Cheick Bougadary Bathily

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ANNEX F-1

RESEARCH PLANNING, MANAGEMENT, MONITORING AND EVALUATION

Currently IER monitors and evaluates research activities through a centralized "Technical Commission". This commission is composed of all IER department heads and program leaders. The commission meets annually to review previous research results and determine the next year's research activities. Continuity over years is achieved through examination of annual commission reports and the budgeting process is only weakly linked to the planning process. Although this system has met some of the administrative needs of IER, there are significant gaps left unfilled by the current process.

In order fill these gaps and thus assist IER meet their objectives as expressed in the IER long term plan, an effective system of planning, monitoring, and evaluating research is essential. SPARC will assist and facilitate IER initiatives to: 1) Plan research 2) Develop research budgets 3) Develop and implement an effective system to track research activities over time and 4) Evaluate research. SPARC will work closely with the IER leaders as well as other key administrative personnel to coordinate and facilitate the technical and management assistance necessary to develop appropriate institutional policy and implementation systems during the first two years of project activity. Management systems will first concentrate on research activities funded by SPARC and eventually include other research activities as IER administration requests.

In order for the initiative to be successful, the SPARC project must act in complete collaboration with IER administrators, researchers, and related ISNAR initiatives. Over three years in the life of the SPARC project, an effective means for planning, monitoring, and evaluating research will be developed to supplement the current processes and to meet the needs of IER. The systems developed by IER under SPARC should also meet, to the extent possible, the needs of other IER donor institutions to avoid duplicative work effort.

SPARC will act as a catalyst to the IER process which is the engine behind the institutional strengthening and restructuring activities. As such, SPARC will facilitate IER initiatives through providing appropriate technical and financial input as into the process as requested by IER. Since the institutional restructuring activity is a process rather than a decree or mandate, the SPARC project should remain flexible at the offset and focus much of its effort in defining its role within the process during the first year.

A. Research Planning

Planning agricultural research is an extremely critical component of the research process. Slight deviations from good planning procedures result in large sums of money being spent over years for very few meaningful, impactful results. SPARC will work closely with IER administrators and researchers in those regions and programs to conceptualize and devise effective planning procedures. Paramount to SPARC activities in research planning will be to encourage the interdisciplinary research approach. SPARC will achieve this through working with "commodity research teams" rather than individual researchers as the basic research activity unit.

Currently, IER is in a state of change regarding their planning exercises. The former "Commission Technique" will be replaced pre-SPARC by another interim system. As a result, this paper can only provide some guidelines and possible activities in this area.

Some important criteria to framework an effective planning process include:

- Working directly with research teams throughout the process rather than individuals

- Short term TA to regional centers for short courses in research planning and budgeting
- Focusing team efforts on the "end-user" product of research rather than the process
- Encouraging and funding participation in planning exercises of appropriate extension personnel and industry, farmers, PVOs, etc.
- Involving all relevant research expertise in the planning process
- Encouraging and funding the participation of commodity CRSPs, IARCs, and other representative research organizations in the planning process either directly or indirectly through proposal reviews, etc.
- Other

B. Research Monitoring

The major objective of Research Monitoring System will be to provide IER administrators and researchers with the necessary research management tools for effective "decision-making" capability at all levels of research activity:

- Operational
- Programmatic
- Commodity
- Regional
- National

Upon achievement of this objective, the project aims to enhance the IER research planning and prioritization process to a level where research programs are improved, sustainable and better focused on their objectives and eventual impact. The system will also allow research leaders to better evaluate research operations over time.

1. Special Criteria of the System

In order to be truly effective, there are certain requirements or criteria that the M&E system must meet to adequately monitor program activities and impact:

- **The system should be simple and not overburden the researcher with meaningless paperwork:** Much of the information collected for the system will come directly from the researcher. It is therefore important that all M&E forms are well conceived with the researcher and the research process in mind rather than from a completely administrative perspective. The system should benefit the researcher as much as the administrator. This will best be achieved through researcher input into the development of the Monitoring system. A special committee including researchers should be formed to fine-tune the system over time.

- **The system should meet multidonor needs without duplication of effort:** The system should be flexible enough to supply all IER donors, i.e. CIDA, CIRAD, CRSPs, WB, etc., with their specific requirements. This criteria can be built-in from the beginning through interaction with relevant donors, determining their requirements. In this way the system reinforces donor confidence in an autonomous IER financial system.

- **The system should be linked to the research budget and planning process:** It is assumed that under new

the new IER structure, researchers will be responsible for their research budget. The system will therefore not make new demands upon the researcher, but will rather take advantage of the new financial structure. In order to meet this criteria, the basic unit to be tracked in the system will be the research operation and its corresponding cost. These "research costs" can be calculated by operation, weighed in light of the research result achieved and compared to other operations within and among programs by year and over years. A "tool" is therefore created through the system for better research planning and management.

- **The system should respond to the management needs of both the researcher and administrator:** Keeping in mind the need to minimize bureaucracy and red tape, the system must be able to provide broad, macro research program analyses tailored to facilitate research planning and administrative decisions. At the same time the system must provide the programmatic and operational analyses needed to facilitate research planning at a more micro but equally important the researcher level. To meet this criteria the system must be computerized in simple relational database languages like 'Db IV' or 'Alpha IV' driven by high powered micro computers.

- **The system should emphasize end-user response to technology and act as a vehicle for end-user feedback to the researcher:** Research must be demand driven if it is to be useful and effective. As such, the systen should attempt to provide a quantitative measure of the demand for a given research operation or theme. Researchers can then better focus and plan research operations. The system proposes to accomplish this by systematically monitoring and evaluating the demands of the end-user (farmer, industry, etc.). This will be discussed in more detail under the section on technology adoption.

- **The system should allow cost-benefit analyses to be performed on any single research operation/objective:** By tracking the cost of a research operation and by systematically evaluating user benefits, as discussed above, the system will allow the economics unit to perform valid cost-benefits for given research themes and programs. These ratios can then be used for resource allocation and research prioritization. However, this criteria will take time to meet since research must first be generated and extended to the end user, a process requiring more time that the SPARC LOP.

- **The system should ultimately provide a continually self-enhancing mechanism for research planning and prioritization:** As research activities are monitored and evaluated over time, changes in the direction and focus of research occurs. Since the system will be designed to provide decision makers with information on the process of research with ultimate accent on end-user impact, the process of research will become increasingly demand driven over time.

As stated above, the system will be developed in cooperation with the IER/USAID/ISNAR project. Clearly defined roles between SPARC and ISNAR efforts need to be established before SPARC project implementation. SPARC plans to focus efforts on a few priority research programs within three agricultural regions. The system will be pilot tested in these regions for the commodity programs covered under the project and then eventually cover other commodities and regions as IER prescribes.

2. A Monitoring Model with Some Initial Impact Indicators

IER is a research institute responsible for the development of technologies to alleviate priority constraints to production of agricultural commodities in Mali. As such, technology generation is a major activity of IER. However, technology development rarely involves a single eureka-type breakthrough, but rather a process encompassing many different stages of research, testing and fine-tuning. It therefore follows that in order to effectively monitor and evaluate research activity, research must be viewed as a process and monitored within discrete evolutionary stages of development.

A simplified generic diagram of the process is presented in figure F-1 (1).

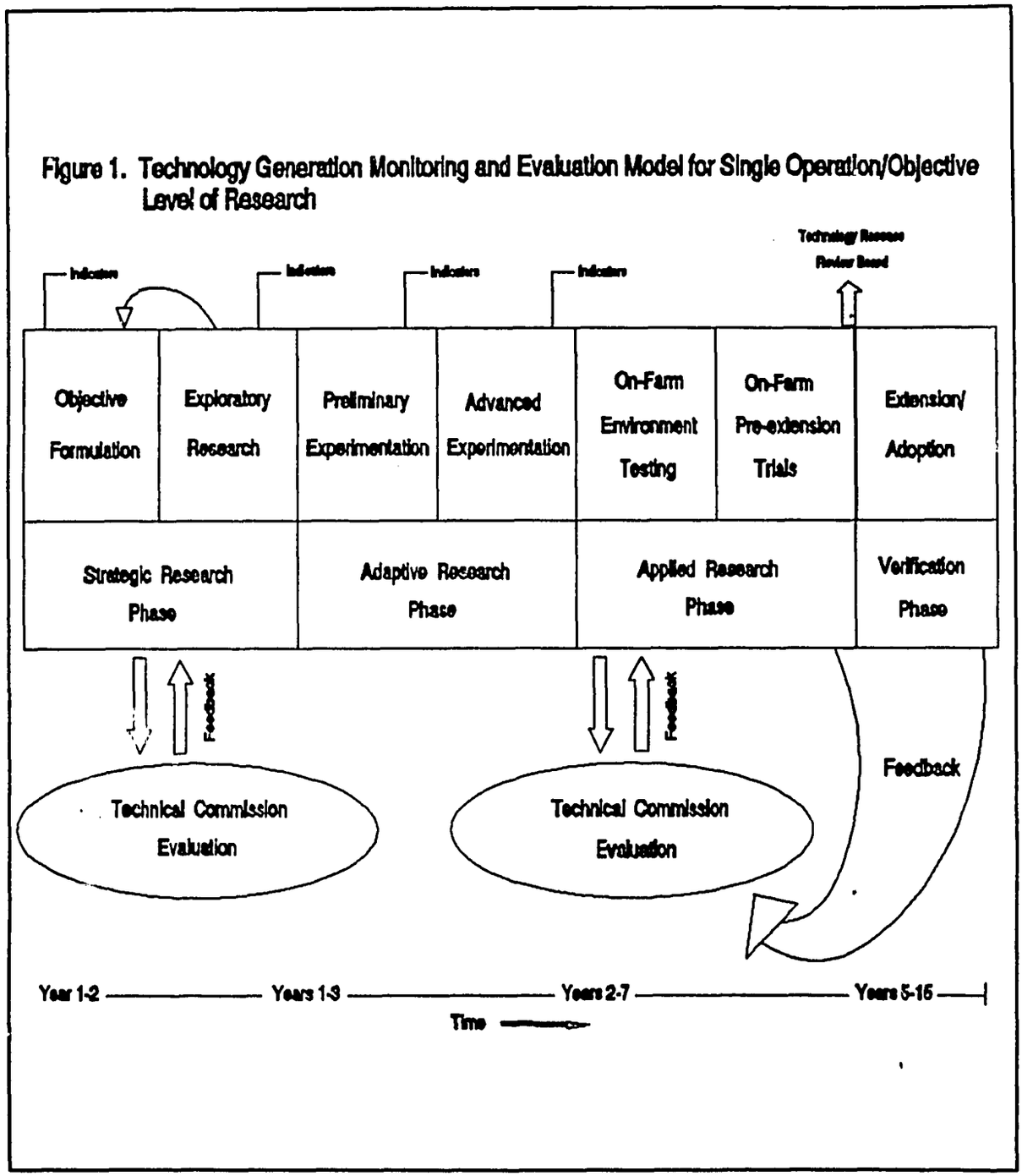

Figure 1. Technology Generation Monitoring and Evaluation Model for Single Operation/Objective Level of Research

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Throughout the process, an effective Monitoring system must be able to track the flow of activity occurring in each discrete phase through sets of indicators which reflect the quality, volume, rate, and probability of meeting the particular objective. Ultimately, research which is aimed at increasing yields or some aspect of farmer or end-user productivity, must be judged by measuring the increase in productivity and the adoption rate of the technology by the end user.

It is sometimes necessary to view monitoring as an integral component of evaluation. However, for practical reasons SPARC will consider the monitoring component apart from the evaluation component because the indicator variables for the monitoring of research are not necessarily correlated to a value judgement.

Indicator variables are listed below by technology generation phase as presented in the box chart above. These are suggested indicators and are by no way mutually exclusive or inclusive.

a. **Objective Formulation Phase**

This is the research planning stage of the process. As stated above, the basic monitoring unit is a research operation. A research operation is the lowest level of research activity which can be planned, conducted, an analyzed and a discrete, self-contained activity. Research operations should be able to be expressed by one major objective. An example might be "Screening for Headbug Resistance within a Local Germplasm Collection"; the operation requires a field, labor, bags, tags, etc. in order to produce a.result. A research proposal is prepared by the researcher by research operation for which there is a detailed budget. The proposal will contain the research objective, time framework for accomplishing objective and target performance criteria. An evaluation of the proposal will take place at both a regional level and national level (Technical Commissions). If the research passes these committees then the monitoring of the research may begin with the following indicators.

collaborators
collaborating institutions
end-user input?
literature review?
based on past work?
based on farming system recommendation?
others

b. **Exploratory Research Phase**

Usually an exploratory phase of research is proposed to begin the investigation of the objective proposed above. Research conducted in this phase is sometimes not replicated. Examples include crossing plants and evaluating segregates. Indicators may include:

crosses
technologies examined
other disciplines involved in observation
% time devoted to activity
size of experimental area and total experimental cost

c. **Preliminary experimentation**

This phase of research is usually conducted in laboratories or on experiment stations. It is characterized by maximum researcher control over environmental variability. Typical activities in this phase include preliminary yield trials, factorial agronomic experiments, pesticide dose studies, etc. Indicator variable might include:

trials
technologies (doses, varieties, etc.)
technologies significantly > control
mean level of improvement over control
locations
other disciplines involved in observation
% time devoted to activity
size of experimental area and total experimental cost

d. **Adaptive Experimentation**

This phase is characterized by fewer treatments and higher repetition. The emphasis is on "adapting" worthy technologies to the target agroeconomic and socioeconomic region. Experimental repetition in time and space therefore usually a trademark of this phase. Upon completing the experiment in time (usually 2-3 years) it is expected that one or more technologies may be deemed worthy for consideration for testing on-farm. A technical evaluation of the cumulative results performed by the regional technical commission should be conducted before the technology is advanced to the next stage of testing due to expense and extension interaction in the next phase. Indicators of activity may include:

trials
years
technologies (doses, varieties, etc.)
technologies significantly > control
mean level of improvement over control
locations
other disciplines involved in observation
% time devoted to activity
size of experimental area and total experimental cost
visits to sites

e. **On-Farm Testing**

Again, this phase emphasizes repeatability of the technology in time and space. However, in on-farm testing, control of environmental variability (soil, insects, pathogens) is reduced and the technologies are tested in farmer fields usually under management conditions suggested by the researcher. Management by researchers is intended to ensure careful monitoring and control of inputs and agronomic practices. Because input levels and agronomic practices are carefully controlled, the trials tend to show the response of the technology to environmental and climatic conditions. For certain technologies that dramatically alter labor requirements (tied-ridging, animal traction, etc.) data on input levels of labor will need to be collected.

trials
years
technologies (doses, varieties, etc.)
mean level of improvement over control
locations
other disciplines involved in observation
% time devoted to activity
size of experimental area and total experimental cost
visits to sites by researcher
field days organized

f. **Pre-Extension Phase of Testing**

This phase is characterized by continued testing of only the most promising one or two technologies to have emerged from the previous phase. The major difference between this and above is that here, the farmer manages the technology instead of the researcher. Selected farmers are provided with key inputs (improved seeds, fertilizer, etc.) and informed of agronomic practices to be informed, but should receive limited direction from the researcher. The farming systems team should implement the trials. Data are collected on input levels applied, timing of operations, yield response, taste preferences of family members in the household, the farmers views on the advantages and disadvantages of the technology, and the farmers subjective assessment of his or her willingness to continue with the technology the following year. Socio-economic surveys administered randomly to households in the on-farm site to determine constraints to technology adoption (see economics section), and opportunities for reshaping technology development. Demonstration trials are implemented for purposes of pre-extension.

trials
years
technologies (doses, varieties, etc.)
mean level of improvement over control
locations
other disciplines involved in observation
% time devoted to activity
size of experimental area and total experimental cost
visits to sites by researcher
field days organized

g. **Post-Extension Rate of Adoption Monitoring**

Unlike the economic assessment of agricultural research at the farm level, a rate of adoption study measures the economic benefits to agricultural research and diffusion. Economic benefits to SPARC will be heavily influenced by two factors: the increase in yields associated with new technologies generated under the project, and the extent of diffusion of the new technologies measured by area covered and speed of adoption. Technology diffusion is in part determined by the success of the research and extension programs, but also by the extent to which farmers spread technologies themselves.

On-farm studies of agricultural research prior to extension are generally not appropriate for assessing the rate of adoption
because farm inputs and extension advice are heavily subsidized by the research program, and results are biased by the involvement of researchers at the site of the on-farm research. Farming systems programs also typically suffer the disadvantage of collecting data very intensively for a limited number of villages. Technologies may thus be adopted in the immediate vicinity of the research program where the on-farm studies of adoption are taking place, while diffusion beyond is limited

The economic evaluation of rate of return to investment in agricultural research and extension must obtain an unbiased measure of both the increase in yield from technical change, and the area covered by new technology. Data on these variables are not currently collected at the regional level, although the FSR/E project has collected these data for the specific villages in which they are working. The implementation project will need to design a research methodology to collect and evaluate these data. An indicative research methodology is outlined below that could help meet the monitoring objectives of the project, and provide key information on the rate of technology adoption over a large survey area.

i. Sampling frame. The most recent population census from 1987 contains data on villages and population for each of the regional centers. A survey will be administered to a randomly selected group

of 200-400 households in a cluster of villages within a region.

ii. Survey Design. Two different options can be considered for selecting villages: (1) random selection of approximately 20-40 villages depending on population density in the region; or (2) stratify and pre-select villages according to factors known to influence rate of adoption:

a. Proximity to the station and/or on-farm research (villages nearer to or further from research sites) to assess the impacts of on-farm trials and extension services in technology diffusion.

b. Proximity to roads and markets (i.e. villages nearer to further from principal or secondary roads and/or markets) to evaluate the impact of marketing costs on the rate of technology adoption.

iii. Questionnaires. A one-round questionnaire would be administered to a random sample of 10 or so households within each village. The farming systems group will meet with technical scientists and extension agents to clearly define a list of technologies that have been promoted through on-farm research and through agricultural extension. This technologies will be included in a questionnaire, and questions included on:

- Whether or not the technology (or modified version) has been adopted by the farmer.
- If the technology has been adopted, how many years has the farmer been using it, on what types of land is it being used, on how much area (hectares or percent) is it being used, and about what level of yield increase is being experienced relative to previously used technology.
- If the technology has not been adopted, key questions will need to be asked on whether the farmer is aware of the technology, and if so why it is not being adopted.

iv. Scheduling. Some of these surveys can be undertaken January-March when other activities on the research station are at a lull. This study is intended to be carried out rapidly, using a combination of rapid appraisal techniques and short and focused surveys. However, due to human limited resources, it will probably not be possible to carry out surveys in every region in all years of the project. Surveys may thus need to be staggered every other year, for example: Sotuba and Mopti in 1992, 1994 and 1996; and Cinzana and Sikasso in 1993, 1995 and 1997.III. Management.

Ultimately, the indicators from this stage of evaluation will include:

% farmers/users adopting technology
estimated acreage under new technology
estimated level of improvement over replaced technology

As stated earlier, the list of indicators presented above represent only a sample of suggested indicators to be fine-tuned and streamlined as the process is iterated over time.

3. Implementation of the Research Monitoring System:

The above system of monitoring assumes a centralized database management system in the sense that all information originating from stations will be processed at the IER national level. As such, M&E data forms will be sent to all researchers at the time research budgets and workplans are requested. In the first and second year of project implementation, only those researchers participating in SPARC funded research will be required to complete the M&E accompanying forms.

The M&E data collection forms will be an extension of the budget and workplan form in the sense that the base unit of information retrieval will be the research operation, i.e. sub-program=sorghum breeding, operation=uniform regional variety tests for which there is a single major objective thus linking the system to the research process as outlined in figure 1. These forms will be sent to the IER Bamako unit responsible for M&E and will be entered into a well selected database program. Analyses will be generated for each level of research management. Other reports and analyses of data can be generated to provide a more comparative analysis of the information by program, department, etc. which will be most useful in determining budget allocation priorities. The Regional and National Technical Commissions will also desire special analyses and reports from the system. The more powerful decision-making capabilities of the system will be revealed over time.

4. Requirements of System

The proposed M&E system will require the following resources in the initial phases of implementation:

- High powered 386/486 computer with relevant and equal peripheral equipment
- State of the art database management and graphics software
- Laser printers
- Two full time data entry person

Funds should be made available for a short term training session to be conducted at each regional center for implicated researchers in year 1 and 2. These training sessions should be conducted in concert with those proposed in the budgeting and research planning workshops to be conducted.

C. Research Evaluation

Integral to the research process is an effective means of evaluating the performance of the research program per se. Similar to the planning process, IER is currently embarking on the development of an interim system which departs from the former "Commission Technique". This "first step" will be important to underpin further evaluation processes as the research progresses.

Evaluation of the research can take place through three processes:

1. Analysis of monitoring indicator variables over time

Some of the analyses for which the system is capable of generating are as follows:

Analysis	Management Level
Cost and Activity by Operation	Researcher
Cost by Operation	Researcher
Activity by area	Researcher
Cost and Activity by Theme	Researcher Program leader
Cost and Activity by sub-program	Program leader Director of Center Chief of Department

Cost and Activity by program	Program leader Director of Center Chief of Department

2. Technical Committee evaluation at key phases of the research process

- Annual Evaluation: Encouragement of interdisciplinary team approaches to research is an excellent means to critically evaluate research results internally. Team members might form evaluation procedures to ensure that all "team" documents, proposals, and research are as rigorously reviewed as possible before they are submitted for "higher" review.

- Bi- or Tri-Annual Evaluation: Formation of an external evaluation committees which include representatives outside IER. These committees might be formed and implemented at the regional level to increase the relevancy of research activities to the region. At a national level, representatives of extension, industry, farmers, IARCs, CRSPs, CIRAD, and NGOs are likely candidates for inclusion. Caution should be exercised to limit the size of the committees.

3. End user evaluation of research product through on-farm testing phases and adoption studies

These evaluations were described in detail in the above monitoring section. Reports from the various evaluation teams would be made available to the internal and external evaluation committees.

ANNEX F-2

INSTITUTIONAL ANALYSIS

This analysis deals with five principal institutional issues related to the design and implementation of the SPARC project. These issues are: (1) the organizations and agencies involved in the project and their role and capacity in carrying-out project activities; (2) the institutional context in which these organizations and agencies will interact concerning SPARC activities; (3) the institutional capabilities for undertaking the planning, management and research activities supported by the project; (4) the local, regional, national and international types of research and policy coordination and linkages relevant to successful project implementation; and, (5) the sustainability of project-related institutions beyond the life of the project.

The presentation of these issues is organized in three parts. Part I provides a description of the proposed, and soon-to-be-approved reorganization of the Rural Economy Institute and its implications for the implementation of the SPARC Project. Part II presents a preliminary review of several issues concerning various options for IER as an "independent" national agricultural research agency. Part III offers an overview of other major institutions and programs that are part of the Malian national agricultural research system (NARS). Project-supported opportunities for collaborative relationships with IER are discussed.

A. The Rural Economy Institute - Organization (Figure F-2(1))

Since 1987, the Rural Economy Institute, with assistance from the International Service for National Agricultural Research (ISNAR), has been assessing how to improve its organizational capacity to achieve the objectives of the Institute's long-term strategic research plan. Related to this long-term planning process, the government, in October 1990 (Décret 90-432/P-RM, 31 October 1990) approved the merger of the National Institute for Animal Science, Forestry and Water Resources Research (INRZFH) with the Rural Economy Institute. This included official endorsement of a new organizational structure for the expanded IER.

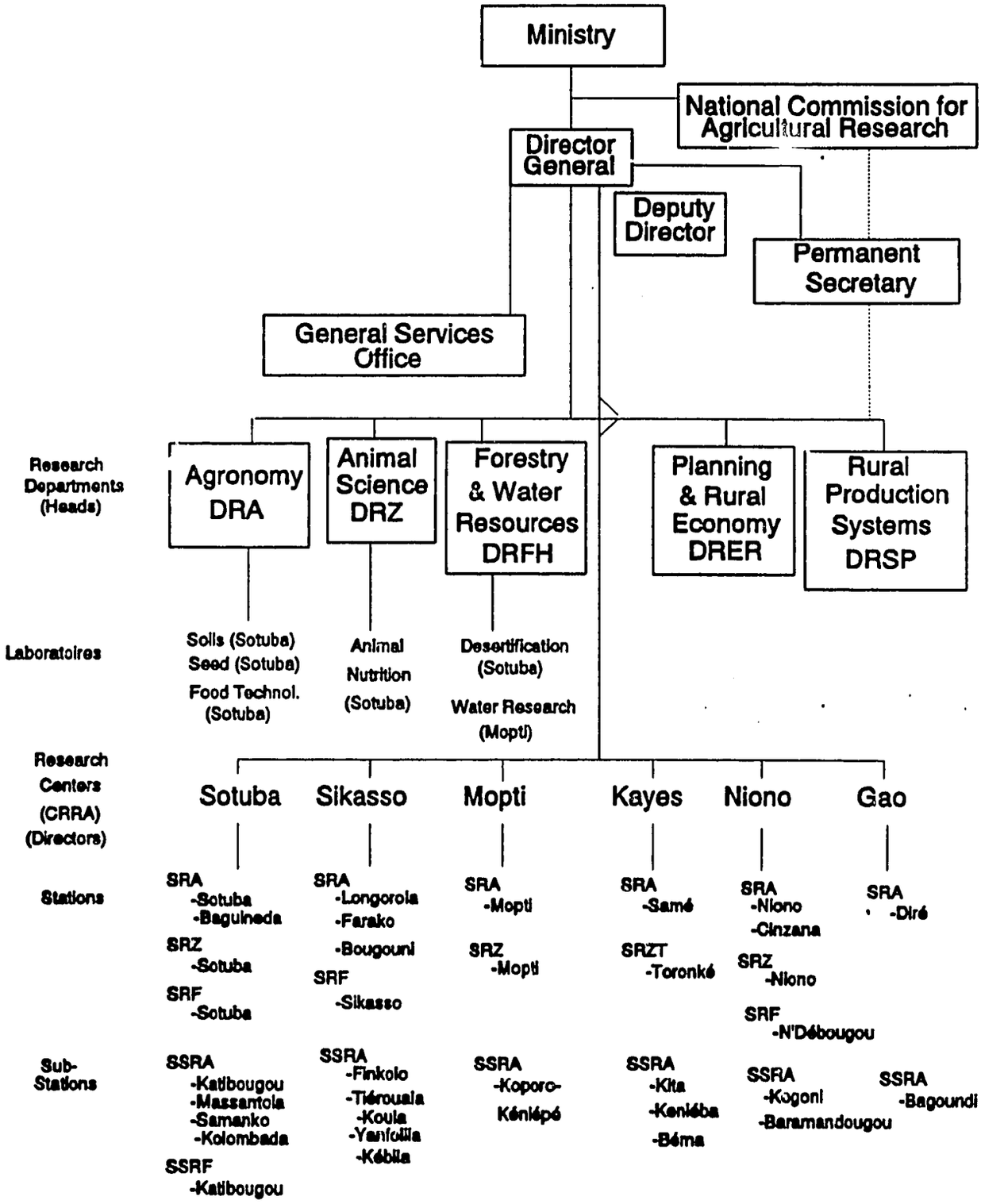
Three ministerial arrêtés which define this new structure are under legal review by the Prime Minister's Office. These texts are expected to be approved, prior to project authorization, without significant changes. As a result, the following discussion, which derives largely from these proposed arrêtés, is based on the assumption that these texts define the organization of the IER and can be used as the basis for identifying some of the most important institutional issues related to the successful implementation of the SPARC Project.

This part reviews the three principal organizational components related to IER research policy, planning, management and implementation: the National Committee for Agronomic Research (CNRA); the research and planning departments and management office; and, the new system of regional centers, stations, sub-stations and laboratories.

1. National Committee for Agronomic Research (C.N.R.A.)

The National Center for Scientific and Technical Research (CNRST) formally defines national scientific policy and holds scientific authority over all national research institutes. Within this

RURAL ECONOMY INSTITUTE
Proposed Organization Chart



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framework, the National Committee for Agronomic Research (Comité National de la Recherche Agronomique) formulates national agricultural research policy and strategy. The Committee's responsibilities include review and approval of: research program priorities and budgets, plans to extend research results and the establishment of institutional relations with national and international research agencies and with policy-makers. Under the direction of the IER Director General, the Permanent Secretary of the IER has responsibility to implement the decisions of the large, 20-plus member CNRA[1], which meets only once every three years.

The Committee's responsibility for the promotion and enhancement of IER's institutional relations with national agricultural development agencies and policy-makers presents an officially-endorsed rationale and unique opportunity for IER to seek out and establish closer links with development policy-makers, especially at the national level. The establishment and/or consolidation of such policy relationships might be the foundation of a national structure of demand and support for public agricultural research.

The Committee's obligation to monitor the Institute's research program is performed by two specialized technical commissions (Commission Technique Spécialisée "Resources" and "Scientifiques") which also only meet triennially. These commissions are assigned, respectively, to assess the adequacy of the Institute's human, financial and physical resources and to evaluate the implementation of the Institute's research program. The contribution of the Research Management Specialist, who will be assigned to the office of the Permanent Secretary under the project, to the design and use of a research monitoring and evaluation system, and a project-supported agreement with ISNAR to help IER implement a management information systems program should contribute directly to the work of these committees.

A National Program Committee, composed of senior national researchers and international researchers, meets annually to review the progress of all agricultural research programs and to define the Institute's annual plan of work and budget.

In addition, annual meetings of Regional Technical Committees (CTR) are intended to advise researchers on local research issues and needs and link agricultural research and rural development activities at the regional level. The committees will annually review the progress of the Institute's research programs in each region and will make recommendations concerning the Institute's annual (regionalized) research program[2].

These Regional Technical Committees should be a useful policy and planning mechanism for helping to implement the government's regionalized agricultural research policy. These committees should be able to play an important role in identifying regional research priorities and in assuring the responsiveness to IER programs to regionally-defined needs and interests. In particular, the committees should be an effective means for helping to reinforce agricultural research and extension (development) links. As such, these committees may become a relatively unique Malian contribution to the process of linking

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1 The CNRA includes one representative from the following: The Presidency, The Prime Minister's Office, the National Assembly, the Chamber of Commerce and Industry, the Director of the National Center for Scientific and Technical Research, the Director of the Rural Polytechnic Institute-Katibougou, the Director of the Institute for Training and Applied Research, the Director of the National Bank for Agricultural Development and the Order of Veterinarians. The Chamber of Agriculture has two seats on the Commission. Representatives are also invited from: each ministry concerned by rural development, each donor agency involved in agricultural research, the Directors of the National Extension Services and Agencies and the regional and international research agencies and institutes in Mali. In addition, the IER Deputy Director and the Heads of the Research Departments sit on the Commission, along with anyone nominated for their specific expertise by the President of the Commission.

2 In those regions with a Regional Agronomic Research Center, the membership of each Regional Technical Committee includes a Representative of the Governor's Office (President), a representative of the IER Director (Vice-President), the Director of the Regional Agronomic Research Center (Secretary), the Regional Development Committee, the Regional Chamber of Agriculture and the heads of the Research Programs.

agricultural research priorities and programs with local development needs and interests.

The involvement of both the Program Committee and the Regional Technical committees in research programming reflects the government's concern with balancing research program responsiveness to both regional and national agricultural research and development priorities. As a result, senior IER administrators will need to manage an on-going process which seeks to assure the responsiveness of research to regional needs within the context of nationally-defined scientific research programs. Regular seminars or short workshops which review the Institute's experiences may be a useful contribution to the planning process.

These regional committees might also offer an excellent forum for defining the research roles and relationships of IER departments, including the Farming Systems Department, and other regional agencies, (e.g. NGOs), in the research process from on-station trials through on-farm testing and extension. The experiences of these committees might also help to identify some research planning and management recommendations that could be of use to other national institutes in the Sahel.

With support from the SPARC Project, IER management may also wish to examine the creation of a senior, international scientific advisory panel for its contribution to sound research programming. If well-planned and organized, perhaps through the Permanent Secretary, an annual meetings of such a panel can help to improve the overall quality of the Institute's program.

2. Research and Planning Departments

The Rural Economy Institute includes five departments with heads (Chefs) who report directly to the Director General.

Four of the Departments, Agronomic Research (DRA), Animal Science (DRZ), Forestry and Water Research (DRFH) and Production Systems Research (DRSP)[3] share responsibility, in their respective scientific and technical domains, to: supervise the implementation of experiments and research; support the analysis and diffusion of research results; coordinate the activities in Mali of all regional and international agencies; and, protect the country's national scientific patrimony.

In addition, the DRA has specific responsibility to: supervise all scientific research on agricultural equipment; and, to regulate, monitor and certify all seed production in Mali. The DRZ manages research on cattle breeding, herd management and agropastoralism, and animal feed and nutrition. It also provides technical follow-up for all research in veterinary medicine and monitors the use of artificial insemination and animal feeds. The DRFH is responsible for all forestry, wildlife and environmental research. Finally, the DRSP has the mandate to develop methods for technology transfer, in addition to managing all production systems research programs.

A fifth Department, Planning and Rural Economy (DPER)[4], combines the former Departments of Planning and Evaluation and Technical Studies. Its research mandate is limited to sector and sub-sector studies of the rural economy. Its primary assignments involve feasibility and evaluation studies of agricultural development projects and programs, monitoring the implementation of development projects and reporting on the execution of the country's rural development and food strategy plans.

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[3] DRA: Département de la Recherche Agronomique; DRZ: Département de la Recherche Zootechnique; DRFH: Département de la Recherche Forestière et Hydrobiologique; DRSP: Département de la Recherche sur les Systèmes de Production.

[4] Département de la Planification et de l'Economie Rurale.

Several research laboratories are attached directly to the research departments. The DRA manages three laboratories: the Sotuba Soils Laboratory, a Seed Laboratory (primarily for seed certification and regulation) and the Food Technology Laboratory. The Animal Science Department is responsible for the Animal Nutrition Laboratory and the DRFH will direct the Sotuba Desertification Research Laboratory and the Mopti Water Research Laboratory.

The terms of reference for the Institute's departments raise important issues related to the Institute's overall mission. First, the Departments could be a means for assuring services, such as the scientific or professional development of department researchers. These staff are among the Institute's most important resources, and responsibility to assure their career development could be a clear and useful responsibility of the Research Departments[5].

Second, project feasibility and evaluation studies undertaken by IER economists and sociologists currently represent an important source of income for the Institute (see Table I.2). In the absence of financial support for other types of socio-economic research, such studies also provide IER economists and sociologists regular opportunities to practice their professional skills. The employment of some of the Institute's most senior social scientists in service and consultancy studies, however, can seriously compromise the contribution of these scientists to important development research activities. The short-term financial gains from planning and evaluation studies need to be weighed against the longer-term consequences of sacrificing the role of senior social scientists in agricultural research programs.

Third, the Agronomic and Animal Science Departments are responsible for several, purely regulatory activities. The time, personnel and financial resources allocated to these non-research functions raises the risk of detracting from support for research programs.

Moreover, at a time when tough decisions concerning the number and allocation of scientific research personnel will be made, the appropriateness of, and consequences for continuing these non-research and basic service activities within the Institute raises fundamental questions that could affect the sustainability and success of the IER and publically-supported agricultural research in Mali. Highly-trained and experienced research scientists might be more effectively deployed in research instead of regulation. It may be more appropriate to identify a separate office for these study and regulatory activities elsewhere in the Ministry of Agriculture, Livestock and Environment.

In addition to the departments, the IER headquarters includes a General Services Bureau. The Financial Office within this Bureau is responsible for the Institute's financial, equipment and personnel management. The Financial Management Specialist under the SPARC Project will be assigned to this office. A Documentation, Training and Information Office manages the Institute's documentation and publication activities, including the organization and monitoring of all IER personnel training. A Statistics and Computer Service provides biometric and computer services to the Institute's research departments and serves as an agricultural statistics reporting service within the Ministry of Agriculture, Livestock and Environment.[6]

These General Services Bureau responsibilities also raise serious questions concerning the Institute's mission. First, there is some measure of complementarity between agricultural research and agricultural statistics reporting. Nevertheless, the costs of trying to maintain a statistics reporting service might compromise the Institute's efforts to establish a solid, credible and sustainable research program. As

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5 The establishment of a separate office for all personnel training within the General Services Bureau has been proposed (see below).

6 The information and documentation activities were previously administered by the Documentation and Information Division (DDI). The former Planning and Evaluation Division (DPE) had responsibility for agricultural statistics.

noted above, such a non-research function might be more suitably located elsewhere in the Ministry. Second, the creation of a personnel training section within the General Services Office must be balanced by a means that assures the expression of professional scientific concerns with career development of research scientists. The proposed unit within the GSB office is the appropriate organizational unit for personnel management (salary, benefits, leave, etc.). Experiences in other Francophone West African countries suggest that such an administrative office alone is ineffective and inefficient in assuring the links between training for scientific research personnel, research program planning and implementation and the career development needs of research scientists and technicians. Such training must be designed and planned primarily by those responsible for the Institute's scientific program management.

3. Research Management: Programs, Centers and Stations

Research programs are a centerpiece of the IER's research management system. Each program is managed by a coordinator who will be located at that Regional Center from which it is most reasonable to carry-out a program's major research activities. There are two coordinators for food and oil seeds research, and one each for cash and horticultural crop research. Three program coordinators manage research on ruminants, non-ruminants and forage crops. Similarly, there are three program coordinators for land management, forestry and fisheries research. Each multidisciplinary rural production systems team is managed by a coordinator. Finally, two coordinators are responsible, respectively for studies and planning and for review and evaluation[7].

Regional Centers are the second major centerpiece of the IER's reorganized research management systeme. In 1988 a joint ISNAR-IER review mission recommended that regional centers be established as the principal mechanisms to regionalize IER research programs in each of the country's major agro-ecological regions[8]. As proposed, these centers would represent IER in each region and would bring together a critical mass of research scientists, or "Center Team," to address priority national and regional research questions. This "team" would be composed of specified commodity, animal and natural resources research program scientists; a multidisciplinary rural production systems team would also work out of each center in order to better understand specific regional agricultural problems and carry-out on-farm testing. Through the work of such a "team," IER also would be able to establish more effective and permanent relations with regional development programs, improve the implementation and lower the cost of its research activities.

Building upon this recommendation, the IER plans to establish six Regional Agronomic Research Centers

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[7]The programs include: **Cultures Vivrières et Oléagineuses** (millet, maize, sorghum, all rice, fonio, peanuts, cowpeas, soya, wheat, sesame and Bambara groundnuts); **Cultures Industrielles** (cotton, dah, sugar cane, tea and tobacco); **Cultures Horticoles** (fruits, vegetables and root crops); **Ruminants** (cattle, sheep and goats, camelins); **Non-Ruminants** (poultry, swine, donkeys, horses); **Ressources Fourragéres** (pastures and forage crops); **Gestion des Ressources Terrestres** (land resource inventory and ecological survey; desertification; wildlife and apiculture; agroforestry); **Productions Forestiéres** (forestry management; seed production; forestry technology); **Productions Halieutiques** (improvement of fisheries ecosystems); **Etudes et de la Planification** (coordination of planning for the rural sector; monitoring financial support and implementation of projects and programs; information concerning the implementation of rural development plans; feasibility studies for research and agricultural development studies); and **Suivi-Evaluation** (rural economy sector and sub-sector studies; development of monitoring methods for rural development projects and programs and for socio-economic research).

[8] ISNAR (1990). Analyse du Système National de Recherche Agronomique du Mali. Rapport au Ministère de l'Agriculture, République du Mali. January. ISNAR R46f. The Hague: ISNAR. This report is based on a joint ISNAR-IER review mission undertaken in February-March 1988.

(Centres Régionaux de Recherches Agronomiques, CRRA) in Kayes, Sotuba, Sikasso, Niono, Mopti and Gao. The Director of each Center will coordinate, lead, and in relationship with the appropriate research departments and the General Services Office, supervise all research activities and manage the resources for the research programs in the area covered by the Center.

The headquarters location of each program would be assigned according to an assessment of which station offered the best site for the optimal concentration of program activities and resources. Depending upon the importance of a particular commodity in a region, research program coordinators will assign multidisciplinary sub-program teams to a center. The specific project activities of these teams will be undertaken through the network of the Center's stations and sub-stations. Research will also be done directly with farmers and rural development agencies. Program activities based at other stations would collaborate with the headquarters station program, depending upon their importance in the national research program strategy.

4. SPARC Implementation: Research Organization and Management Issues

In its attempt to deal with the common dilemma in research organization and management between geographic decentralization or regionalization and program-based research planning and implementation, the proposed system, as presented in the arrêtés, clearly gives the regional centers the dominant role. The Center Director is bureaucratically superior to both Program and Department Heads (Chef)[9]. This means that IER senior management will need to assure that Program and Center interests are balanced.

The Center-based system for research organization and management clearly expresses the Institute's concern to regionalize its research activities. IER senior managers will need, however, to take steps to clarify and specify the separate and complementary responsibilities for research program management and financial and administrative management. Otherwise, the general nature of the administrative responsibilities accorded to Center Directors for program implementation may conflict with the Institute's efforts to implement a national, long-term research strategy.

Based on experience with similar research structures elsewhere in sub-Saharan Africa, IER managers should consider at least the following issues as they begin to clarify the shared responsibilities for research management between researchers, program coordinators, department heads, center directors and station managers.

First, research program priorities must drive the allocation of Center technical, and administrative services. In other words, ways need to be defined to protect the execution of research programs from non-program related administrative decisions that could delay or cancel research activities in order to meet administrative or financial requirements judged more important.

This type of "protection" for research programs is critical to the successful implementation of a program evaluation and monitoring system that permits the IER to track its progress toward achievement of its long-term strategic plan.

Finally, a personnel evaluation system needs to be defined that permits a review and evaluation of a scientist's performance independent of the individual's administrative relationship with a Center Director. An effective personnel evaluation system An administrative decision, taken without regard to its

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[9] A Center Director's responsibilities are like those of a "chef de service central" while those of the Department Head resemble the definition of a "chef de division." See Décret No. 204/PG-RM, Déliminant les modalités de gestion et de contrôle des structures des services publics. It may useful to clarify, however, if the method of appointment could be used to override the authorities identified in the job description. Department Heads are appointed by arrêté from the ministry, while Center Directors are appointed by décision from the ministry.

implications for the integrity of a research program, and which prevents a scientist from carrying-out a well-defined research activity, can compromise the basis of evaluation, and thereby the career, of the research scientist.

In sum, without clear and specific terms of reference that consider both scientific and administrative responsibilities in research management, administrative requirements can too easily take priority over scientific concerns.

The establishment of a new system of centers and stations also raises questions concerning financial sustainability. New management and administrative staff will need to be hired. As a result, it appears useful to begin an examination of how the Institute will bear the additional personnel, logistic and maintenance costs associated with the creation of regionalized Center system of research organization. The recommendation in a draft World Bank evaluation mission report to reduce the number of stations by discontinuing those identified as "departmental stations" appears to be a step in the right direction.

Support under the SPARC project for selected commodity research activities at some of the newly regionalized stations should also be a basis for addressing, in collaboration with the proposed World Bank project, some of the infrastructure needs at various stations.

The development of a two-track system of financial management which conceptually separates research program budgeting requirements from site (Center, Station and Sub-Station) administrative and operations will contribute to clarifying the scientific and administrative relationships in research program management and implementation. The new financial management system should be one way to assure the integrity of national research programs while assuring the gains from a decentralized organizational structure.

In other words the new administrative and financial system will be dealing with many of the following issues: who is accountable and at what organizational levels for the results of a research activity? What are the separate and related responsibilities between a researcher and a station manager? Where are, and what are the points of interdependence between research program implementation and station management? How are conflicts resolved within the system? Within a program and between researchers and station managers?

Table F-2 (1): Regional Centers and Stations

CRRA de Kayes	
SRA de Samé	Varietal improvement, agronomy and technical practices, and crop protection research for: peanuts, cowpeas, sesame, soya, sorghum, millet, irrigated rice, early season maize, and vegetable crops.
SRZT du Toronké	Breeding for cattle, goats, Toronké sheep and horses; pasture management and animal feeding; agroforestry, forestry management, desertification and forestry seed production.
SSRA de Kita	Trials for peanuts, sesame, soya, sorghum, maize, cowpeas and cotton.
SSRA de Kéniéba	Trials with mangoes and citrus fruits.
SSRA de Béma	Trials for sorghum, millet, cowpeas and peanuts.

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Table F-2 (1): Regional Centers and Stations	
CRRA de Sotuba	
SRA de Sotuba	Varietal improvement, agronomy and technical practices, and crop protection research for: sorghum, maize, millet, peanuts, cowpeas, sesame, soya, Bambara groundnuts (Voandzou) and fonio.
SRA de Banguineda	Varietal improvement, agronomy and technical practices, and crop protection research for: vegetable crops, fruits and tobacco.
SRZ de Sotuba	Introduction of new breeds, improved cattle, goat and sheep and poultry breeding; pasture management; forage crop research.
SRF de Sotuba	Forestry seed research, agroforestry, forestry management and technology and wildlife.
SSRA de Katibougou	Trials for sorghum, maize, peanuts, cowpeas, soya and cotton.
SSRA de Massantola	Trials for millet, peanuts, sorghum and cowpeas.
SSRA de Samanko	Trials for sorghum, peanuts, maize, millet, cotton, and cowpeas.
SSRA de Kolombada	Trials for cotton, sorghum, millet, peanuts, cowpeas and maize.
SSRF de Katibougou	Forestry seed technology.
CRRA de Sikasso	
SRA de Sikasso-Longorola	Varietal improvement, agronomy and cultural practices and crop protection for: rainfed and lowland rice, millet, sorghum, maize, peanuts, sesame, cowpeas and vegetable crops.
SRA de Farako	Varietal improvement, agronomy and cultural practices and crop protection for: fruit trees, pineapple and root crops.
SRA de N'Tarla	Varietal improvement, agronomy and cultural practices and crop protection for: cotton, dah, urène and for millet, sorghum, peanuts and maize.
SRF de Sikasso	Forestry management, agroforestry, forestry seed production and desertification.
SRA de Bougouni	Varietal improvement, agronomy and cultural practices, and crop protection for: cotton, dah, maize, sorghum, millet, cowpeas and peanuts.
SSRA de Finkolo	Varietal improvement, agronomy and cultural practices, and crop protection for tea.
SSRA de Tiérouala	Trials for cotton, sorghum, millet, cowpeas, peanuts and maize.
SSRA de Yanfolila	Trials with mangoes and citrus crops.
SSRA de Koula	Trials for cotton, sorghum, millet, maize, peanuts and cowpeas.
SSRA de Kébila	Trials for cotton, sorghum, millet, maize, cowpeas, dah and peanuts.

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ANNEX C

INITIAL ENVIRONMENTAL EXAMINATION

- Project location: Mali

- Project Title: Supporting Research Planning and Research on Commodities (SPARC)

- Project Number: 688-0250

- Funding: FY 92: 1.8; LOP: $18 million

- Life of Project: FY 92 - FY 98

- Determination prepared by: George R. Thompson, Mission Environmental Officer

- Threshold Decision Recommended: Categorical Exclusion

Project description: Agriculture is the dominant economic sector in Mali. One of the constraints to the ability of the agricultural sector to achieve its potential in providing food security, raising farmer incomes, and earning badly needed foreign exchange, is the low level of appropriate agricultural technologies. This project will assist Mali to establish an agriculture research system that can generate the technologies necessary to increase productivity and incomes. The project has three major objectives: to assist in developing a national agriculture research system administered and managed by Malians: to promote growth through agronomic and livestock research that generates additional export earnings; and to increase food security by continuing technical assistance in food grain research. Technical support helps to implement a national research strategy, manage the research institutions, and undertake applied research. Institutional capacity will be built by providing additional participant training and research equipment. Thus, the basic project qualifies for a categorical exclusion under Reg 16, Section 216.2(c)(2)(ii) "Controlled experimentation exclusively for the purpose of field evaluation confined to small areas and carefully monitored."

Insecticides: No pesticides will be procured under the project, and any assistance for the use of pesticides will be only for research and/or limited field evaluation purposes by or under the supervision of project personnel. This research and evaluation will be conducted within research and/or field stations as part of the normal work carried out in these stations. Project personnel will ensure that the manufacturers of the pesticides will provide toxicological and environmental data necessary to safeguard the health of research personnel, field labor, and the quality of the local environment in which the pesticides will be used.

In the future, perhaps during subsequent phases of this project, pest control techniques may be extended to outgrowing areas. In this case, the above manufacturer information, as well as any other pertinent information gathered by project personnel on efficacy and safety of individual formulations, will be used to prepare a risk/benefit analysis (as per Section 216.3 (b)(1)(i) of Reg16). The Mission Environmental Officer and/or project personnel can be guided in this process by the Regional Environmental Officer. Thus, the use of pesticides qualifies for an exclusion under the A.I.D. pesticide procedures (Section 216.3 (b)(2)(iii).

Recommendation: Based on the above discussion, a categorical exclusion is recommended, with the provision that if the project objective changes, or if project personnel decide to extend pest control technologies to areas outside the research/field stations, this IEE will be revised to include a risk/benefit evaluation as discussed above.

Concurrence: _____ Date: 8/2/90
Africa Bureau Environmental Officer
John J. Gaudet

Approved: ✓
Disapproved: _____
Date: 8/2/90

Clearance: AFR/GC CFM DATE 8/2/90

AFR/TR/ANR:JGaudet:7/17/90:JG:K:\data\nr\iee\jjgma101

Table F-2 (1): Regional Centers and Stations	
CRRA de Niono	
SRA de Niono	Varietal improvement, agronomy and cultural practices, and crop protection research for: irrigated rice, sugar cane, millet, sorghum, and fruit and vegetable crops.
SRA de Cinzana	Varietal improvement, agronomy and cultural practices, and crop protection for: millet, fonio, sorghum, cowpeas, Bambara groundnuts (Voandzou), peanuts, sesame, soya, root crops, forage crops, agroforestry and desertification.
SRZ de Niono	Breeding for cattle, goats and sheep; pasture management; forage crops.
SRF de N'Débougou	Forestry management, agroforestry, and forestry seed in irrigated areas.
SSRA de Kogoni	Trials for irrigated rice, millet, sorghum, maize, cotton, dah, cowpeas and forage crops.
SSRA de Baramandougou	Trials for millet, dah, cowpeas sorghum and peanuts.
CRRA de Mopti	
SRA de Mopti	Varietal improvement, agronomy and cultural practices, and crop protection for: floating and deep irrigated rice, sorghum, cowpeas and vegetable crops.
SRZ de Mopti	Sheep and goat breeding; re-establishment of herbages dégradés (bourgoutières); pasture management; forage crops; forestry seed; wildlife and desertification.
SSRA de Koporo-Kéniépé	Trials for millet, cowpeas, Bambara groundnut (Voandzou), sorghum, peanuts and fonio.
CRRA de Gao	
SRA de Diré	Varietal improvement, agronomy and cultural practices, and crop protection for: wheat, irrigated rice, flood recession sorghum, cowpeas and vegetable crops.
SRRA de Bagoundié	Trials for flood recession sorghum, rice and vegetable crops, plus improvement, agronomy, cultural practices and crop protection concerning date palms.

Table F-2 (2): Rural Economy Institute, External Funding by Department and Source, (CFA), 1989		
Agronomic Research		656.415.877
USAID	ICRISAT/Mali	108.577.802
	IER/TROPSOILS	4.093.708
	Cinzana Station	44.187.369
	Peanut CRSP	2.238.659
	Sorghum/Crop Protection	2.539.420
	Network-Sorghum-AFR-OCC	1.690.000
	Multilocal Trials	16.384.338
	INTSORMIL	17.100.000
CRDS	Vegetable Crops	12.045.504
CIBA-GEIGY		
Netherlands	Rice - Kogoni	62.801.464
	Soils Laboratory	37.017.871
EDF	Bas-Fonds - CEE	12.986.957
	Ahint-Hydrique	1.507.240
	Agrégation - Soils	4.500.224
	Cereals Technology	599.995
	ST/D2-SRCFJ	11.170.000
IMPHOS	IMPHOS	3.565.275
World Bank	Food Crops/CMDT	4.663.878
	Phosphate Program	5.183.377
	(w/ADB)-Mopti Reg. Dev.	27.328.421
	Mali-Sud, Cotton	188.343.916
France-Cooperation	Irrigated Rice	52.893.912
(FAC)	Soil/Water/Plant	18.847.386
	Maize - Network	345.755
	Rice - Network	400.000
	(with UNDP) Seed Multi/Diff	1.616.510
	Maize - Network	700.000
SAFGRAD	Striga - MRES	4.126.505
MRES	Pesticide Trials	1.332.679
FIRMES	IER - IFDC	16.628.512
IRDC		
Rural Production Systems		558.449.719
Netherlands	Fonsébougou	197.563.299
IDRC	Mali IV	14.696.450
USAID	FSR/E	344.889.700
FAO	Technology Transfer	1.300.000
Technical Studies		31.734.092
CANADA	Dioro Land Management	2.017.650
CTFT	Firewood Study	3.165.055
ACCORD	Agro Studies	2.352.000
CAPF	Socio-Economic Studies	3.349.500
CIBA-GEIGY	Cinzana	2.076.250
UNDP	Faguibine System	7.000.000
CDJT	CDJT - Touba	1.250.000
CMDT	Mali-Sud III	6.036.187
FIDA	Village Development Funds	4.487.450
Planning and Evaluation		150.371.482
EDF	CILSS-Permanent Diagnostic (w/DNA, OMBEVI, Livestock and DNS)	110.502.000
PRMC	Credit Impact Study	20.900.000
FIDA	Village Development Funds (Ségou)	18.969.482

B. Statutory "Independence" for the Rural Economy Institute: Options and Considerations

This part identifies some of the relevant features of the IER as a service within the Ministry of Agriculture, Livestock and Environment and briefly reviews some issues to be considered in evaluating the Institute's options as some type of independent government agency.

Government regulations in Mali require that all revenues earned by governmental agencies revert to the national treasury. For several years, these regulations have frustrated plans by IER managers to use the proceeds from revenue-generating research activities to help cover some of the Institute's operating costs. As a result, several IER researchers and managers feel that a change in the Institute's status to that of some type of independent governmental agency might be a more stable and reliable basis for mobilizing resources in support of research activities.

Recently renewed interest in the IER from the Special Programme for African Agricultural Research (SPAAR) has been a source of external encouragement for a review of the Institute's options as an independent government agency. The World Bank SPAAR selected the IER as the West African pilot country for its Initiative for the Sahel Program, "Revitalizing Agricultural Research in the Sahel, A Proposed Framework for Action."

In addition to encouraging more and sustainable external funding for African agricultural research, this Initiative seeks to:

- Establish Consolidated Funding Mechanisms (CFMs) through which all funding for research will be reviewed, coordinated and perhaps channeled;
- Improve national agricultural research by creating regional collaboration in which each national system specializes in its area of comparative advantage; and
- Improve the institutional capabilities of individual national systems based on principles of research accountability and relevance.

According to the World Bank, the proposed initiative to support improved research programming and implementation can only become operational in independent research institutions which are not tied to public accounting and management procedures of a government service.

In addition to revising its organizational structure, as discussed in Part I of this analysis, the IER is prepared to adopt some type of statute that would give it more operating and financial autonomy. Several options were discussed during a recent World Bank Agricultural Research Project Preparation Mission. A special consultant mission to review the juridical options available to the IER could be arranged as part of the World Bank's Pre-Project Financing.

The adoption of a new statute could affect the ability of the SPARC Project to strengthen the capacity of IER to develop and disseminate sustainable, productive and income-generating technologies for small farmers. A shift to a new statute might, for example, generate significant personnel shifts and/or very severe budgetary restrictions. Thus, it is useful to briefly identify some of the key issues which should be tracked during project implementation in order to assure that proposed, and perhaps preferred, institutional changes do not compromise the achievement of project objectives.

1. IER Status

The Rural Economy Institute is one type of Malian public service. As defined by Ordonnance No. 79-9/CMLN of 19 January 1979, the IER is a service attached directly to the Cabinet of the Ministry of Agriculture[10]. In contrast to a central service with a fixed organizational structure that is common to all central services of the government, the "attached" status gives the Institute the ability to define and adapt its organizational structure in order to carry out its special national mandate for agricultural research.

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10 Ordonnance No. 79-9/CMLN portant principes fondamentaux de la création, de l'organisation, de la gestion and du contrôle des services publics, 19 Janvier 1979.

This is the basis upon which it was relatively easy for the IER to adopt a new organization chart in 1990.

As a public service, the IER must conform to all civil service regulations and governmental financial management procedures. As an "attached" service, however, the IER can establish a parallel and independent budgeting system[11]. This stipulation allows for the use of cash advance and revolving fund mechanisms. This type of mechanism may be very useful in setting-up a prototype IER financial management system under the SPARC Project (see the Financial Management Analysis).

2. IER Options

The World Bank encourages the IER to seek some type of independent status within the government. The government's public service order (Ordonnance No. 79-9/CMLN) identifies the available options under the public service category of "organismes personnalisés." Public services within this category are administratively responsible to, but financially autonomous from, a Ministry. Three types of public establishments (établissements publics) are defined: administrative (EPA), industrial and commercial (EPIC), and professional (EPP)[12].

As part of its pre-project financing prior to project appraisal, the World Bank may finance a study of these options, and perhaps others, with attention to their implications for research management. Based on experiences in other Francophone countries, such a study must be extremely thorough and carefully undertaken. A review and constructive consideration of possible options demands the widest possible discussion within the Institute and with its principal partners.

If the decision is made for the IER to become a type of "organisme personnalisé," considerable time will be required for this decision to become legal. First, all such public services must be created by a separate law. Second, the organizational chart and internal operations must be approved by decret (décret) from the Council of Ministers. (This will also reduce the ease with which the Institute can modify its organization chart.)

As a type of public establishment, the Institute would be able to set its own staff recruitment criteria[13]. In contrast to the current civil service procedures, the ability to recruit will give the Institute an important means to assure the professional qualifications of its personnel. Experience in other Francophone countries, however, suggests that the stipulated 6-month "trial period" for newly recruited researchers should be extended to one year. This would permit new researchers to carry-out (barely) a full year of research and reduce the paperwork, time and disrupted salary payments associated with the request for a one-time, six-month extension. (It should be noted that such an extended trial period also

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11 Decret No. 204/PG-RM, Déliminant les modalités de gestion et de contrôle des structures des services publics, Sect. 3, Article 11: "Les services rattachés peuvent être dotés, en raison des exigences et de la specificité de leur mission, d'un regime de fonctionnement comportant, selon le cas, une régie d'avance, un compte d'affectation spéciale ou un budget annexe."

12 EPA: "dont la mission et les modalités de gestion sont voisines de celles d'un Service public administratif non personnalisé de l'Etat." EPIC: "dont la mission marquée par une activité de production ou d'échange, la mode de gestion et les rapports avec les tiers sont analogues à ceux des Entreprises privées comparables." EPP: "chargés de l'organization et de la représentation d'une profession ou d'un groupe de profession."

Some of the relevant texts include: Loi No. 91-051/AN-RM Portant statut général des Etablissements Publics à Caractère Industriel et Commercial, 26 Février 1991; Ordonnance No. 91-014/P-CTSP Fixant les principes fondamentaux de l'organisation et de fonctionnement des Etablissements Publics à Caractère Industriel et Commercial et des Sociétés d'Etat, 28 Mai 1991; Loi No. 90-110/AN-RM Portant principes fondamentaux de la création, de l'organisation et du fonctionnement des Etablissements Publics à Caractère Administratif, 18 Octobre 1990.

13 See Loi No. 85-89/AN-RM Abrogeant et remplaçant la Loi No. 81-10/AN-RM du 3 Mars 1981 portant Statut du Personnel des Sociétés et Entreprises d'Etat et du Personnel Malien des Sociétés d'Economie Mixte, 1 Novembre 1989.

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keeps a new recruit on a lower salary scale for a longer period of time.)

If the Institute elects an EPIC statute, this apparently will have two very significant implications for IER. First, as an independent and commercial-type agency, the IER, without any government budget support, would have to cover the salaries of all employees. Second, in order to work for the IER all employees would be on contract (conventionnaires) to the Institute. Other cases in Mali suggest that similar changes have led to a considerable loss of sometimes the best staff. Many staff are more interested in steady, albeit low, rather than high but very uncertain salaries[14].

The pay scales within a public establishment are fixed by decret by the Council of Ministers. The Institute would be able, however, to define its own promotion and advancement system. This would give the IER the required flexibility to establish a system of professional advancement based upon scientific accomplishment. It will still be necessary, however, for Institute researchers, and their colleagues holding comparable positions in Malian institutions of higher education, to seek approval of a "Statut de Chercheur." As the 1990 ISNAR analysis of the Malian agricultural research system noted, researchers are not covered by a special statute. They are classified as civil servants for whom evaluation and advancement follows that of others in their Ministry.

A 1986 decret (Décret No. 68/PG-RM) authorizes a system of salary bonuses and confers the status of researcher to those in the civil service category A with a doctoral degree or its equivalent. As the ISNAR report notes, however, the regulation does not deal with recruitment, evaluation or career development criteria, nor its applicability to those in higher education.

In sum, it will take more than moving toward a public establishment in order to assure and sustain the scientific capacity of the Institute.

The issue of the financial sustainability of agricultural research in Mali, and of the IER, is a central to the review of IER's status as an "independent" government agency. In addition to the support expected from the World Bank to review some of the statutory options for the IER, the SPARC project in particular might be able to help IER managers examine various options to achieve a greater measure of financial sustainability.

Project funds could be used to help IER examine how other national research institutes in Francophone West Africa have sought to generate some operating funds through the assessment of overhead or indirect costs on research projects. For example, the head of the General Services Bureau could probably gain some useful insights by examining the type of indirect cost system which the Senegal National Agricultural Institute (ISRA) is trying to implement.

In addition, a full-scale evaluation of other options might be useful: would other foundations, as Ciba-Geigy has done, be interested in providing specific support for specific stations or programs? what possibilities exist for generating some funds from the export of agricultural commodities? could an endowment be launched with the use of food aid-generated local currency? Short-term technical assistance under the project, in collaboration with a senior IER manager, could help clarify these questions, and others, related to the issue of financial sustainability.

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14 The relevant texts need to be confirmed, as do the appropriate texts concerning an EPA or an EPP.

C. Mali's National Agricultural Research System

According to the ISNAR 1990 Analysis of Mali's national agricultural research system[15], Malian agricultural scientists comprise one of the largest national agricultural research systems in Francophone sub-Saharan Africa. With over 130 national researchers, the Rural Economy Institute is clearly the most significant national research organization in Mali.

This part briefly discusses current research activities and interests in five additional national organizations. Some of these organizations may offer opportunities for collaborative research programs with the Rural Economy Institute that would enhance the achievement of the objectives of the SPARC Project. In addition, selected external partner relationships that contribute to the achievement of the SPARC Project objectives are described.

1. National Institutions

a. Rural Polytechnic Institute-Katibougou (IPR)

The IPR-Katibougou is the country's only post-secondary and university-level institution for agricultural education. Consequently, collaborative IER-IPR research relationships may offer the most direct, and sustainable, opportunities to strengthen the Malian national agricultural research system, and thereby contribute to the achievement of the long-term objectives of the SPARC Project.
At least five IPR faculty members direct research programs that are financed by either a rural development organization (ODR) or an external scientific or donor agency. Current research includes: sorghum breeding, soil fertilization, soils classification, biogas (from harvest by-products), and vegetable crop entomology. In addition, one faculty member directs an action-research program financed by the Food Corps International Liaison Committee (CILCA).

Most IPR faculty maintain regular, professional contact with IER colleagues who manage similar research programs. They also see their IER contacts, given IER's national research mandate, as an effective means through which to establish more direct contact between their IPR research activities and the programs of the country's rural development organizations. At the same time, some faculty also feel that the status of the IPR as a national institution of higher education gives them more opportunities, and more of a mandate than the IER, to concentrate on "upstream" or non-applied research topics.

Several institutional mechanisms that link IPR and IER research scientists and the missions of the two institutes are already in place. The Director General of IER sits as the Vice President on the IPR Advisory Council (Conseil de Perfectionnement). Each year several fifth-year IPR students spend their thesis (memoire) year in an IER research program, and IER research scientists are regularly invited as visiting faculty (vacataires) and as members of thesis examination committees (jury de soutenance). Moreover, the IER, and other research agencies such as ICRISAT, maintain experimental plots at the IPR.

IPR faculty are encouraged to engage in externally funded research activities and they have full administrative and financial responsibility, autonomous from the IPR administration, to manage their research programs. As a result, the establishment of collaborative IER-IPR research programs can be negotiated directly with IPR faculty and could be formalized by a memorandum of understanding between the IER and IPR Directors.

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15 ISNAR (1990). Analyse du Système National de Recherche Agronomique du Mali. Rapport au Minstère de l'Agriculture, République du Mali. ISNAR R46f. The Hague: ISNAR.

The sorghum, millet and cowpea teams supported under the project should be encouraged to take a first step toward the establishment of closer IER-IPR relationships. For example, part of the operating costs allocated to each team could be earmarked to support selected on-station work at Katibougou that would be designed specifically to complement a teaching program while also meeting the needs of the IER research program.

Such an arrangement presents several opportunities for building closer research-education links in Mali. IPR faculty would be responsible for part of a research protocol and jointly author any report of research results. A regular program of on-station trials, and perhaps eventually multi-locational work, offers IPR faculty a regular basis upon which to build participation in on-going national research programs and national researchers into their course offerings. Such involvement could be the foundation upon which IER scientists and IPR faculty play a key role in refashioning higher agricultural education in Mali.

b. **Agricultural Equipment Division, Ministry of Agriculture (Machinisme Agricole)**

As a service division within the National Office of Rural Engineering, the Agricultural Equipment Division is responsible for testing, experimentation and the promotion of improved agricultural equipment and related technology. The Division does not engage in research per se, but instead has undertaken prototype development and testing for the Malian agricultural equipment industry and for several rural development organizations.

At the request of some NGOs, the Division has done some work on the development of improved food processing equipment, such as shea nut (karité) presses and with the equipment needed to produce biogas from crop residues.

During the discussions which have led to the reorganization of IER, the Agricultural Equipment Division, arguing that it was primarily an applied research unit, requested incorporation into the Institute. Such an institutional change would presumably make better use of its skills and experience and offer its technicians more opportunities to contribute to research-development programs.

Aside from any financial implications, the incorporation of the principal technical staff from such a unit into the IER would probably require the creation of separate cellule or unit within the Agronomic Research Department, or elsewhere in the Institute. Such units exist in other agricultural research institutes in Francophone sub-Saharan Africa.

If IER managers wanted to pursue this question, a key issue would involve the identification of research activities for agricultural equipment and the effective integration of these activities and staff into multi-disciplinary commodity programs.

2. **Other Institutions**

The establishment of some type of collaboration or regular exchange with programs in two sections within the National Public Health Research Institute (INSP) warrant further inquiry during project implementation. The Toxicology Section is currently undertaking some contract research for the CMDT on the use of agricultural pesticides in the Sikasso region. This work may be relevant to some of the project-supported research in that region. This work might also complement similar USAID-supported programs with the Crop Protection Service.

On-going work in the INSP Nutrition Section may be complementary to project activities with the Food Technology Institute.

The IER has had collaborative research programs on nitrogen fixation (azolla) with faculty at the National Teachers Training School (ENSup). Renewed contact with interested faculty might be the basis for the development of longer-term, mutually complementary relations between agricultural research and higher education in Mali. On the same grounds, it may useful, as well, during project implementation, to explore new opportunities with the Applied Research Training School (ISFRA).

3. International and Regional Programs

Several IER scientists have been actively involved for many years in a variety of research activities supported by international and regional programs. The establishment of the Institute's research monitoring system, supported by the project, should help to track more systematically the contribution of these activities to the IER's on-going, long-term strategic planning process.

IER socio-economists and crop scientists participate in regional research programs coordinated by the Sahel Institute (INSAH). At least two IER researchers are part of the INSAH regional food security network, and the INSAH Socio-Economics Program will be funding a special study of food security policy in Mali by IER.

For several years, INSAH-coordinated crop production programs, R3S and Regional Cereals Improvement, have supported specific IER research activities and involved IER scientists in regional networking for several years.

Financial support for research with the SAFGRAD Regional Sorghum and Millet, Cowpea and Maize Networks, which involve IER scientists, has been extended through the middle of 1992. Participation in the regional trails sponsored by these networks has fostered the professional growth and performance of national researchers and technicians. In addition, technologies developed as part of Mali's national program have passed into the SAFGRAD regional trials and thereby "spilled-over" for use by scientists in neighboring countries. A 12 month impact study of SAFGRAD research is under consideration and, if approved, would be a means for IER scientists to maintain some of their regional contacts.

With a grant from the Ford Foundation, the ICRISAT-Mali Program was established in 1976 to develop the national capacity for sorghum and pearl millet research and to conduct long-term research on their cropping systems. With financial support from USAID/Mali the program was continued through mid-1991. Research was carried out at Sotuba and Cinzana, with multi-local trials at Samanko, Béma, N'Tarla, Massantola and Koporo-Kéniépé. (This research, in part, is the basis for some of the continued program support under the SPARC project.)

The ICRISAT West African Sorghum Improvement Program (WASIP/Mali) is based at Samanko and aims at improving sorghum production in the Sudano-Guinean and Guinean zones. Both CIRAD/IRAT and ICRISAT provide scientific personnel and funding for this program. A Pearl Millet breeding activity, managed through the ICRISAT Sahelian Center in Niamey, is attached to the WASIP/Mali program.

Even though these programs are conceived separately from the IER national program, the IER millet and sorghum teams should be requested annually to evaluate the contribution and/or relationship of international center research to their long-run research objectives.

ILCA has supported animal production and pastoral systems studies in Mali since 1976. Consistent with its new orientation in the subhumid zones, the current ILCA program focuses on peri-urban dairy production systems. A joint ILCA-IER proposal to examine village, communal corral and private dairy production has been prepared.

ORSTOM has conducted research in Mali for many years, but its orientation towards basic research, including a narrowly defined area of fisheries, does not offer useful opportunities for collaborative work with IER at this time.

Several **Collaborative Research Support Programs (CRSPs)**, and especially INTSORMIL and TropSoils have supported research activities and trained IER researchers for several years. Continued support from the CRSPs will continue to be an important part of the annual program planning for the commodity programs supported by the project. It is expected, as well, that some of the long-term training in the U.S. will be supervised by CRSP scientists.

Mali benefits from a fairly large (over 130 national NGOs), active and fairly well-organized NGO Community, in which many members concentrate on action-research village land management (aménagement de terroir) programs. These NGOs vary from village-based associations to national organizations operating independently or in partnership with other local or international NGOs.

The AID/Washington Natural Resources Management Support Project (NRMS) has been helping to strengthen the management capacity of national NGOs for natural resource management programs since early 1990.

Malian NGOs can offer original insights into the needs of rural communities and their presence at the local level might offer unique opportunities to help implement the IER regionalization policy directly in the villages. NGOs in Mali and throughout the West African sub-region have been long recognized as effective social change agents and for their role in testing new techniques and technologies.

It would be useful for the commodity programs supported under the SPARC Project to explore how their research activities could be enhanced by collaboration with the NGO community. This might be most effectively accomplished through the Regional Technical Committees. Representatives from the regional NGO community could be invited to participate in committee planning meetings. More specifically, each team might review the activities of regional NGOs in order to assess how they might complement research programs and/or play a more direct role in the research process at the stage of multi-locational trials and on-farm testing. Finally, if USAID/Bamako approves, the new Sustainable Agriculture CRSP, which is in the planning stages, might offer a more systematic framework in which to link IER research, training and collaboration with the Malian NGO community.

Table F-2 (3): Rural Economy Institute, Principal Cooperating Agencies, by Area of Support, 1989[2]	
Technical Studies	
NORAGRIC - Norway	Socioeconomic studies, Bafoulabé
CCCE	Socioeconomic studies of land management, Bafoulabé
CIBA-GEIGY	Socioeconomic studies around Cinzana
IFAD	Socioeconomic studies, Kidal; Village Development Fund; Ségou
CTFT (CIRAD)	Socioeconomic study of firewood, Pondori
UNDP/UNSO	Socioeconomic studies, Faguibine system
RTI	Environmental profile, Mali-Sud
ACORD	Socioeconomic studies, Gao
Training	
IFARC	Organization and annual follow-up of long- and short-term training programs
IAM	Involvement in training programs supported by CIRAD
IPD-AOS (Pan African Institute for Development - West Africa)	Organization of training seminars
AGECOOP (Cultural and Technical Cooperation Agency)	Organization of economics training seminars
FAO (Policy Analysis Division)	Socioeconomic studies
Ford Foundation	Socioeconomic training; degree programs at the University of Ibadan; on-the-job training for socioeconomists
Documentation/Information	
AGRIS, CARIS and RESADOC	REI/Documentation is the Mali National Coordinating Center for these documentation networks
IDRC	Financial support for RESADOC
France, Cooperation	Computer support for the REI/Documentation
AGRIDOC International	Library materials and documents
CIDARC	Support for the use of documentation software
UNESCO	Support for the use of documentation software
ACCT	Library materials
EIB (International School, Bordeaux)	Organization of documentation training seminars
ILCA	Library materials
CTA	Library materials and equipment
RTI - Netherlands	Library equipment (laser disk reader)
ISNAR	Library materials
ICRISAT	Library materials

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Table F-2 (3): Rural Economy Institute, Principal Cooperating Agencies, by Area of Support, 1989[2]	
Rural Production Systems Research	
IDRC	Legume research Cinzana; production systems research
RTI	Farming systems research Sikasso
BCN - Netherlands	
USAID (with SECID)	Farming systems research Sotuba and Mopti
RESPAO	Farming systems network
R3S	On-farm verification trials network
ICRISAT	Support to national sorghum and millet prog.; regional sorghum ctr.
CABO - Netherlands	Primary Production in the Sahel; Production systems Fifth Region
Agronomic Research	
CIRAD	Technical support and personnel for crop research programs
SAFGRAD	Support for adaptive research with cereals and legumes

Table F-2 (3): Rural Economy Institute, Principal Cooperating Agencies, by Area of Support, 1989[2]	
ICRISAT	Varietal improvement of rainfed cereals; West Africa Regional Sorghum Improvement Program
WARDA	Varietal improvement and technical practices for floating rice
IFDC	Improved formulations for the use of Tilemsi phosphates; and farm-level fertilizer use studies
RTI - Netherlands	Support for rural production systems research; case studies, Sikasso; support for the Sotuba Soils Laboratory
CIBA-GEIGY	Support for the Cinzana station
IDRC	Support for rural production systems research; on-farm fertilizer evaluation
INTSORMIL	Support for research on agrophysiology and food technology
TROPSOILS	Support for soil management and practices research
Sahel Institute	Support for water use studies
ODNRI (UK)	Support to SPV for millet and sorghum pest mgt. research
Planning and Evaluation	
CCCE	Cost of Production Studies: 1987, 1988, 1989
EDF (FED)	Food Security Studies
FRANCE COOPERATION (FAC)	Study of Cereals Marketing, 6th Region
PRMC	Credit Impact Study

1. Source: République du Mali, Ministère de l'Agriculture, Institut d'Economie Rurale, Rapport Annuel 1989, Bamako:IER.

2. République du Mali, Ministère de l'Agriculture, Institut d'Economie Rurale, Rapport Annuel 1989, Bamako:IER.

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ANNEX F-3
FINANCIAL MANAGEMENT AND ACCOUNTING

The SPARC project will provide technical assistance to help IER develop and install an integrated financial system that will institutionalize the capability to manage all aspects of IER's operations in the future.

There are five different reasons for creating the system:

1. **Program budgeting** of research resources is not currently undertaken by IER. As a result IER has no set of tools by which to ensure conformity of resource allocation decisions with research priorities. The system will provide IER with a means to do program budgeting, and to use budgeting as a tool in resource management and research planning.

2. **Effective logistical support** is essential for the smooth flow of field operations. When experiments are under way, it is damaging to experience interruptions in the delivery of key inputs. Experiments can fail if they don't receive the proper attention at the right time. Therefore, funds and inventories of supplies need to be available at the site when they are needed. The activities conducted at the stations are the main reason for the project's existence and the need for carry them out efficiently is the principal justification for investing considerable time and effort in a solid financial management system.

3. **Coordination of donor contributions** has been a problem in the past, because of insufficient information about the particular activities of any given project. The new system will remedy this from two different perspectives: 1) The concept of a Consolidated Funding Mechanism, which is being proposed by the World Bank, will provide a shell which will bring about an unprecedented measure of cooperation and coordination between donors that will be useful for the planning and prioritizing of activities and, 2) it will eliminate the waste and inefficiency created by the redundancy of multiple donor enclaves, each with their own individual accounting systems.

4. **The generation of useful financial information** is essential in order to gauge the cost-effectiveness of project activities and set priorities for the future. The combined financial reporting that will be produced by the system will provide an overview of the entire organization that has never existed in the past.

5. **Integrity of project funds** has always been a major concern among donors in the past. Donor reluctance to commit funds to certain activities has been attributable to their lack of confidence in the local system that administers the monies they contribute. Under the new system, the responsible use of donor funds will be assured through the implementation of strong internal controls and establishment of clear audit trails linking transactions to source documentation.

Management Issues

Most projects that fail to meet their designers' expectations do so as a result of **management failure.** The nature of international development projects demands that particular care be exercised in all aspects of their administration--financial, technical and logistical. The difficult operating environment imposes standards well in excess of what might be required in an operation of comparable size and scope in the United States. The demanding conditions can cause well-designed and adequately funded projects to succumb to lax controls and the failure to promptly detect problems and implement timely solutions. Once this occurs, it is very difficult to reverse.

Preventive measures are the project's best insurance against suffering management failure sometime in the future. These are:

* The creation and adherence to **formal written procedures** in all functional areas.

* The implementation of **strong internal controls** to guarantee the financial integrity of the project.

* The establishment of **concrete, measurable goals** for key staff, who will be held accountable for meeting them.

* The design of a **meaningful reporting system** that is capable of alerting management to potential problems before they go out of control.

* Careful **selection and training** of both expatriate and host country staff members.

Implications of PID Goals for Accounting System Design

Project Goals

"...Support for commodity research...will result in a...capacity to analyze cost-effectiveness and impact of research investments..." (PID Page 5)

Design Implications

The accounting system must pick up sufficient detail regarding the costs of operating facilities and programs which can be combined with impact data in order to come up with a conclusion regarding cost effectiveness of the project and to validate the assumptions and calculations regarding internal rate of return. This implies an adequate impact data collection system.

Expected Achievements

1. A program planning and budgeting system, permitting rational resource allocation and priority-setting based on available resources,
2. A sound financial management system which in addition to accountability permits some IER self-financing through revenue generating activities,
3. An increasing share of IER financial resources coming from sources other than GRM salary support or donor projects,

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4. A Monitoring and Evaluation (M&E) system that tracks on-farm adoption, assesses research cost-effectiveness and provides critical farm-level information to research-extension staff. (PID Page 6)

Design Implications

1. The annual program budgets must be built from the bottom up, calculating the cost and amount required of each output. These need to be consolidated so that the total annual expenditures can be calculated and evaluated, so that priorities can be established.
2. The USAID standards require a good accounting system for accounting for US grant funds. Projects and government agencies receiving such funds must be certified by the USAID Controller's Office as having sound financial control and tracking systems. As far as self-financing, it will be necessary to deal with the GRM requirement that all government institutions turn over to the Treasury any revenue that is generated as a result of their activities.
3. New forms of income generation may have to be devised, in addition to those that already exist.
4. As mentioned in the section above concerning project goals, both the accounting and information collection systems have to capture the appropriate level of detail that permits these calculations to be performed.

Research Management

"...Equally important is IER's putting in place a financial management system that is acceptable to donors, the GRM and USAID requirements; and that enables administrators and researchers to do program budgeting, while monitoring the cost-effectiveness of individual research programs." (PID Page 8)

Design Implications

Reinforcing what was said earlier, in order to monitor the cost-effectiveness of activities, the system must generate quantitative data regarding achievements which can then be related to the cost of the program, as reflected in the accounting system.

Inputs

"It is anticipated that the World Bank's proposed Agricultural Research Loan will provide major support for commodities and construction." (PID Page 9)

Design Implications

It will be necessary to determine the extent that the infusion of commodities financed by the World Bank will affect the investment budgets of USAID and other donors. In the event that the World Bank commodities replace those budgeted by other donors, it will be necessary to reprogram these funds to support other activities or programs within SPARC. Since the acquisition and operating costs of these assets are often allocated across function areas, the budgeting and accounting system should contain sufficient flexibility to accept major changes of this nature.

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Monitoring and Impact Assessment Plan

"...that will track project performance, document results achieved, and assess the overall impact of SPARC activities...Information will feed into [the] program-budgeting process to insure that research investments are cost effective... the MIS system being developed under the SAARFA project will help orient the SPARC M&E Plan." (PID Pages 9-10)

Design Implications

The design team needs to review the MIS system being developed for the SAARFA project. Again, the need for good information-gathering and budgeting is emphasized, so that cost-effectiveness can be verified.

Relevant Experience with Other Projects

"Realizing the full benefits of agricultural research requires that attention be given to management, administration and strategic research planning. (PID Page 12)

Design Implications

The proper design of an effective financial management system is going to be critical to the success of the project. It is important that the project be closely monitored to insure that the promise that "USAID can provide SPARC with competent management and leadership." is being fulfilled and that problems are corrected before things go out of control and result are compromised. (PID Page 12)

Recurrent Costs

"How can IER support an increasing share of the recurrent costs of the agricultural research system?...Most important will be the development of better financial management and reporting systems that will permit IER, for example, to charge overhead for services such as studies, seed production, laboratory tests and advice...These systems will also enable the GRM to show the cost-effectiveness of its research programs, thereby helping IER secure increases in GRM allocations for agricultural research." (PID Pages 14 and 15)

Design Implications

Good accounting and financial reporting will not change the basic economic realities of the project nor will they help the project increase the revenues they receive from fees charged for services. Revenues from third parties or the GRM, for that matter, will only be forthcoming when there is a general perception that IER is delivering something of value. People not only must believe that the service is worth paying for, but also must have the cash to do so. In similar projects in other countries, farmers have failed to attach much value to services rendered by agricultural extension agents. While patient and polite in listening to advice, they generally failed to implement the recommendations and never suggested that they were worth money. The type of thinking whereby farmers pay money for intangible services is a long way off in most parts of the developing world.

Internally-generated self-sufficiency is not likely to be achievable. Some costs may be defrayed, but revenues from fees are unlikely to be material in light of the very high recurrent costs of the project. Considering the high cost of operating and maintaining a vehicle fleet alone, it is hard to envision a level of fees for any type of service that would support a continuous expenditure of that magnitude.

Agricultural Research Portfolio

FSRE and ICRISAT financial management systems will be absorbed by IER. (PID Page 15)

Design Implications

FSRE already has a well-developed financial management system and there may be lessons learned at FSRE that could be of use in designing the system for SPARC. The ICRISAT program has already wound down. The design team might contemplate the possibility of superimposing the new system on top of FSRE's system and merging the two projects early on.

Design of the SPARC Accounting System

For complex multifaceted projects, there is no such thing as a "simple accounting system". Project managers who settle for simple systems generally end up with weak controls, useless reporting and ineffectual audit trails. To properly isolate direct costs requires effort on the part of all project staff. If an extension agent spends part of the week visiting farmers and another part conducting training seminars, then his or her time needs to be allocated between the different categories of extension and training. If this is not done, the end result will be large amounts charged to the fuel and per diem accounts, which are not terribly useful for the purpose of management decisions without some notion as to what activity was involved or which persons are responsible for them. It is not unusual to see situations where a project officer has seriously underbudgeted an activity because he or she based the estimates on direct costs extracted from the project's accounting system, oblivious to the pool of indirect costs which were not allocated to the various activities because somebody insisted on a simple accounting system.

In the design of any system, there has to be a balance between effective controls and staff work load. In the private sector, it is not unusual to see 25% or more of operating expenses allocated to the administrative function. The administrative burden experienced by development projects is easily as complex as that of corporations and they face the additional constraints of being spread over vast geographic areas with little or no infrastructure and being staffed by personnel who often have undergone less training than their private sector counterparts. In addition, they engage in tasks that are very difficult to control or measure.

There should be an adequate number of IER accounting staff assigned to the task of running the new accounting system. It should be recognized that certain critical functions, such as report preparation for USAID, are literally full-time occupations. The staff should not be overburdened with excessive workloads, as this is a sure prescription for poor performance. Every staff member's responsibilities should be clearly spelled out in his or her job description.

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Every attempt should be made to avoid the use of contractual personnel within the IER General Services Department. The use of contractual employees compromises the long-term sustainability of a project and often leads to undesirable results. It is important to note that at present, the DRSPR accounting function is run largely by contractual personnel.

Rarely does one see 25% of a development project's budget allocated to administration and finance, yet when a project fails, this is invariably the area that breaks down first and precipitates the collapse.

System Design

The initial purpose of the accounting system to be installed for SPARC is to provide the project with a mechanism that facilitates the disbursement of funds in an efficient manner while providing an appropriate level of control, thus permitting the local USAID controller to certify its adequacy for the protection of U.S. government funds. Later, as the system is refined and personnel are trained, it will provide IER with a vastly improved and permanent institutional capability to manage its own financial affairs.

The system must be operational as of the first day that the project officially begins functioning. In order to do this, there must be **considerable lead time** budgeted for the design, installation and testing of the system. The physical workplace will have to be set up. A document filing scheme must be put in place. Computers will have to be procured and installed. IER personnel will have to be recruited or identified and trained in the use of the equipment and the software. It is not unreasonable to expect that this initial phase could take upward of three months, even with numerous people working on it.

To commence operations without a functional system in place may well be courting disaster. Once a system goes amok, it requires two or three times the effort and expense to wrestle it back under control. It would be preferable to **delay the project start-up date** rather than begin without a complete accounting system. There is no shortage of examples in the developing world of the negative consequences of prematurely opening an otherwise well-designed project.

There are other considerations regarding the system design. Aside from safeguarding USAID funds and providing for expeditious execution of project activities, there is an important element of institution-building to be considered. If the independent status of IER as a semi-autonomous entity is likely to become a reality sometime over the life of the project, it will be necessary to have a system in place that is appropriate to deal with the requirements of this different organizational structure.

Once the basic system is in place, it is anticipated that other autonomous enclaves created within IER by various donors will be brought under the IER financial management umbrella. For this, it will be necessary to incorporate this eventuality in the initial design, even if it is activated at a later date. This will avoid costly and time-consuming redesign down the road.

The creation of a comprehensive system to manage all of IER activities at headquarters and in the field is an ambitious undertaking and needs to be planned in considerable detail so that the implementation phase is carried out smoothly and on schedule.

Decentralization

Under the proposed decentralization plan, control over a wide range of activities will pass to the various regional centers located in different geographic areas of the country. In addition, other organizations such as laboratories and testing facilities will also be given a measure of independence in the management of their own activities and resources.

The decentralization of management is necessary in order for the local units to be more responsive to problems as they surface and to react promptly in devising solutions. Furthermore, the ability to mobilize resources or assets on short notice is essential to keep up the pace of field activities and to avoid waste that might result from not having a given input or piece of equipment on-site at the time that it is required.

Normally, when control is transferred from a central location, it is necessary to establish key control points within the system in order to provide assurance to managers at the central level that their delegation of authority is being applied appropriately and that the organization's resources are being used in a responsible fashion.

The overall integrity of the system needs to be guaranteed through a number of mechanisms:

* **Improved management reporting:** The decentralized units must provide the central administration with regular, detailed reports covering both technical and financial activities.

* **Internal audits:** When the requirements for pre-approval of routine expenditures by headquarters are dropped, local managers must be accountable for their decisions. This implies that the records must be maintained in such a fashion that permits easy verification of transactions and their supporting documentation.

* **Personnel training:** Since the local operations will be performing functions that were previously the responsibility of headquarters personnel, the local staff will have to acquire the same level of proficiency in their jobs as their counterparts at the central level.

* **Written procedures:** In order to eliminate ambiguity regarding the performance of a particular task or job function, it is necessary to develop detailed written procedures that serve not only as a guide to the staff, but also as training materials for newly-recruited employees.

Project Autonomous Status

The fact that IER does not enjoy full autonomous status present a number of problems. The principal constraints faced by IER are its statutory linkages to the Ministries of Agriculture and Finance and the Treasury. The intricate system prescribed by law for the procurement and payment of goods and services is hopelessly complex and redundant and totally inappropriate for providing an adequate level of service. The restrictions imposed by law regarding the financial controls to be exercised over all transactions initiated by government agencies preclude implementation of measures that might streamline IER's accounting. The most prominent among these is the prohibition against owning a

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bank account. An internally-controlled bank account is the most practical means of providing timely support to project field activities, since transactions do not have flow through the four levels of control mandated by the Ministry of Finance. Rather, control can be exercised using other more expedient mechanisms.

As a public service, IER must conform to all civil service regulations and government financial management procedures. As an "attached service" (*service rattaché*), however, IER can establish a parallel and independent budgeting system (see Institutional Analysis Annex). This stipulation allows for the use of cash advance and revolving fund mechanisms. This type of mechanism may be very useful in setting up a prototype IER financial management system under the SPARC project.

When autonomy is granted, it must be genuine decision-making independence. It has been the experience of some semi-autonomous organizations that the contracts-plans, or agreements, signed between the entities and the Malian government contain clauses or restrictive covenants clauses which effectively compromise the entity's independence of action, increasing operating costs in the process. In the end, they are no better off than before they became autonomous.

Past experience in Mali suggests that when independent status is conveyed to a public organization, that the civil servants employed there will generally exercise their option to transfer to some other branch of government service, rather than continue employment with same organization, even at significantly higher pay scales. The issue of continued job security would appear to be a more important concern that increased income.

Semi-autonomous entities must periodically undergo a sort of certification process prescribed by the Malian government. For each autonomous organization, a ***Commissaire aux Comptes*** is assigned. It is the responsibility of each of these private sector accounting firms to review the entity's financial statements and comment on their reliability. The process, however, falls short of the scope and depth that would be characteristic of an audit.

At present, there is some revenue-generating potential within IER. Fees can be charged for services rendered to third parties by various facilities within the organization, such as laboratories that test soils or products. However, under Malian law, which reflects practices in many other countries, any funds generated by a governmental organization must be returned to the Treasury, where they are placed in the general fund. Therefore, there is little incentive for IER to try to increase its income from these activities. It is hopelessly optimistic to expect that IER will ever achieve self-financing status exclusively through internally-generated revenues. However, the broad base of its support amongst international donors safely guarantees its continued operations for the foreseeable future, provided it can document progress towards achieving its research objectives.

Overview of AID Financial Certification

USAID will ensure that the project comply with requirements for certification of the adequacy of its accounting system. The certification procedure is a two-step process. First, the initial certification is provided at the time the project is designed and approved. Subsequently, all of the projects in the mission's portfolio are reviewed every six months for continued compliance with requirements. A Sahel Regional Financial Management Project (SRFMP) document summarized the most important elements that determined a project's eligibility for certification as follows:

1. The system must identify the receipt and expenditure of AID funds.

2. The system must ensure that approved budgets and budget categories do not become oversubscribed. In other words, there must be a system for identifying commitments and encumbrances and funds due or receivable, by budget category.

3. Accounting entries must refer to documentation which supports the entry and is filed in such a way that it can be easily located.

4. The system must generate accurate and current financial reporting information, including periodic bank reconciliations.

5. The system must include appropriate internal controls which assure usefulness of financial data, accuracy and integrity.

6. The system will enable an auditor to trace readily each accounting transaction from accounting records to source documents to determine the validity of project expenditures.

Implications for System Design

Most of these requirements are standard elements of any well-designed accounting system. However, items (1) and (2) involve somewhat specialized features. In standard commercial accounting systems, the issue of the **fungibility of funds** is not a major consideration. Although the summary of global sources and uses of funds is a meaningful tool in managing the firm's finances, there is rarely any concern regarding the specific use of the funds obtained from a particular source. That is to say that the proceeds from the collection of any given account are simply fused with funds obtained from other sources and used at the discretion of the firm's management according to plans set forth in the annual budget. However, in development projects, donors frequently request that their funds be segregated from those contributed by other donors and that their use be accounted for separately. This imposes special constraints on the accounting function, since it essentially requires the creation of numerous "mini-systems" with the main system. Each donor may have certain activities that are priorities for its funds and other uses that are not authorized. Furthermore, each donor usually has its own unique reporting format and a fiscal year-end cutoff that is different from everyone else's. These distinctive features make the system a great deal more complicated and are important considerations for the SPARC project, since one output of the project is the creation of a financial management system permitting eventual absorption of activities financed from many sources, both local and foreign, under an umbrella organization within IER, which the World Bank technical assistance team refers to as the "Consolidated Funding Mechanism".

The second point also adds complexity to the system. In commercial systems, the budget serves as a management tool in assisting the financial staff in adhering to a pre-approved program of expenditures. The monthly actual-to-budget financial reports detail variances against plan which are reviewed at monthly meetings. Management must explain expenditure line items that exceeded budget, but the amount expended for any given line item is largely at the discretion of the manager, who has a great deal of latitude in the way he or she commits funds. If a manager chronically exceeds the expense budget without a commensurate increase in profit, this fact will generally be reflected in his or her annual performance bonus, which is calculated on a formula involving sales, expenses and net income.

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Public sector accounting, on the other hand, works on a system of appropriations, obligations and commitments. There is a fixed amount of money available for a specific set of activities and there is nowhere to go for additional monies, unless you are the federal government and you simply borrow it from the general public. This constraint gave rise to a methodology called **encumbrance accounting**. The principle underlying this concept is that any time a commitment is made against a given budget line item, the amount represented by that commitment is immediately removed from the available budget, so that the total amount cannot be exceeded.

Private sector firms consider these controls to be excessive and unduly complicated and prefer to deal with this problem in a way that is a little bit less instantaneous. Vendor invoices are always booked to accounts payable and are thus recorded in the general ledger as official commitments the organization has made to third parties. At month end, all open (uninvoiced) purchase orders issued to the firms suppliers of goods and services are summed up and a general ledger entry called an **accrued liability** is posted to the general ledger. This accomplishes, however belatedly, the objective of reflecting the obligation on the general ledger, although it does not provide the same degree of protection against overspending as a budgetary encumbrance system. However, private sector managers who are accountable to top management as well as the directors and stockholders, have strong incentives to stay within their guidelines or they will promptly be replaced.

It is important for the managers of economic development projects to recognize these signific differences between private and public sector accounting when they attempt to draw up specifications for an accounting system for a project. When these special requirements are introduced, they rule out the majority of shelf commercial software packages. A great deal of thought has to go into the design of the system to manage a project of the complexity of SPARC to insure that all of its requirements are addressed by the accounting system.

Encumbrance systems are the systems of choice in situations where strong budgetary controls are required. However, they don't always work properly. The most frequent cause for the demise of encumbrance systems in the developing world is the failure on the part of management to reverse or adjust the encumbrance after an invoice for the transaction has been processed and posted to accounts payable. This underscores the need for well-defined written procedures, thorough training of staff and frequent and effective supervision by project management.

Essential Elements of IER's New Accounting and Control System

The new system to be supported under SPARC will incorporate all of the accounting conventions, internal controls and reporting requirements specified by all donors proving funding to IER.

Budgeting and Encumbrance

Formal written procedures for budget preparation will be drawn up. Budgets will be built up from the smallest elements at the lowest levels, based on inputs from the same technical personnel who will be responsible for the execution of the activities being budgeted. The budget preparation exercise will be an iterative process, whereby field personnel will express their needs, which will be consolidated and evaluated at the next level up. As amounts are adjusted in accordance with the total pool of

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resources available, the input of field personnel will be taken into account in determining the final amounts allocated to each activity. An encumbrance mechanism will be attached to the budget control system to prevent overspending of any given line item. There will be a formal procedure for requesting and approving reallocations between line items and time periods.

Imprest Funds, Petty Cash, and Payroll

Meeting the disbursement needs of several geographically separate research sites will require careful planning and management of payroll, petty cash, and periodic advance accounts together with a centralized payment processing system. Modalities will need to be worked out with GRM and the USAID Controller.

Travel Expenses

The capability for processing transportation and per diem advances to project personnel travelling on official business will be incorporated into the system.

Purchasing and Procurement

A purchasing function will be created. Procedures for obtaining and evaluating quotes will be prepared. An approved vendor list will be set up. Purchase orders will be encumbered against the appropriate budget line items.

Accounts Payable and Disbursements

Payments to vendors will be based on a package of approved documents: Requisitions, quotes, purchase orders, receiving reports and inspection reports.

Inventories

Many field locations will need to stock inputs of supplies that are used routinely in carrying out their activities. This includes items such as fertilizer, insecticides, bags, spare parts and m[illegible]hicle and generator fuels and lubricants. The system will recognize the tradeoff between the problems and costs of carrying stocks and the inconvenience of frequent purchases. Procedures for receiving, inspecting, requisitioning and issuing stores from the warehouse will be established. A perpetual inventory system will be used to control stocks and will be backed up by shelf cards. Controls will include periodic wall-to-wall physical counts and permanent, ongoing cycle counts.

Fixed Assets

There will be a need to track all of the project's fixed assets. These will be classified according to their source: GRM, USAID, other donors etc. A fixed assets tracking system will set up whereby all assets will be tracked according their location and the person responsible for their custody. Forms for the transfer of custody will created, so that as personnel assignments change, new custodians are assigned. The tracking mechanism will also note the condition of the asset. A physical inventory may be performed of all of the assets in the custody of IER, possibly financed by the World Bank.

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Vehicle Fleet

SPARC will be procuring a number of vehicles for use in project activities. These will be assigned to the various stations throughout the project area. The system will include a methodology for controlling and accounting for vehicle use as well providing a schedule for important routine maintenance. The failure to adhere to strict preventative maintenance practices, such as frequent oil, air and fuel filter changes, is the most common cause for the premature demise of vehicles used under difficult field conditions.

Internal Audits

An internal audit function will be created and SPARC/IER administration personnel will designate the internal auditor and his or her staff. Audits will be performed on a rotational basis and will include surprise visits. Formal audit programs will be developed and workpapers documenting all audits will be kept on file for inspection. Audit reports will be published and circulated to SPARC/IER management and donor representatives. Aside from findings and recommendations, they will include the comments from the local managers whose operations are being audited. IER could also seek a role by the *Contrôleur Général d'Etat* in a periodic audit program.

External Audits

In the interest of maintaining a high level of integrity with respect to the management of donor funds, there should be a comprehensive external audit performed once every six months. In order to guarantee independent and thorough reviews, audits that are to satisfy USAID's requirements must be conducted by expatriate auditors. Local audit firms or firms based in Dakar are unlikely to conduct an thorough audit that would reveal operational deficiencies. The local representatives of U.S. "Big Six" public accounting firms frequently assign junior staff to these audits and often do not perform an examination of sufficient depth. As a result, they fail to identify major operating problems that could threaten the organization's financial integrity.

Implementation Plan

The accounting system will be created using a combination of documents and manual records, coupled with computerized processing, filing and analytical capabilities.

It is anticipated that the central accounting system will be domiciled at IER headquarters or at the DRSPR offices in Bamako. The initial phase does not contemplate any significant computer processing capabilities other than those to be installed in Bamako, although spreadsheets will be used at some field locations.

The first version of the system will be initially designed in the U.S., based on information obtained in Mali by the project paper team. By performing some of the initial design work in the United States, it will be possible to get the process under way faster and save some money on per diem and travel expenses at the same time. It will also allow the designers to consult their libraries and records from other jobs, which may be of considerable help in conceiving the new system for SPARC.

Once the first level of design is performed, the system will be further refined in-country by the implementation team. It will then be installed, turned over to the project personnel for operation. The persons responsible for running the system will be trained. Before the implementation team departs, there will be an oversight phase, where the consultants will observe local staff operate the system and be available for assistance.

MIS Linkages

At the time that the accounting and financial management system is being designed, it would be advantageous to look at the technical information system. By designing and implementing these two sections concurrently, it would be possible to create certain synergies in the process. The design team is going to have to review existing records and interview personnel at all levels. This will entail considerable time, effort and expense. It would be a great deal more efficient to have the same team design the MIS system, using inputs from technical personnel. Furthermore, a better definition of the total volume of data to be collected will be useful in determining the requirements for computer hardware and software procurement as well as personnel training.

A major constraint to this approach is the fact that the financial design team must begin its work soon after the contract is signed, some months before the long-term technical advisors are in-country, or perhaps even identified. This implies that additional TDY consultancies for technical personnel may be required, preferably by members who participated in the design of the project. However, the overall savings, increased efficiency and superior quality of information that will be obtained in the future will most likely justify this methodology.

Computer Hardware

It would be preferable to procure the equipment gradually in accordance with the project's ability to absorb it. The rate of installation of hardware should not be done too far in advance of the development of software systems or the training of personnel. One of the risks of procuring the equipment in advance is that it will sit around unused for a long time before there is software ready to run on it and people trained to use it. The equipment will become technically obsolete and funds will be wasted, as each generation of computers experiences a significant decline in price as newer, more powerful machines replace them. For this reason, a phased procurement plan for computer equipment is being recommended for the project. This assumes that procurement can be made in the U.S. by the contractor with a minimal amount of lead time and red tape and that it is possible to make arrangements to expedite the equipment's trip through Malian customs by processing the duty exonerations in advance of the shipment.

Number of Units Required

The number of units to be procured is governed by three principal considerations: 1) The volume of work, 2) the number of users and 3) the need for segregation of activities.

The number of units required for the central accounting function will depend on the volume of transactions to be processed. This is very difficult to estimate, and it may not be possible to come up with even a comfortable guess until some survey of the nature of all the donor enclaves is conducted by the initial design. If possible, it would be preferable to avoid, or at least delay the installation of a local area network at IER. For the initial phase, this is likely to be possible, but if the volume of

transactions increases sharply as more donor enclaves are brought into the accounting mainstream, the need for multiple input stations may be difficult to elude. In addition to systems used for the general accounting function, it may be necessary to have a few machines that can be used for miscellaneous financial functions, such as budgeting, feasibility studies and other activities that might not be part of routine daily record keeping. They would also be used for typing up financial reports, proposals and other word processing functions.

Normally, access is restricted to a system used for accounting, primarily due to the risk of an accident resulting from the actions of a novice user. In most cases, the security systems contained in accounting software packages are adequate to protect the records from unauthorized access or change. The main concern in sharing a computer where vital information is stored is the possibility of accidental or deliberate introduction of viruses as well as other actions which could corrupt files or cause the hard disk to crash. Viruses are particularly insidious as they can sometimes escape detection and infect the backup sets of diskettes or tapes, causing a complete and irretrievable loss of critical data. This risk of this occurring increases proportionally with the number of users of the equipment. In a project setting, there are typically a large number of users amongst the technical personnel, since there is a great deal of data to be entered and analyzed and many reports to be written.

For this reason, it is recommendable that the accounting department of each organization have a dedicated system used exclusively for its financial records and a separate system for use by the technical staff. All systems will run anti-viral software and procedures will be established for checking diskettes before loading data into any system.

It would be desirable for each person who has responsibilities relating to any aspect of the financial management to have his or her own machine. The prices have dropped to a point where the cost of hardware is not material, when compared to the overall cost of the project. The increased availability of machines for practice and training would add depth to the organizations in-house management capability.

It is not normally necessary for a project of this nature to have the very latest in computing hardware, but the present price structure is such that there is little advantage in buying into older generations of technology. Purchasing equipment that is up-to-date is recommendable in that it is more likely to be compatible with future generations of software. Computer hardware is rapidly reaching the status of being little more than a shelf commodity.

A determination will have to be made regarding the type of equipment to be purchased. Laptop computers have the advantage of being portable, and their price now compares favorably with that of desktops. A laptop allows a researcher to do his or her report preparation at home or to work directly at the location of field trial sites. Although laptops have become sturdier, more tolerant of abuse and less prone to failure, they still do fail on occasion. When this occurs, their highly-integrated, single-board construction makes them almost impossible to repair in the field. On the other hand, clone desktop machines, which are usually assembled from modularized shelf components, can frequently be diagnosed and repaired by a person with minimal training, drawing from a stock of shelf parts. The most common items to fail are power supplies, hard disks and video cards, any of which can replaced in less than an hour right at the project site.

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SCOPE OF WORK FOR DESIGN OF SPARC FINANCIAL MANAGEMENT SYSTEM

BACKGROUND

IER has over the last three years embarked on a course of major reorganization, institutional change, and more focused research programs. The changes are not yet fully implemented, and indeed one of the objectives of the SPARC project is to assist IER in implementing at field level the better research planning and management procedures it has decided upon. Prior to arrival of the long term TAMU team, two activities are required. These are 1) Participation by short term research management TA in personnel, planning, and commodity management decisions with IER and USAID; and 2) Design of the project financial management system. Completion of this latter activity, in particular, requires some background as presented below.

The SPARC project will provide support to several different research activities (specifically in sorghum, millet, cowpea, forage/animal nutrition, socio-economics, and farming systems research) in order to make them prototypes of improved research planning and management, including financial management. As progress is achieved in these programs, IER may decide to extend the procedures and planning and management methods undertaken in these activities to other, non-AID funded, activities undertaken by the Institute. In the particular case of the financial management system, IER may decide to extend it to include some other sources of funding simultaneous to, or in sequence with, its initial use to manage and track USAID SPARC funding. Hence the financial management procedures by which USAID funds are disbursed to IER and accounted for by IER need to be designed from the outset in a way that they can be more broadly applied, not just to other AID funded research activities in IER, but more broadly to IER research activities funded by other donors as well. This means that one of the key activities of the contractor will be assisting IER to engage the active participation of various Malian and other financial staff from several different IER projects in the design of the system.

All of the changes underway demand better financial management and tracking, and have implications for the financial management procedures that IER needs to put into place. There are several aspects that require consideration as AID, the contractor, and IER work to help design a project financial management system which can provide the basis for an Institute-wide financial management system during the course of the SPARC project. These are presented below:

The old system: The system until recently was characterized by three features: centralization, complete separation of research approval decisions and financing decisions, and donor "enclave" projects. The system was centralized in that all research programs were discussed and approved individually at the level of Bamako. Research and financing decisions were separate because the centralized research approval decisions bore very little relation to the decision making process for spending money in support of research. Financing decisions were not an integral part of research programming and priority setting. The donor enclave projects, which constituted most of IER's funding for operating expenses and other expenses of research, arose as each donor developed its own separate project management unit and financial management system for the research programs it was willing to support in IER.

Regionalization: In order to make research more accountable to local clients (farmers and extension agencies), as well as to decentralize and rationalize the research planning process, part of IER's reorganization involved a regionalization of research planning and management. The first step in the

annual research planning process will be presentation of research programs at regional level, for input and approval from local extension agencies and farmers. And the regional research center will be the key administrative unit within IER, responsible for administration and support (including financial management) of the activities taking place within the region it is responsible for. Most regional research centers will in turn support the work of one or more research stations in their regions.

Programming: IER has also developed a set of seven research programs (Grains and Legumes; Industrial crops; Animal production; horticultural crops; forest and water resources; production systems and rural economy; and natural resources management). Within each program it has developed a prioritized series of research projects. Many of the research projects will take place across a range of regional research centers (and the stations under them), with one center or station playing the lead scientific research role. For example, in sorghum research the Sotuba regional center will provide scientific leadership to the program, while IER activities will be undertaken (and funded) not only at Sotuba, but at Longorola and Cinzana, as well. USAID will fund some, but not all, of the sorghum activities through the SPARC project.

The SPARC project will support some of the research projects in the grain and legume program, the animal production program, and the production systems and rural economy program. Most of these projects will involve USAID disbursements of research operating expenses to more than one station or regional center.

IER status: IER is currently a *service rattache* of the Ministry of Agriculture. In practice, it relies on the DAF (Division Administrative et Financière) as do the other Ministry services. In theory, as a *service rattache*, it could have its own bank account and some degree of autonomy, but this has never been tested. The DAF manages less than 10% of IER's budget, with the Ministry of Employment and Civil Servant managing the approximately 25% salary bill and the donors providing and managing the remaining 65% of financial resources flowing through IER.

The Ministry is committed to providing an important measure of autonomy for IER in both personnel and financial matters. The World Bank, with whom AID and IER have been collaborating as the Bank prepares a major project of support for agricultural research in Mali, believes that this autonomy should include:

- Complete financial independence and a "comptabilite entreprise" rather than a public sector accounting system, but with continued guarantee that the GRM's support for salaries and some operating expenses continue.

- Independence of staff from civil service constraints and security, and the hiring of research and other staff on a contract basis (permitting selection for performance) but with a definite career path spelled out.

- Legal status (eg, parastatal (such as EPIC, EPA, EPST) or foundation) to ensure the independence.

Uncertainties regarding the Bank's proposals include:

- GRM willingness to grant IER the degree of autonomy the Bank is requesting.

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- Personnel status of researchers if such autonomy is granted: Would IER be able to retain high quality research staff, or support staff such as accountants, if their status shifts from civil service lifetime employment to a kind of shorter term contractual status.

- Mechanisms by which the GRM could sustain its current financial support to IER, both salary support, and operating expenses, if IER autonomy, for example as an EPIC, means its removal from the national budget, and removal of its salary bill from the civil service salary bill.

- Relationship with the DAF and Treasury as regards time-consuming and inefficient accounting procedures, either under a scenario of autonomy, or under the scenario of achieving greater independence but still within the Ministry.

World Bank support to Niono station: Early World Bank support to IER will be provided in 1992 and 1993 to the Niono regional research center. The Niono center is seen as ideal for a prototype of the kinds of organizational and planning changes currently being discussed because it combines both crop and livestock research, it is a new center, it is responsible for one of the most successful stations in Mali (Cinzana), and a number of different donors are funding research there. One challenge to the SPARC financial management system will be to determine how quickly the system will be at an adequate stage of experience and functioning to take on the management of the World Bank financing to the Niono center.

Cadre organique: This is IER's personnel plan, which identifies numbers of positions it is entitled to. The cadre organique may permit IER some modest increases in both professional and non-professional support staff and research staff.

Attempts at similar systems elsewhere: IER staff and technical assistance recently visited two neighboring research institutes, in Burkina and in Senegal. Burkina has attempted to put into place a system similar to the one being contemplated for Mali, and for which the contractors actions in designing a SPARC financial management system would be a first step. What they found was critical personnel constraints that were preventing the system from becoming operational.

SCOPE OF WORK

The contractor will assist IER in the design and start-up operation of a financial management system that can simultaneously ensure that AID funds can be disbursed to support SPARC research sites beginning with project implementation, and that the system can provide the basis for a broader IER system encompassing a range of different funding sources. Any decision on computerization and software for the system will be based on advance concurrence between IER, USAID, and other interested donors. Specifically, the contractor will:

1. Discuss IER financial management requirements (including need for Institute - wide audit of assets, control systems, and funds usages) with World Bank, ISNAR, and Ministry of Agriculture and it's DAF.

2. Identify numbers and quality of current IER civil service accounting staff (support staff, accountants, and CPA - level) and their location (eg, IER headquarters, stations, donor-

funded project accounting units). Identify likely increase in accounting staff which current "cadre organique" would permit. Estimate volume of transactions and financial flows which could be handled for IER by:

a) Current IER civil service and contractual accounting staff
b) Larger civil service accounting staff permitted by cadre organique.
c) Larger staff permitted by using both civil servants and contractual staff.

3. Visit the stations, regional centers, or departments with IER management staff if possible, to gain understanding of possibilities, and quality of current staff and procedures. In particular, visit or examine the following:

a) Cinzana station
b) AID-funded FSR/E project office
c) Mopti regional center (with IER civil service accountant and FSR/E financial management system).
d) Dutch-funded IER/DRSPR program at Sikasso.
e) Longorola research station outside Sikasso (including for management of USAID funds for sorghum research in 1991)
f) N'tarla research station (including both CMDT-funded research and modest AID-funded 1991 sorghum research)
g) Niono regional center
h) Korporo-Kenieba substation, and its funding through USAID/FSR/E project.
i) In addition, discuss with Sotuba sorghum program leaders, and with FSR/E financial management unit the experience in disbursing and tracking 1991 sorghum funds for post-ICRISAT sorghum research.

4. Assist IER General Services Bureau to obtain and understand the charts of accounts, as well as other basic accounting, reporting, and control requirements, of the several major donors to IER, including at least the World Bank, the Dutch, the Swiss, Ciba-Geigy, and the CMDT. Assist IER to ensure participation by Malian and expatriate financial management staff from other IER projects in the design of the financial management system, including the development of the manual of procedures (see item 9 below).

5. With the same donors cited in (4) above, assist IER General Services Bureau staff to construct an Institute-wide operating and investment budget for 1992/93 for major research programs, which provides an overview of all major sources of funding, both donor and GRM.

6. Work with IER accounting staff, donor financial staff, Department and Regional Center Directors, and other researchers involved in research planning and implementation to design a financial management system which can:

- Ensure adequate and timely disbursements to researchers in widely scattered stations

- Provide basis for program budgeting, monitoring and cost accounting

- Ensure tracking and controls adequate to donor requirements and capable of being

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implemented on a sustainable basis by IER

- Meet reporting requirements of several key donors

- Permit IER to charge overhead and fees on those services for which it could charge on a fee-for-service basis

- Initially serve as USAID/IER SPARC project accounting system, but be expanded, either immediately or later, according to the plans of IER and other donors, to include other projects and sources of funding, and ultimately provide the basis for the accounting system of IER even if its status changes to a more autonomous one.

7. Determine with IER staff the extent to which GRM financial support to IER which currently goes through the DAF could be accounted for in a new accounting system meeting these other criteria.

8. Recommend the accounting staff and advance/disbursement methods required at the level of regional centers and stations for such a financial management system to work.

9. Design financial management system permitting SPARC disbursements and disbursements from those other donors or sources of funding ready to use the system, and permitting AID certification. This new accounting and financial management system will conform to the current GRM accounting plan 57 and provide for conversion to the 82 accounting plan. The system will provide for:

9A. Development and editing, at any time of the following reports:

- a chart of accounts in conformity with 82 chart of accounts;

- an account balance (beginning balance, movement for the period, ending balance);

- a general ledger with the following characteristics:

  - beginning balance;

  - total for the period;

  - total for the accounting period;

  - end of accounting period statements;

- profit and loss statement;

- establishment of the following journals: bank, encumbrance and petty cash; general journal balance sheet;

- determination of operating expenses;

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- statement of accounts payable/receivable. Detailed tables on:
  - fixed assets/non-expendable properties
  - depreciation
  - short and medium term credit;
  - short and long term debt;
  - grant per donor and per project;
  - accounts payable/accounts receivable;
  - specific balance for financial decisions;
  - account statement.
- automated bank reconciliation;
- relation between account posting and the budget;
- automated clearing of accounts between the accounts receivable and balance sheet account.

9B. A cost accounting system, integrated with the financial accounting system, which will function to meet the following needs:

- determination of costs per research project;
- development of a billing system;
- determination of indirect costs and direct costs;
- determination of inventory value.

9C. A budgetary management system which will function to meet the following needs:

- overall budget planning for IER;
- development of yearly and quarterly operating budgets by major line item;
- budget planning and management for each program/center/station;
- determination of planned versus actual expenditures and analysis of differences or variances.

9D. An inventory management system for management and control of inflow and outflow of

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goods and stocks, and their use.

9E. Organizational chart providing for roles, responsibilities and functional relationships of IER personnel.

9F. An internal control system which will function to meet the following needs:

(1) roles and responsibilities of each post in the accounting system;

(2) qualifications of the accounting staff;

(3) segregation of duties;

(4) safeguard of assets to include:

- control of petty cash;
- control of cash checking and deposits;
- disbursement of cash advances;
- inventory request, utilization and disposal

9G. An accounting and financial manual of procedures detailing required procedures for proper (GRM and donor requirements) for accounting and financial management.

9H. The new system will take into account the financial management requirements of various funding sources such as:

- The National Budget
- The donor agencies
- The resources generated through IER profitable activities
- Other funding sources

9I. The system will be designed to produce financial status summary reports for GRM, USAID, and other donors, to include cash on hand and bank balance and their comparison to actual needs.

10. Develop a phased plan by which all of the research activities, regional centers, stations and other research units supported by SPARC will be phased in to SPARC financial management system during the first one to three years of the project.

11. Develop plan by which USAID funds to IER currently going through FSR/E project will be managed and tracked by SPARC accounting system.

12. Develop plan by which World Bank funds to support research in Niono could be managed and tracked by the new financial management system before 1994.

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13. Analyze several options for IER staffing in financial management.

14. Revise AID PP implementation plan, in English and French, to include all tasks involved in implementing the financial management system during the life of project.

15. Prepare (1) a brief trip report, in French and English; and (2) a manual or procedures, in French, both of which will be provided to USAID two weeks before the departure of the consultant. The consultant will then revise and finalize the report and the manual or procedures, in light of AID, IER, and other donor comments, prior to his departure.

ANNEX F-4: RESEARCH PROGRAMS ANALYSIS

The Tables presented in this annex describe several of the IER research programs making up the Government of Mali's Long Term Agronomic Research Plan. The programs described herein are the Cereals and Legumes Program, the Animal Production Program, and the Production Systems and Rural Economy Program. These are the three programs which will receive support under SPARC.

The content of these programs was developed and refined by IER researchers and GRM extension agencies over a period of two years. With the assistance of ISNAR, IER research administrators and researchers established a consultative and iterative process leading to development of a coherent set of programs. The process was based on in-depth constraints identification and cataloguing of available research results, and then on targetting high priority researchable problems amenable to resolution by current or projected numbers of research scientists. The priority established for individual research projects within programs was based on a method developed by ISNAR which uses the best information available to calculate research benefits (value of yield improvements multiplied by projected area of adoption). The method also calculates projected research costs (based on Malian projections for researchers needed for each projects, and Malian cost data for cost per researcher in existing productive research programs). The priority ranking of each project within a given research program is then made according to the greatest benefits achievable per researcher-year.

Tables F(4)-1 through 3 set out the research projects in priority order for the three IER Programs to receive SPARC support. Table F(4)-4, building on the table of research personnel needs in Section III.D (Research Programs Summary) in the main body of the Project Paper, sets out scientific personnel who will be working in those IER projects and programs supported by SPARC, and provides an indicative estimate of operating cost requirements, and their sources, in order for those projects to achieve desired results.

Table F(4)-1 indicates with an asterisk those research projects identified as high priority by IER which will receive USAID funding through SPARC. Tables F(4)-2 and F(4)-3 do not have similar indications between those programs will undergo further definition and refinement during Year One of the SPARC project in preparation for identification of actual projects to be supported by SPARC, to begin in Year 2.

TABLE F (4) - 1: PRIORITY RESEARCH PROJECTS IN IER CEREAL AND LEGUME PROGRAM

TABLEAU 20 LISTE DES PROJETS PAR PRIORITE (CEREALES ET LEGUMINEUSES ALIMENTAIRES)

PREMIERE PRIORITE

	PROJETS	SOUS-PROGRAMMES	ZONES	NOTES
	1. Variétés performantes adaptées (intensification)	Riz irrigué	Toutes	14 169
	2. Fertilité des sols	Riz irrigué	Toutes	12 360
*	3. Systèmes de culture (intensification)	Mil/sorgho/maïs *	Sud	11 859
	4. Techniques agronomiques d'intensification	Riz irrigué	Toutes	10 879
	5. Lutte intégrée contre les nuisibles	Riz irrigué	Toutes	10 371
*	6. Variétés performantes et adaptées	Mil/sorgho/maïs *	Sud	10 263
*	7. Lutte intégrée contre les nuisibles	Mil/sorgho/maïs *	Sud	9 792
	8. Techniques agronomiques appropriées	Maïs	Sud	9 538
	9. Variétés peu exigeantes	Maïs	Sud	6 438
*	10. Systèmes de culture (sécurisation)	Mil/sorgho *	Centre	5 788
*	11. Paquets techniques rentables	Niébé *	Centre	4 893

* Indicates projects to receive support through SPARC

Table F (4) - 1 (Con'd): PRIORITY RESEARCH PROJECTS IN IER CEREAL AND LEGUME PROGRAM

TABLEAU 20 (suite) LISTE DES PROJETS PAR PRIORITE (CEREALES ET LEGUMINEUSES ALIMENTAIRES)

PREMIERE PRIORITE

PROJETS	SOUS-PROGRAMMES	ZONES	NOTES
12. Consolidation du statut de l'arachide	Arachide	Toutes	4 743
13. Lutte intégrée contre les nuisibles	Mil/sorgho	Centre	4 444
14. Variétés performantes adaptées	Arachide	Toutes	3 986
15. Paquets techniques adaptés aux zones	Arachide	Toutes	3 499
16. Variétés performantes	Riz d'immersion	Toutes	2 364
17. Techniques agronomiques (efficience)	Riz d'immersion	Toutes	2 210
18. Fertilisation rentable	Riz de bas-fonds	Sud	1 879
19. Variétés performantes	Riz de bas-fonds	Sud	1 849
20. Lutte intégrée contre les nuisibles	Riz d'immersion	Toutes	1 642
21. Systèmes de culture (extension)	Mil/sorgho	Sud	1 426
22. Lutte intégrée contre les nuisibles	Riz de bas-fonds	Sud	1 154

TABLE F (4) - 1 (Con'd): PRIORITY RESEARCH PROJECTS IN IER CEREAL AND LEGUME PROGRAM

TABLEAU 21 LISTE DES PROJETS PAR PRIORITE (CEREALES ET LEGUMINEUSES ALIMENTAIRES)

DEUXIEME PRIORITE

PROJETS	SOUS-PROGRAMMES	ZONES	NOTES
23. Systèmes de culture performants	Céréales	Décrue	940
24. Variétés performantes et adaptées	Céréales	Décrue	868
25. Paquets techniques	Sésame	Sud	847
26. Valorisation des cultures nouvelles	Sésame	Sud	826
27. Systèmes de culture à base de riz	Riz pluvial	Sud	661
28. Lutte intégrée contre les nuisibles	Céréales	Décrue	569
29. Techniques de production	Fonio	Toutes	517
30. Amélioration variétale	Riz pluvial	Sud	509
31. Conservation de l'eau et du sol	Riz pluvial	Sud	480
32. Amélioration variétale	Fonio	Toutes	384
33. Lutte intégrée contre les nuisibles	Riz pluvial	Sud	377
34. Paquets technologiques	Blé	Nord	132
35. Amélioration variétale	Blé	Nord	130

TABLE F (4) - 2: PRIORITY RESEARCH PROJECTS IN IER ANIMAL PRODUCTION PROGRAM

TABLEAU 21 - PROJETS DE PRIORITE I

No	PROJETS	SOUS-PROGRAMME	ZONES	SYSTEMES D'ELEVAGE	NOTE
1	Techniques d'utilisation des résidus de récolte	Bovins	Semi-humide/Semi-aride	Agro-pastoral	50 123
2	Précocité des bovins	Bovins	Semi-humide/Semi-aride	Agro-pastoral	41 769
3	Techniques d'amélioration de la qualité des aliments	Bovins	Semi-humide/Semi-aride	Agro-pastoral	27 846
4	Introduction de la supplémentation chez les petits ruminants	Petits ruminants	Semi-aride/Aride	Pastoral	25 507
5	Rations alimentaires adéquates	Bovins	Semi-humide/Semi-aride	Agro-pastoral	25 061
6	Amélioration de la qualité de la viande	Bovins	Semi-humide	Agro-pastoral	21 441
7	Modèle d'exploitation des pâturages naturels	Bovins/Petits ruminants	Toutes	Tous	18 378
8	Schémas de sélection appropriés	Petits ruminants	Semi-aride/Aride	Pastoral	18 076
9	Amélioration du taux de fécondité	Bovins	Semi-humide	Agro-pastoral	17 901
10	Intervalle entre vêlages	Bovins	Toutes	Tous	17 901
11	Techniques d'utilisation du matériel génétique amélioré	Bovins	Semi-humide	Agro-pastoral	17 901
12	Couverture vaccinale des petits ruminants	Petits ruminants	Toutes	Tous	17 747
13	Pathologie de la reproduction des petits ruminants	Petits ruminants	Semi-aride/Aride	Tous	13 311
14	Pneumopathies des petits ruminants	Petits ruminants	Toutes	Tous	13 311

TABLE F (4) - 2 (CON'D): PRIORITY RESEARCH PROJECTS IN IER ANIMAL PRODUCTION PROGRAM

TABLEAU 21 (suite) PROJETS DE PRIORITE I

No	PROJETS	SOUS-PROGRAMME	ZONES	SYSTEMES D'ELEVAGE	NOTE
15	Causes de mortalité des jeunes petits ruminants	Petits ruminants	Semi-aride/Aride	Tous	13 311
16	Schémas de croisement des bovins	Bovins	Semi-humide/Semi-aride	Agro-pastoral	13 311
17	Schémas de sélection des bovins	Bovins	Semi-humide/Semi-aride	Agro-pastoral	
18	Amélioration de la fertilité des reproductrices	Bovins	Semi-aride	Pastoral	11 934
19	Pathologies des bovins ayant un impact sur la production laitière	Bovins	Semi-humide/Semi-aride	Agro-pastoral	11 934
20	Calendrier de déparasitage des petits ruminants	Petits ruminants	Semi-aride/Aride	Pastoral	9 800
21	Evaluation des races bovines locales	Bovins	Toutes	Tous	8 951
22	Paramètres de la reproduction des petits ruminants	Petits ruminants	Semi-aride/Aride	Pastoral	8 331
23	Cultures fourragères en milieu réel	Bovins	Semi-humide/Humide	Agro-pastoral	8 168
24	Maladies aviaires	Volaille	Toutes	Tous	7 983
25	Elevage des races exotiques	Volaille	Toutes	Tous	7 603
26	Méthodes traditionnelles de traitement du bétail	Bovins	Semi-aride/Aride	Pastoral	4 437
27	Biotechnologies de la reproduction	Bovins	Semi-humide/Semi-aride	Agro-pastoral	3 647
28	Rotations alimentaires petits ruminants	Petits ruminants	Semi-humide/Semi-aride	Agro-pastoral	2 466
29	Productivité de la volaille locale	Volaille	Toutes	Tous	2 281
30	Habitat	Volaille	Toutes	Tous	

TABLE F (4) - 2 (Con'd): PRIORITY RESEARCH PROJECTS IN IER ANIMAL PRODUCTION PROGRAM

TABLEAU 22

PROJETS DE PRIORITE II

No	PROJETS	SOUS-PROGRAMME	ZONES	SYSTEMES D'ELEVAGE	NOTE
31	Technologie de transformation et de conservation du lait	Bovins/Petits ruminants/ Camélins	Toutes	Tous	
32	Technologie de transformation et de conservation de la viande	Bovins/Petits ruminants	Toutes	Tous	
33	Schémas de croisement	Petits ruminants	Semi-humide/Semi-aride	Agro-pastoral	
35	Biotechnologie de la reproduction des petits ruminants	Petits ruminants	Semi-humide/Semi-aride	Agro-pastoral	196
38	Pathologie de la reproduction des petits ruminants	Petits ruminants	Semi-humide/Semi-aride	Agro-pastoral	769
39	Causes de mortalité des jeunes petits ruminants	Petits ruminants	Semi-humide/Semi-aride	Agro-pastoral	
41	Méthodes de lutte contre les pathologies non maîtrisées	Bovins	Semi-aride/Aride	Pastoral	920
43	Paramètres zootechniques des camélins	Camélins	Semi-aride/Aride	Pastoral	1 011
44	Substituts aux céréales dans l'alimentation de la volaille	Volaille	Toutes	Tous	2 251
45	Reproduction des camélins	Camélins	Semi-aride/Aride	Pastoral	1 011
46	Schémas de sélection des camélins	Camélins	Semi-aride/Aride	Pastoral	2 001
47	Amélioration du disponible alimentaire	Camélins	Semi-aride/Aride	Pastoral	

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TABLE F (4) - 2 (Con'd): PRIORITY RESEARCH PROJECTS IN IER ANIMAL PRODUCTION PROGRAM

TABLEAU 22 (suite)

PROJETS DE PRIORITE II

No	PROJETS	SOUS-PROGRAMME	ZONES	SYSTEMES D'ELEVAGE	NOTE
48	Pathologie des camélins	Camélins	Semi-aride/Aride	Pastoral	2 183
49	Amélioration des porcs	Caprelins	Semi-humide	Agro-pastoral	5 961
50	Schémas d'amélioration génétique des porcs	Porcs	Semi-humide	Agro-pastoral	1 892
51	Maladies des porcs	Porcs	Semi-humide	Agro-pastoral	2 271
52	Pathologies des équidés	Equidés	Semi-aride/Aride	Pastoral	301
53	Alimentation des équidés	Equidés	Semi-aride/Aride	Pastoral	358
54	Evaluation des races d'équidés	Equidés	Semi-aride/Aride	Pastoral	192
55	Amélioration génétique des races équines	Equidés	Semi-aride/Aride	Pastoral	345

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TABLE F (4) - 3: PRIORITY RESEARCH PROJECTS IN IER PRODUCTION SYSTEMS AND RURAL ECONOMY PROGRAM

TABLEAU19.6 **PROJETS (PAR ORDRE DE PRIORITE), PRODUITS, LOCALISATION ET ANNEE DE MISE EN OEUVRE PAR SCENARIO**
PROGRAMME : SYSTEMES DE PRODUCTION ET ECONOMIE RURALE

PROJETS	SCENARIO 1		SCENARIO 2			SCENARIO 3			SCENARIO 4			
PRIORITE 1 & 2	An 1	An 7	An 1	An 4	An 7	An 1	An 4	An 7	An 1	An 3	An 5	An 7
1. Filière céréales sèches et légumineuses/Mopti												
2. Filière céréales sèches et légumineuses/Niono												
3. Filière céréales sèches et légumineuses/Sikasso												
4. Filière céréales sèches et légumineuses/Sotuba												
5. Filière cultures industrielles/Sikasso												
6. Filière cultures maraîchères et fruitières/Sotuba												
7. Coordination filière/Sotuba												
8. Filière production animales/Niono												
9. Filière production animales/Sikasso												
10. Filière production animales/Sotuba												
11. Filière ressources forestières/Sotuba												
12. Filière riz/Mopti												
13. Filière riz/Niono												
14. Système systèmes de production/Mopti												
15. Système systèmes de production/Niono												
16. Système systèmes de production/Sikasso												
17. Système systèmes de production/Sotuba												

TABLE F (4) - 3 (Con'd): PRIORITY RESEARCH PROJECTS IN IER PRODUCTION SYSTEMS AND RURAL ECONOMY PROGRAM

TABLEAU9.6 PROJETS (PAR ORDRE DE PRIORITE), PRODUITS, LOCALISATION ET ANNEE DE MISE EN OEUVRE PAR SCENARIO
PROGRAMME : SYSTEMES DE PRODUCTION ET ECONOMIE RURALE

PROJETS	SCENARIO 1		SCENARIO 2			SCENARIO 3			SCENARIO 4			
PRIORITE 3	An 1	An 7	An 1	An 4	An 7	An 1	An 4	An 7	An 1	An 3	An 5	An 7
18. Filière céréales sèches et légumineuses/Gao												
19. Filière céréales sèches et légumineuses/Kayes												
20. Filière oleagineux/Kayes												
21. Filière productions animales/Gao												
22. Filière riz/Kayes												
23. Système riz/Gao												

TABLE F(4)- 4: OPERATING COSTS AND SOURCES OF FUNDING FOR SPARC PROGRAMS (1)

($000)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Cereal/Legumes Program							
Station and multi-locational							
Scientists	8	16	16	16	16	16	16
Costs	496	992	992	992	992	992	992
Food technology							
Scientists		1	1	1	1	1	1
Costs		62	62	62	62	62	62
Animal Production							
Scientists		2.25	2.25	2.25	2.25	2.25	2.25
Costs		140	140	140	140	140	140
Production Systems and Rural Econ							
Socio-Economic							
Scientists		4	4	4	4	4	4
Costs		180	180	180	180	180	180
Production Systems							
Scientists					8	8	8
Costs					360	360	360
Total operating budget level	496	1374	1374	1374	1734	1734	1734
SPARC/AID support (2)	200	300	400	500	500	500	400
GRM support (millions of FCFA)	153	205	267	267	267	267	265
GRM support ($) (3)	510	683	890	890	890	890	883

Notes: (1) Most recent ISNAR estimates (1991) for costs per researcher-year, including salary, are $62,000 for station research and $45,000 for systems and on-farm research.

(2) This item is the total USAID project support to SPARC operating costs (see Table II.G-2) less the average '$275,000 per year for operating costs of IER project coordination, short-term in-country training, short-term TA travel in country, and other project administrative costs.

(3) GRM contribution and USAID contribution total more than SPARC program requirements during first year because most programs to be supported by AID during LOP are not supported by AID, for project start-up reasons, during Year 1. These, however, are on-going IER programs and require some minimal level of funding, which the GRM provides, simply to survive and continue with some research. In addition, not all of the GRM contribution will be spent specifically on the scientists and research programs supported by USAID under SPARC. Additional scientific research support activities, such as station repairs or upkeep in the stations where AID is providing support, or complementary sorghum, millet, cowpea, animal production, food technology, or socio-economics programs supportive of the AID funded activities.

ANNEX F-5
TECHNOLOGY TRANSFER ANNEX

A. Effective Technology Transfer: Research-Extension Links

Introduction[1]

The goal of most strategies to link extension activities with commodity-based, thematic research programs is to improve rural well-being through the transfer of appropriate technological solutions to production problems.

Research-Extension strategies usually cover five important activities:

- The identification of extension themes that are superior to existing practices through on-farm testing within defined agro-climatic zones;
- Feedback to station researchers to permit judicious allocation of station resources;
- Training extension agents to conduct on-farm tests, and working with extension administrators to translate the results of on-farm tests into reliable extension themes;
- Getting farmer feedback concerning on-farm and extension themes as well as a description of the indigenous knowledge of the commodity in the agricultural system; and
- Improving methodologies for increasing the effectiveness of research/extension linkage, including:
  a. defining agro-climatic zones appropriate to different technologies,
  b. developing better methods for comparing on-farm test programs that reduce time and increase the reliability of technology transfer.

Current Constraints on Effective Research and Extension Links

There are several general constraints on effective research/extension linkages which affect the entire agricultural production system. Specific constraints are those which present opportunities for improvement under the SPARC project.

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[1]The working group for research and extension liaison was composed of: Makan Fofana, Agricultural Economist and Head of OHV/DRSPR; Jerry Johnson, SPARC project design Agronomist; Augustin Dembélé, USAID Extension Specialist; and Samba Traoré, Agronomist at Cinzana. This group met with individuals involved in research and extension in Sirakorola (in the OHV zone), Ségou, Mopti, and Sikasso. The group also met with the Head of extension for OHV, and World Bank and National Direction for Agriculture delegates involved in the National Agriculture Extension Project (PNVA). Augustin Dembélé's recent survey of adoption of agricultural technologies in Mali contains a detailed description of the organizations currently conducting technology transfer.

General constraints include:

1. Lack of existing on-farm test themes with production gains that justify more intensive on-farm testing and extension;
2. General lack of conviction that research can make a significant contribution to improved rural well-being;
3. Inadequate affirmative action for improving the well-being of rural women; and
4. Environmental and production problems that need to be addressed through a range of policy, institutional and research measures.

Specific Constraints:

1. Insufficient coordination between organizations at the regional level conducting research/extension liaison;
2. Absence of agro-climatic zonation (as well as socio-economic characterization) for adapting new technology to different physical and biological environments;
3. Inadequate knowledge needed for effective liaison;
4. Insufficient transportation and operating expenses for effective liaison;
5. Lack of defined liaison responsibilities in extension agent job descriptions; and
6. Centralized programming of on-farm test activities.

Discussion of General Constraints

1. Lack of existing on-farm test themes with production gains that justify more intensive investment in on-farm testing and extension

The six different extension agencies that operate in the areas to be covered by SPARC-supported research are making significant investments to increase rural well-being. The IER and associated projects are also investing heavily to create an agriculture research system that is worthy of continued investment. Adoptable extension themes which increase production must be developed in order to justify continued extension and research investments in these areas.

The impact of extension themes varies widely and a few good themes with a profound impact on rural well-being can 'pay' for the whole system. Nevertheless, the potential for existing extension and on-farm test themes to contribute significantly to improvement of rural well-being is often questioned. It needs to be understood that on-farm testing does not create research results. It is only a conduit for confirming, modifying, and transferring new technologies, and station researchers must seek to generate research results that can be translated into viable extension themes.

2. Inadequate affirmative action for improving the well-being of rural women

Building an effective system for liaison between research and extension necessarily implies specific attention to the role of women in the enhancement of rural well-being. Some Malian extension agencies have specific extension themes directed toward women's groups. Given the opportunity, several Malian women's groups have become especially creative entrepreneurs in agricultural production, transformation of agricultural products, and the development of underexploited local markets for agricultural goods.

Most extension agencies are sensitive to the need to create opportunities for women to identify and develop activities that will more fully manifest their potential as innovators and economic agents. The constraint to effective liaison between research and extension at this level is the absence of initiative within thematic research to respond to this need.

3. Environmental and production problems

The easy solutions to many production problems have already been tapped by research and extension. Outstanding problems like restoration of soil fertility within subsistence, low input agriculture systems requires a multi-disciplinary effort among highly-trained and highly-motivated researchers.

It was once thought that exotic cultivar screening would provide modest improvements in food crop yields. However, with the exception of cowpeas, exotic variety screening has not been a viable approach. Local variety collection, evaluation, and selection offer promising mid-term improvements, sound crossing and cultivar creation programs are needed to obtain solutions to a wide variety of crop improvement problems. The incorporation of Striga resistance, leaf diseases, and insect pests in good-quality, high-yielding sorghum, millet, and cowpea varieties will require a concerted, sustained effort by highly trained and highly motivated entomologists, weed scientists, pathologists, and plant breeders.

4. General lack of conviction that research can make a significant contribution to improved rural well-being

With few notable exceptions, food crop research has had limited success with generating research results that have widespread impact on rural well-being. There is a limited understanding of the role that a national agricultural research system should play. Externally-funded extension agencies too often seek to demonstrate impact on rural well-being largely to justify their existence and continue the flow of financial support. Some extension administrators may also feel that extension is "ahead" of research in addressing priority production problems.

Discussion of Specific Constraints

1. Lack of coordination between organizations at the regional level

On-farm testing is currently being conducted by several organizations within and between regions in Mali. EM/PV is SRCVO's unit for multilocational trials and on-farm testing in collaboration with extension agencies. All Malian extension agencies have divisions responsible for coordinating their programs with agricultural research. In one case, the OHV, farmers and extension specialists are also proposing on-farm test themes. The Farming Systems Research Department (DRSP) also conducts large numbers of on-farm tests. The Agrometeorology Service has also enjoyed notable success around Bamako with the application of precipitation probability to specification of optimum planting and weeding dates of local cultivars of sorghum and millet. Within the framework of the World Bank financed PNVA project in Ségou and Mopti, on-farm tests are generated by livestock and forestry researchers, in addition to those conducted by the PNVA and those proposed by collaborators within food crop research.

The multiplicity of on-farm testing efforts is not excessive nor does it represent overlap and duplication. Different organizations have different objectives and on-farm testing is simply the most appropriate multipurpose research/extension tool.

To exploit and disseminate positive technological improvements through this diverse assortment of research programs at the lowest reasonable cost, however, those involved in SPARC-financed research will need to assure clear and frequent communication, and coordinated, complementary actions with the various extension programs in their research areas.

2. Lack of agro-climatic zonation (as well as socio-economic characterization) for adaptability of new technology to different physical and biological environments

Technologies generated on research stations are rarely adapted to the entire range of environments for which they are intended. New high-yielding sorghum varieties may perform admirably in and around the station where they were developed. Yield performance usually declines as they are moved to regions with different soils, precipitation and insolation patterns, insects, diseases, and weed pests. Recommended chemical fertilizer rates based on station response trials are often rendered almost meaningless to the farmer who wants to know how much manure fertilizer should be applied in his field under different crop and soil environments. Sociological and economic considerations further challenge those responsible for providing farmers with reliable recommendations to optimize basic crop commodity production.

Farming systems research has addressed some of the socio-economic subdivisions necessary for focusing research priorities on felt needs of subsistence farmers, but little has been done to characterize the physical and biological zones and prioritize commodity research within regions for different technologies.

3. Insufficient range and depth of technical knowledge necessary for effective linkage

The off-station researcher is expected to be polyvalent with a good grasp of breeding, agronomy, soil science, plant protection, and extension for multiple commodities. In reality, the ability to work with, and learn from other scientists, extension specialists, and farmers is probably the most important skill. It is felt that they could be more effective if they and their extension counterparts had a better command of each of the station disciplines as well as a sound understanding of systematic experimental design and analysis.

4. Insufficient transportation and operating expenses for effective liaison

The multilocational testing unit (EM/PV) at the national level has been deprived of all but sporadic financing since SAFGRAD discontinued support to on-farm testing in 1985. A patchwork of personnel and operating expenses has saved this cell from complete dissolution, but has inhibited them from playing a dynamic role in technology transfer. However, a well-coordinated EM/PV regional unit has been operating from the Cinzana station during the past four years.

Multilocational trials are normally conducted under controlled off-station conditions with the objective of sampling physical and biological environments not found on stations. They are usually small-plot replicated experimental designs that are considered too complicated to be conducted on farmers' fields. Only recently have check plots included farmer practices and low fertility levels.

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Traditionally, IER researchers have argued that, for reliable variety or agronomic practice recommendations, three years of multilocational trials and three years of on-farm testing of new cultivars are needed before seed multiplication and release of cultivars to extension. As one extension agent observed, "people could die before a new variety is released from research."

The key to reducing the amount of time necessary to release a new variety is to increase the number of multilocational and on-farm testing locations. The same principles of reliability, sample size, and staging of adaptability can be applied to non-varietal technology transfer from research to extension. The constraint is that increased testing locations requires more vehicles and operating expenses.

In the areas covered by SPARC project activities, every effort will be made to assure that, as part of the proposed regionalization of research, numerous EM/PV networks, dispersed carefully within each region, will be created. Such networks could be restricted to 10-15 km radius and could be serviced cheaply and efficiently by motorcycles rather than vehicles.

5. Lack of incorporation of liaison responsibilities in extension agent job descriptions

It is not uncommon for multilocational and on-farm testing agents to find that joint testing programs have been designed at the national or regional level and then passed down for implementation. This practice runs contrary to the intent of on-farm testing. The extension agent is usually the contact person for the on-farm testing team and is expected to recruit a collaborating farmer, explain the requirements of the test, transfer the test inputs to the farmer, supervise seeding, collect rainfall data, regularly visit the test, and supervise the harvest. Obviously, the most important player in a large on-farm testing program, other than the collaborating farmer, is the local extension agent. Administratively, however, the agent often has little to gain from good collaboration and can risk a great deal if the test fails even though he has not participated in the design of the test and may not even be in agreement with its objectives.

This uneasy cooperation between research and extension has led to the sentiment among some extension agents that the tests are for research, and that their mainstream extension activities are more important. The percentage of successfully completed tests is affected and the quality of the information provided by the test is compromised when testing activities are not a programmed part of the job description of the extension agent and integrated into the evaluation procedure for extension agent performance.

The decentralized testing networks in the SPARC project will allow more time for the EM/PV agronomists to supervise their trials and have closer local ties with DRSP and extension agents.

6. Centralized programming of on-farm test activities

There is a tradition of planning multilocational trials and on-farm testing programs in concert with national extension leaders during research meetings in Bamako. Some extension agencies complain that experimental designs, varieties, and other new technologies advanced to on-farm tests are inappropriate to regional agroclimatic zones or are not based on priority problems determined at a regional level. The local extension agent is less enthusiastic about close cooperation when the test themes are only tangentially related to more important production constraints. The test becomes an obligation for the farmer and the extension agent and not an instrument for technology transfer.

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Evaluation of the Effects of the IER Re-organization upon Research/Extension Linkages

IER re-organization is oriented around the following changes:

- regional financial and scientific autonomy;
- redistribution of researchers from Bamako to four regional research centers (six regional centers eventually);
- supervision of regional research activities and financing by regional committees;
- a single head of regional research at each center for all research (IER) disciplines (including a farming systems team at each center);
- national support for disciplines (like macroeconomics) that are required periodically in all regions; and
- a new organization chart suggesting new administrative relationships between national headquarters and the regions as well as program leaders for commodity research across regions.

Decentralization and regionalization may address many of the constraints on effective research-extension relations. More regionally defined research priorities, based on a systematic diagnosis of commodity production constraints, will be an advantage over the existing system. More station researchers can be involved in the multidisciplinary task of defining researchable constraints for each commodity. One head of regional research should ensure the interdisciplinary nature of research activities within a region. Strong professional bonds can be built among researchers and extension agents working in the same region toward similar development objectives. Regional oversight committees will be able to generate publicity for the research center and may even be able to encourage regional financial support for key research activities. In some respects, regionalized research activities may be less costly than nationally-run programs, and create an improved capacity to respond to significant regional agricultural opportunities, With a single head of regional research, the liaison responsibilities of the multilocational testing, farming systems research, and others could be precisely defined so the extension agencies in the region would deal with a single representative from research. Regionalized researchers could have a more profound effect on extension activities by sharing their commodity expertise with agents during monthly training sessions of extension specialists.

However, there is some risk that the proposed regional center complete with a director, accountants, secretaries, drivers, technicians, a five-member farming systems team, and four or five thematic researchers will impose a heavy financial burden on the Malian government. The administrative tasks associated with daily operation of a regional research center could deprive research of scarce talented Malian researchers. There is also some risk that research/extension linkage, like other research activities, could be deleteriously affected in the long run.

Efforts must be made to keep a cap on contractual hiring for support positions and the recruitment of new researchers to a fill staffing requirements at new regional centers. The redistribution and training of existing IER staff, including researchers responsible for liaison, must be adhered to as strictly as possible. The delegation of essential responsibilities to higher trained, more motivated, better remunerated, and more highly capitalized thematic researchers should apply to off-station researchers as well as to other thematic researchers.

Options to Establish Effective Linkages for the Commodities Supported by SPARC

Effective liaison will depend upon successful implementation of core activities of the SPARC project:

- Market studies for SPARC commodities that lead to stable crop demand and higher market prices;
- Successful re-organization of extension in DRA Ségou and Mopti via the PNVA project for effective transfer of appropriate technologies. Incorporation of women into extension activities;
- Successful solution to some of the difficult environmental and production problems via the student/researcher mode of training and implementation of research.
- Successful station research leading to viable on-farm test themes;
- Successful agroclimatic zonation (and socio-economic characterization) for SPARC commodities;
- Successful regionalization of research activities during the life of the project.

The three options for successful linkage between research and extension include:

- Adapting the existing system to a regional research center;
- Delegation of responsibility for all off-station research to Farming Systems Research within each region;
- Reinforcing multilocational trial capacity in SPARC project areas and delegation of on-farm testing to Farming Systems Research within each region.

The existing system fails to coordinate scarce liaison resources into a coordinated, well-defined system for technology transfer. There is an overlap of functions performed by EM/PV and FSR. In the Sikasso region, the objectives of farming systems research are very similar if not identical to those performed by SRCVO's EM/PV unit. Adapting the existing system would propagate the confusion of roles and detract from the overall objective of better focused, more responsive, and less redundant regional research teams. Many of the constraints identified above would persist.

The second option implies abolishing the existing unit for multilocational trials and on-farm testing and the allocation of all off-station research to the farming systems research teams at each region. This option is unsatisfactory because thematic researchers must have access to off-station environments to test new technologies and adapt them to agroclimatic zones which are not represented on stations. In addition, FSR teams may have a different agenda and may not be able to assume the responsibility for all off-station research. In the absence of effective FSR, the linkage system would be worse than what actually exists. This option also fails to address some of the important constraints and would essentially only shift the responsibility for technology transfer from thematic research to FSR.

The third and most attractive option for improving the linkages between research and extension would strengthen multilocational testing for SPARC commodity technologies at each regional research center and delegate all large-scale on-farm testing activities to the farming system team in each region supported by the SPARC project. This will involve the coordination with farming systems research to conduct surveys, collect environmental data, and analyze of environmental variables responsible for agroclimatic zonation of SPARC commodities within target environments.

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Collaboration with other entities within and outside of IER (PIRT, Agrometeo, hydrology, IPR) will also be useful in order to bring full Malian expertise to bear on the process of agroclimatic zonation.

This program would be implemented through 10-15 multilocational trials in a limited radius of the regional research center. Highly motivated and competent off-station research technicians would staff the stations and sub-stations in different agroclimatic zones of each region and would conduct these trials with collaborating farmers in the surrounding area. Trial design, procurement of trial inputs, analysis and reporting of results would be coordinated at the regional center.

Such localized off-station research would be inexpensive in comparison to the existing system which requires considerable vehicle use in travel from a national or regional center to different agroclimatic zones. Sikasso and Sotuba regional centers would integrate the existing farming systems teams in these regions and delegate responsibility for on-farm testing to them. A new team is in the process of being installed in Mopti and would be integrated into the regional research center and plans are underway for a farming systems research team for the regional center at Niono. Limiting SPARC support to strengthening multilocational testing is consistent with the concept of support to thematic core commodity research without dilution of project impact by extension into large scale on-farm testing requiring considerable resources.

The SPARC project will concentrate project resources on doing well what thematic researchers do best and solve some of the difficult environmental and production problems that face Malian agriculture.

B. Effective Technology Transfer: Private Sector Opportunities

The recent political and economic changes in Mali have spawned an impressive number of small private agricultural businesses. Many of these small firms serve agricultural producers or transform and add value to agricultural produce. During the implementation of the SPARC Project, it would be useful to examine how the IER might establish and maintain collaborative links with private sector firms in the agricultural business. The payoff in technology transfer may be as great, if not greater, than similar relations with extension services.

The private sector is active in evaluating and making recommendations for:

- New pesticides
- Seed varieties
- Natural phosphates
- Innovative milling
- New food products

New Pesticides

As private sector companies bring new pesticides to the market in developed countries, a few of those products are targeted for developing countries. It is important that Malian farmers are given timely access to new, efficient, and safe pesticides that are profitable and ecologically friendly.

Traditionally, IER has pre-tested and screened pesticides for two to three years before they making them available to farmers. Private firms have usually fully financed this testing. There may be opportunities during the SPARC Project to encourage and expanded this relationship.

Seed Varieties

Until recently, only commercial "European" species of vegetable seeds have been sold in Mali. Recently there have been isolated cases of local okra seed and early variety cowpea seed being produced as seed per se and sold as seed per se rather than as grain for consumption. A commercial seed sector may gradually emerge in Mali. As this sector evolves, the IER should be in the position to provide pure foundation seed via the government seed agency (OPS) to individuals desiring to service farmers with quality seed. In the scope of the present project, cowpeas will probably be the initial crop to be widely sold as seed.

Natural Phosphate (PNT)

Tilemsi Phosphate has been commercially available for over 10 years and production is reaching the capacity level of the present mining/crushing infrastructure. Composting techniques, including PNT are now being tested by IER. As these techniques and application dosages become known during project implementation, contact should be made with major PNT merchants.

Innovative Milling

The Food Technology Lab received an IDRC experimental abrasive "roll over" dehuller in 1980. Initial tests indicated excellent potential for dehulling fonio, pearl millet, and sorghum. This prototype could serve as a conceptual basis for small milling technology in Bamako and eventually all market centers where mechanical milling is available. Contacts with appropriate institutes and persons should be explored in the course of project support for the Food Technology Laboratory.

Innovative Foods

The potential for this area is enormous and is discussed in detail in the technical analysis on the Food Technology Laboratory.

ANNEX F-6: SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

This analysis identifies the stakeholders who will benefit from the assistance to be provided by the project. The analysis then examines the setting for agricultural production in Mali. Smallholder production objectives, strategies, organization, and constraints are described. Opportunities for focused research to address farm-level and institutional constraints and to thus generate improved technical packages or components thereof are discussed, as are incentives and other means by which institutional efficiencies and economies of scale can be achieved. The importance of involving farmers in the identification and testing of promising technology is cited as a key element which will govern the success of the project.

Two basic strategies--participation and communication--are suggested for overcoming or mitigating constraints to smallholder involvement in the research program. The need for complementary research and for effective collaboration among several institutions is cited. An encompassing theme is the importance of female producers to the rural production system and to the well-being of the Malian production unit.

The impact of agricultural research on the Malian economy will depend on the generation of appropriate improved technologies to make farming more productive and profitable for smallholders. The superiority of potential technical packages or production components must be demonstrable at the farm level so that the inherent skepticism of the smallholder can be overcome.

Success in producing suitable technologies will depend on establishing good communications with farmers--male and female--to learn their views on what constraints need to be overcome. Concomitantly, the adoption of new technologies by farmers requires an effective system of extension to provide production assistance but, more importantly, to monitor and evaluate smallholder assessment of technology.

Social scientists will play an important role in facilitating communication between farmers and researchers by surveying villages to identify villages and farmers who are receptive to new ideas, by talking to farmers near research stations to identify their particular constraints and communicating their findings to researchers, by working with extension agents on effective methods of presenting new technologies to farmers, by monitoring farmers opinions of new technologies through periodic interviews, surveys, and meetings with farmers, village leaders and organizations, extension agents, and commodity research scientists.

Mali is a culturally-diverse nation inhabited by a large number of ethnic groups who have worked out complex systems of living

harmoniously with each other, regulating access to farm and range land, and adapting to cyclical demands of ecological disaster. The apparent homogeniety which meets the untrained eye is deceptive. Each of the 10,000 villages in Mali can be unique in its history, its internal and external social and ethnic relations, its ceremonial and religious traditions, its organization, and propensity to accept new ideas and adopt new technologies. Social scientists engaged by the project must treat each village individually. Inquiry cannot assume that agricultural practices, constraints, and opportunities are generic to a group or an area.

II. BENEFICIARIES

A. PRODUCERS

Farmers

Farm families will benefit from agricultural research by increased production of staple and cash crops. This will provide them food self-sufficiency and cash for other expenses. Women farmers will also benefit from more food for their families and increased income and status. Cash crop production in the agricultural sector will attract more young men to participate in farming, rather than leaving to find wage employment in the urban areas. This appears to be happening to a certain extent in the Haute Vallee and the CMDT area. Any reversal of the rural to urban labor migration will be beneficial to the national economy.

Research on forage crops will allow smallholders to keep animals nearby and benefit from their production of meat, milk and income.

Women

Rural women play an important role in the commercialization of cereals at the household level and their incomes will benefit by increased production. Women sell grain in the village markets to meet the financial needs of the household. They sell their produce and grain by measure rather than weight, so these internal village prices are not necessarily the same as the prices for which a man sells grain to a collector. It has been pointed out that women are often selling grain at a lower price than men. Now that the GRM is periodically publishing the current grain prices around the country, farmers can choose their best market outlet.

Village women's groups may buy grain mills where the women can pay to have their grain ground, saving them much time and labor. The transformation of grains in the household is traditionally assigned to women. This involves removing the hull, winnowing, and then producing flour which is used in cooking. Most Malian women use a mortar and pestle for this, spending several hours a day pounding enough grain for the day's meals. In urban areas and increasingly in some villages, mills are available where women have their grain ground. The operators of grain mills can also count on having an

increase in business, as women have access to more cash.

B. CONSUMERS

Consumers will have an increased supply of grain available at more stable prices, which will improve the nutritional status of the community. The production of value added foods will give women the option of a grain food product which requires much less time and energy in preparation than unprocessed sorghum or millet. The millet cowpea composite flour infant weaning food will have in impact on child nutrition and mortality. Healthier children are easier to care for, and can result in a lowering of the birth rate, saving a great deal of the energy that women expend on childbearing and child rearing. Relieving women of some of their time spent on food preparation and child care will free them for other productive activities.

C. RESEARCHERS

Support for IER

The SPARC project will directly benefit those Departments within IER involved in the implementation of agricultural research and extension. Agricultural research will be supported on those commodities (such as millet, sorghum, cowpeas and forage) accorded priority through a collaborative and iterative research prioritization process involving IER researchers and administrators, USAID/Mali, and the SPARC Project design team.

Researchers at the stations and in the labs will have the means to conduct research.

Training

IER has personnel who can benefit from the advanced training opportunities the SPARC project offers. The personnel already have basic training, knowledge of Malian agricultural issues, of agro-ecological and ethnic differences, of major crops grown in each area, of sociological issues related to social division of labor, and other responsibilities between men and women, young and old, of basic knowledge of state and traditional land rights and of consumer tastes and preferences.

IER has only a few women employees, and these should be given the opportunity for further training. More women will be employed by IER throughout the organization and will have opportunities for long and short term training.

Food Technology

The development of products by the Food Technology Lab will open up

a new area of industry in the processing of food grains to produce value added foods, such as rice substitutes, and weaning foods.

D. MERCHANTS

Increased production will help assure stable supplies of food grains. Grain merchants, from the wholesalers to the retailers, will have a more stable market. There are several levels of merchants: collectors, large wholesalers, small wholesalers and retailers. Collectors go to the rural markets to buy cereals. They are usually financed by large urban wholesalers, who remunerate them according to the quantity and price of cereals. These large wholesalers have their own trucks for transport. Smaller wholesalers are the distributors of cereals bought from the large wholesalers. The retailers who buy from the small wholesalers have the least security of all the merchants. In general, the relationships between the different types of merchants are personal and informal.

III. THE PRODUCTION SETTING

A. OBJECTIVES AND STRATEGIES

Farmers' Goals

Farmers study the ecosystem and each farming system is geared towards the accommodation of this complex ecosystem of uneven and unpredictable rainfall, varied soil types, and plant disease and parasites. The small farmer has developed - through the experience of having to operate with limited resources and therefore limited alternatives - a system of resource allocation, cropping patterns and cropping technologies that emphasize heterogeneity. It is this heterogeneity that enables the farmer to spread risks so that farming becomes economically viable. The heterogeneity that is referred to here includes planting different grains or different varieties of grains which have different rainfall and sunlight requirements, varying maturity, and intercropping other crops with the grains.

There is a difference between the strategies of men and women. The male seeks to obtain maximum yield from his fields both for auto-consummation and for cash. The woman is planting a large variety of vegetables to provide the family with the daily food requirements. This diversification provides the family with a varied and nutritious diet. Excess vegetables are sold in the market, but they supply a very small income.

Smallholders need cash to pay taxes, to pay for marriages and funerals, to buy agricultural equipment, seeds and fertilizer, and for other various requirements. Often the income generated from agricultural production is not enough to make buying agricultural inputs profitable. If the farmer has to buy the inputs on credit

he may be forced to sell produce immediately after harvest, when the prices are poor, in order to repay the credit. Later on in the year, if his grain supplies run low, he has to buy grain at very high prices to feed his family.

The farmer also has limited labor. If he has to choose between a more labor intensive technique or extending the area of land he cultivates to increase production, he will choose the alternative that requires the least labor. There is a certain status associated with cultivating a large farm; that farmer is a "hard worker", and if he has a poor harvest it's viewed as bad luck, not lack of inputs.

Livestock Production Goals

Smallholders keep livestock to provide milk, meat and skins for their own use and to sell. Livestock are also a form of investment or savings of wealth and are exchanged among farmers. The animals may be kept near the household during much of the year, being penned up in a corral at night and left to wander freely during the day with a herdsman to watch them. But during the agricultural season the animals have to be kept out of the fields of the farmer and his neighbors.

Many farmers who have contact with pastoral peoples consign their herds full time to a herder, who moves them away from the cultivated area during the growing season to pasture them on rainy season Sahelian grasses and keep them away from the cultivated fields. The herder receives milk and some of the young animals as payment for his labor in pasturing and watering. The owner is responsible for any costs such as cattle taxes or medicines. The farmer may have the animals graze the stubble in his fields after harvest and manure the ground.

There are several reasons why farmers prefer to have the animals pastured elsewhere except after harvest. The financial and labor costs of watering and feeding cattle are too great. The costs of keeping the cattle out of the fields during the growing season, and the fines if the cattle damage a neighbors field, are very high. Farmers feel that they maximize their cash profits by growing and selling crops rather than by feeding livestock with the produce of their fields which competes for production resources with other farm crops.

B. ORGANIZATION OF PRODUCTION

Village Receptivity

About 70% of the Malian population are rural smallholders who grow cereal grains and keep a few animals (goats, sheep and cattle). Among smallholders the predominant ethnic group is Bambara who are concentrated around Segou and scattered throughout the Second Region. Other important agricultural groups are the Malinke in the

Haute Vallee, the Senoufo and Minianka in the Third Region, and the Dogon and Songhrai in the Fifth region.

Because of the historical mobility of the many groups who live in Mali, one cannot easily characterize the people of an area. Ethnicity, occupational caste, religion and other factors give villages in Mali distinctive characters. A village in the Haute Vallee may have a majority of Bambara inhabitants, along with some Soninke and a few sedentary Peul. Neighboring villages may be predominantly Soninke, or Malinke or sedentary Peul. When other variables such as religion are added, it is apparent that no two villages are alike and may respond differently to new ideas.

In the Third region, the CMDT extension agents find noticeable differences in the agricultural roles of men and women, and in receptivity to the agents. Senoufo, Minianka and some Bambara women work in the family fields with their husbands. Gana women and some Bambara women do not help with the cultivation of the family fields, although they carry food to the fields for the men and they do cultivate their own fields. Agents report that the Gana and Bambara women are more open, and easier to work with than the Senoufo women.

The dynamism and willingness of a village to work with extension agents depends not only on the ethnic mixture of the village, but also on the personalities of the village elders and council, and the existence of village organizations. Younger men who are interested in new technologies have little power in the village council. In meetings with farmers, the more powerful often dominate discussions presenting their own problems and views, while others' views are never aired. To balance such group discussions, extension agents should have conversations with individual farmers away from a group or on their farms.

Grain Production

Millet and sorghum are the major cereal crops grown throughout the country and are the staples of the Malian diet. Maize is also grown in the more humid southern regions and because it can be harvested earlier than other cereals, it plays an important role in meeting nutritional needs during the hungry season. Cotton is a major cash crop in the Haute Vallee and the CMDT region.

Although there are exceptions, in many villages both men and women participate in the cultivation of the family's grain fields. Men clear and hoe the land and women sow the seeds and help with weeding. Participation in harvesting varies in different villages and with different grains. Men cut the corn stalks and women break off the ears of corn and carry them to the granaries for storage. Commonly, men cut the millet and sorghum stalks and heads and thresh the grain, and the women winnow the grain and carry it to the house for storage in the granary. After threshing, the women are allowed to pick up the grains left on the threshing floor at

the end of the day, and use it for their personal incomes.

The head of the household (the eldest male in the extended family) controls the use of the grain stored in the household granaries. He determines and measures out the daily quantity of grain which the women prepare for the family's meals and he may sell bags of grain to pay for taxes, marriages or other financial needs. The man is generally responsible for providing the staple grain for his family.

Women's Tasks

Women are involved in multiple work roles: agriculture, child-care, carrying water, searching for firewood, gathering non-cultivated foods, cooking, processing raw-materials and home maintenance. They may be allocated a small parcel of land on which they grow rice, cowpeas, groundnuts, sorrel (dah) and other secondary crops. Women also cultivate vegetable gardens in both rainy and dry seasons, and are responsible for providing the ingredients for the sauces served with the staple grain dishes. The staple grains provide the bulk of the diet and most of the calories and an important proportion of proteins and B vitamins, but they are inadequate without the nutritionally complementary ingredients which make up the sauces and which are provided by women through their gardens and gathered tree products. The traditional dishes eaten on a daily basis, do not contain large amounts of meat, but get their protein content from a combination of vegetable proteins along with small quantities of dried or fresh fish, meat or poultry. Some of the most important vegetable protein sources are fermented locust bean (sumbala), peanuts, cowpeas, various green leaves (including baobab), and fermented sorrel seeds (dahtu). These are also important sources of iron and calcium, which are otherwise scarce in a diet which doesn't include much meat and milk. The assortment of vegetables in the sauce must also provide a complete array of vitamins and other minerals which are not found in the staple.

Although women's gardens do not seem important on the national economic level, they are very important from the nutritional point of view. Just as there often occurs a shortage of grain during the hungry season, there is also a shortage of garden vegetables at this time because of lack of rainfall, limiting the ingredients for the sauce to those which have been dried and stored, such as dried baobab leaf powder, dried okra, fermented locust bean, fermented sorrel seed and dried fish.

Food preparation is labor intensive and requires many hours of labor by the women each day. A number of different dishes are prepared from sorghum and millet, and certain varieties are used to make beverages. If the grain was stored on the stalk, it must be threshed and winnowed before beginning the process of turning it into flour by pounding the grain in a mortar and pestle and winnowing again to remove the husks. The grain is then pounded and sifted to produce flour. The flour is cooked with boiling water

and lye (locally made from millet or sorghum stalk ashes), while stirring vigorously to produce a gelatinous porridge, to, which is eaten with a sauce for the main meal. The lye increases the nutritional value of the amino acids (proteins) in the grains, and Malian people say the grain is more satisfying to eat. The flour may also be worked into pea-sized balls with a little water, and this is then cooked as a breakfast porridge.

Women typically pound grain in the morning for the noon meal, and pound grain in the afternoon for the evening meal and breakfast. The work is very strenuous and time consuming and just one of a number of daily chores that girls and women must perform. Research has suggested that the effect of the intensive labor may be to retard the growth in height of village girls, while increasing the width of their shoulders and the size of their biceps. Growth retardation has implications for women's health and childbirth complications.

Cowpea Production

Cowpeas have been traditionally grown by men and women farmers and used in southern Mali, and their use in intercropping is increasing in central Mali. Farmers recognize the value to the soil of intercropping cowpeas with millet or sorghum, and will be receptive to new technology in this area. Farmers have problems storing cowpeas because of insect damage. This discourages them from increasing production, and limits possible storage time, preventing farmers from selling when the market prices would be at their highest. Project marketing studies and interventions will promote export of cowpeas to neighboring countries.

Animal Production

Many farmers keep a few cattle and small ruminants. Cattle have great value and are exchanged by the head of the family during marriage arrangements. Aside from the beef sold in markets, cows are only killed and eaten at important ceremonial events, such as the funeral of a prominent person. Local consumption of meat is more likely to be goat or sheep than beef.

Women have managerial responsibility for the sheep and goats penned near the house and fed on household refuse and nearby forage. Small ruminants have several advantages over cattle: they mature and reproduce more quickly; they require less water and can eat village refuse, kitchen waste and any vegetation; they can be consumed by a few people without spoilage; they are easily sold for cash; and they can be herded by small children. Goats are of special interest because they survive droughts better, they can survive on browse species when the annual grasses have been consumed, allowing them to remain in the permanent residential areas during the entire year. The goat is an efficient converter of low quality feed into high quality protein. They may be the only source of milk in the dry season when sheep and cows have been

sent elsewhere to graze.

Growing forage crops could increase this economic sphere of women, giving them more income and greater status.

C. FARM LEVEL CONSTRAINTS

Erratic Rainfall

Millet and sorghum are the major crops in Mali, both in terms of land area and use as food. There are many different local varieties recognized by farmers for their characteristics of length of maturity, drought resistance, pest resistance, yield, and suitability for food or beverage preparation. In each agroclimatic zone, farmers have a number of local varieties of grains which will produce under varying rainfall conditions. In the higher rainfall zones maize, sorghum and millet can be planted. Each having different requirements for rainfall, and length of time to maturity. They may not all do well, but the varieties requiring the least rainfall will at least produce something in a drought year. The immature maize will be harvested early to provide food after the previous year's store is depleted.

In the lower rainfall zones a farmer may choose to plant millet and sorghum varieties that have different moisture requirements so that some will mature no matter what the rainfall. But these varieties are not very high yielding when rainfall is good, so he sacrifices the possibility of a large harvest, for the assurance of a modest harvest if rainfall is poor.

Labor Constraints

Lack of sufficient labor is often cited as a constraint, creating bottlenecks at times when intensive labor is required for planting, weeding or harvesting. The labor shortage caused when young people leave their villages to seek jobs in urban areas or other countries is an established tradition. Some travel seasonally and return to help with the agricultural work, but others stay away for several years and send money home. An increase in production resulting in cash income for laborers could slow the out-migration. In some areas the labor force is reduced because of diseases such as onchocerciasis. And there are other activities which compete for the farmer's time, such as hunting and gathering in the Cercle of Yanfolila.

Farmer's View of Production Inputs

Farmers are reluctant to buy agricultural inputs because it is difficult for them to earn enough cash from the sale of produce to cover the cost of inputs plus their other cash needs. Grain prices are often not high enough to make a profit, especially soon after harvest. Aside from the ability of the farmer to pay for inputs he often finds that they are not available when he needs them.

Agricultural equipment has sometimes been erratically introduced without advice to the farmer as to how to best utilize it, and without enough research. Another problem is that the animal traction equipment that is available is not adapted to the Trypano-resistant N'Dama cattle.

Crop Pests

Pests are very damaging to the crops, and farmers combat them in a variety of ways. Farmers recognize that Striga increases in a field after it has been planted in the same crop for several years, and they interpret the presence of the plant as a sign that the field fertility is exhausted. They will leave the field fallow if possible, or plant a different crop. This reduces the Striga population temporarily. It is, however, becoming more difficult to leave land fallow, as the human population increases.

Birds also take a heavy toll on crops near harvest time, and farmers try to avoid planting varieties which will mature at the same time that many birds are known to arrive in the area. This cannot always be avoided and children are sent into the fields to scare away the birds during the day. Platforms are also built in the fields so that someone can stay there day and night near harvest time to protect the crop from damage by birds and other animals.

In southern and western Mali hunters kill some of the more damaging animal pests such as the phacochere, monkeys and baboons. One farmer near Kita had the tails from a hundred phacochere that he had shot in his fields. The meat of the phacochere is eaten by animist Malians, although Muslims say they don't eat it.

Storage Problems

Mice, rats and insects can destroy much produce during storage. Farmers construct granaries of designs which are specific to their locale. Granaries are typically raised up from the ground on a log platform and have a base made of special resinous cedar-like woods, to discourage insect and rodent damage. The walls of mud blocks or mud and wattle are plastered with a mud and green cow dung mixture which is resistant to termites. The granary is topped with a conical thatched roof and has a small door high up on the side. A carved wooden door lock with an iron key insures that only the head of household has access.

Insects are a special threat to cowpeas, damaging them so extensively that they can only be stored for a few months. This means that cowpeas are only available for a short time, and then the cowpea shortage causes market prices to rise. Thus one of the important protein sources is unavailable throughout much of the year.

Women's Constraints

Women face special constraints because they have limited access to land, small parcels of which are usually allocated to them by their husbands. Women also have limited access to labor, since most family members work in the family field. The pervasive illiteracy rates of rural women restricts their access to information, such as new technologies and the current grain prices that are published by the GRM. Information they do receive about new technologies is usually passed to them through their husbands, and may have lost its accuracy in the transmission. Women do not have access to equipment when they need it, and may have to rent it even if it is owned by the head of the household, or borrow it from a relative, for example, a brother. They also have no access to inputs such as compost produced in the household, because all these are controlled by the head of the household.

With all these constraints and the other demands on their time, women have difficulty increasing production in their fields and gardens. This is unfortunate because nearly all a woman's production and income is used to feed, clothe and provide medicine for her family.

IV. FEASIBILITY AND IMPACT OF SPARC PROJECT

A. OPPORTUNITIES

Benefits to Producers

Increased Incomes

Malian farmers are open to new technologies and will adopt technical packages which will increase their production without unacceptable risk. At the Cinzana millet research station, farmers come to request seeds and inputs for the crops that they see growing on the station, even though these may not be ready for extension. An increasing number of farmers own traction animals which would allow them to apply recommended techniques. New crop varieties and technical packages produced by research will increase farmers' production and income. Increased income will be reflected in improved quality of life (food self-sufficiency, better nutrition, access to family planning, vaccinations and health care and education).

Farmers employ risk-avoidance strategies to ensure that they will have at least a minimum production if rains fail, but those strategies do not allow them to maximize production when rains are good. Farmers often increase area of land cultivated rather than buy inputs to intensify cultivation on smaller areas. The greatest need is for plant varieties that are well-adapted to the environment--drought, pest and disease resistant and technologies that are appropriate to the farmer's needs without increasing labor requirements. They must also have qualities for cooking,

conserving, color, texture and taste that are acceptable to the population. Research programs can develop drought resistant varieties that will produce adequately with poor rains and better with good rains. They also need to test resistance to various pests and diseases.

Some ecotypes of millet and sorghum have been recently selected and improved and are now being tested on farms. There is also promising work in crossing and using nurseries against diseases. Effective insecticides are available and certain varieties are available which are more resistant to insect attacks. The Cinzana research station has been working on a quarantine method to prevent the spread of mildew and carbon. Some resistant varieties of millet are known, and there is a seed treatment against mildew. Intercropping and fertilizer use have reduced Striga in millet. Since finding that one of the new high yielding sorghum varieties did not have eating qualities that were acceptable to the Malian consumers, one of the first criteria has been the aptitude of the grain to make a good traditional dish. The Cereal Technology Lab at Sotuba was created to test these qualities, and also for a program of diversification of uses of millet and sorghum. They have been successful in developing a sorghum variety which has acceptable cooking qualities and is more resistant.

Market prices for produce have to be high enough to allow farmers to make a profit. Research focused on the market system will find ways to increase marketing efficiency, thereby increasing market volumes and lowering transport and marketing costs through economies of scale, and increasing benefits to both producers and consumers.

Reduced Labor Requirements

Women also grow smaller fields of grains, and can benefit from extension services. Extension work with women will contribute to an improvement of their condition of life, through the availability of resources, like grain mills and wells, which will alleviate their work load. The economic benefits of mills must be considered in relation to the amount of time and labor they save women, and the effects on their health. The same time could be spent on other chores, cultivation or child care with benefit to the family.

Extension agents will work with village associations (AVs) which can be used as the basis to organize men's and women's groups to promote literacy, form credit associations, promote agricultural extension themes, or for other purposes. DHV and CMDT have both used village associations successfully to mobilize farmers and help them acquire needed agricultural inputs. AVs have been an especially effective tool for helping women with gardening, small livestock, marketing, production of soap, sumbala and pomade, and buying grain mills on credit. Savings associations are organized in some villages, and can be a source of funds to buy agricultural inputs. In fact, people seem to work harder for success of an investment coming from a savings association that that from a

public fund.

Improved Nutritional Status

Research advances with cowpeas are of particular interest because of their good nutritional value. Improved cowpea plants exist, and with further research plants can be developed which will be resistant to insects, Striga and diseases. One local variety, gorom gorom has already proved itself popular with farmers. Intercropping and fertilizer use have been shown to reduce Striga in millet and peanuts, and may prove useful with cowpeas. Hermetic storage has preserved cowpeas at Sugula since 1984. These technologies need to be made ready for extension to farmers via an appropriate communication strategy.

Cowpeas are used in a variety of ways but they could play a greater role in the Malian diet. They are used in certain dishes and in fried cakes which are eaten as snacks. The leaves are used in sauces and the immature bean pods are eaten like green beans. The Food Technology lab is working on infant weaning foods made of the flour of the mature cowpea, as well as a mixture of cowpea and millet flours.

Increased use of cowpeas would be nutritionally beneficial to the population because of their high protein content. The Malian diet relies heavily on vegetable protein, and leguminous proteins such as cowpeas, locust beans and peanuts, are very important because they supply the essential amino acids which are lacking in the cereal grains. Together the grains and legumes provide all the essential amino acids for human nutrition, which is important because the diet is low in animal protein.

Improved Animal Nutrition

The droughts in the 70's and 80's made it more and more difficult for the pastoralists to find pasture for their cattle and as the pastoralist way of life became increasingly difficult, many of them have moved further south into the towns or turned to cultivation. Decreasing rangeland has made it more difficult to support the herds and has increased interest in the integration of forage crops for their nutrition. Research on forage crops has been directed towards agro-pastoralists, integrating forage crops with cultivation of other crops and with the use of natural pasture. Thus far the research station in Mopti has taken four legume species to the farmers to try, and has concentrated in the past year on cowpeas. The Animal Research station at Mopti has also been working with Bourghou, an aquatic plant, as forage. The receding waters of the Niger river expose plains of Bourghou plant material which the cattle can eat. The local inhabitants also use the Bourghou seeds for food.

In the south, cowpea fodder is being grown to feed livestock. This has great potential because more farmers are incorporating livestock into their activities and animals are being kept closer

to home. Women are also raising small ruminants, and will increase their production by growing forage in their personal fields.

Keeping animals close to home by feeding them with forage will increase the amount of milk and meat available for consumption, as well as supplying skins and cash when needed.

New Products From Food Technology Lab

Research in food technology will produce value added foods from sorghum and millet which will have a great benefit for Malian women. Women will welcome grain food products which are time and labor saving. The food technology laboratory is working on processed sorghum and millet products which can be used as rice substitutes. The acceptability of these products will depend on their qualities such as taste, color and texture, and their suitability for use in traditional dishes. Cost will be an equally important factor. New products should be put through extensive tests for acceptability to the public, who will be most interested in products which perform well in the traditional dishes.

Infant weaning foods, made of composite millet and cowpea flour, can have a greater impact than is immediately apparent. Young children make up a sizeable portion of the population and an enormous amount of time and energy is used by mothers and relatives to care for them. Consider the amount of energy that goes into each period of pregnancy, nursing and infant care that a woman goes through. That energy investment is lost each time a child dies. As long as child mortality remains high, women will continue to have numerous pregnancies, at a great energy cost to the family and the country. Child survival is closely linked to nutrition; minor illnesses kill children who are already undernourished. A high protein weaning food such as the composite millet cowpea flour would improve child nutrition and survival and reduce the amount of energy used in childbearing.

Training

Nineteen researchers will be selected by IER to receive long-term degree training, on the basis of their competence and according to the areas of specialty given priority. The most direct effect of the project will be to increase the educational level and research expertise of IER personnel, producing 10 Masters and 9 Ph.D.s. These degrees will augment the existing areas of expertise, bringing in more training in agricultural economy, agronomy, biometrics, breeding, entomology, forage specialty, management, soil science, plant pathology, plant physiology, sociology, cereal technology, and weed science. Training will bring an exchange of ideas at national and international levels, new techniques and new plant material. It will also reinforce the institutional capacity of IER.

Experience in other African countries has shown the value of graduate training at Land Grant Universities in the U.S. Through

summer work experience on American farms, trainees develop a respect for the work habits and decision-making capabilities of American farmers which can carry over into an increased appreciation of the knowledge and skills of African farmers. For these investments in higher education to pay off also requires investment in the generation and diffusion of technological innovations that are feasible and profitable for large numbers of farmers operating under extremely diverse agroclimatic conditions.

The number of other researchers who attend short term training will be determined during the course of the project, according to needs. The possibilities of further training, and attendance at international seminars will allow researchers to raise their level of competence, bring in new ideas and experiences and share their own experiences. Selection for further training also recognizes the merit of the researchers work. Other means of recognizing merit should also be sought. Other IER personnel will learn new techniques while being supervised and working with the researchers who have received advanced degrees.

Institutional Concerns

Under the proposed plan to decentralize IER, control over a wide range of activities will pass to the various regional centers located in different geographic areas of the country. In addition, other organizations such as laboratories and testing facilities will also be given a measure of independence in the management of their own activities and resources.

Research themes will be proposed at the regional center, station and sub-station levels where feedback from farmers can be incorporated. In the system, research themes should originate from the dialogue between farmers and researchers or extension agents, and be passed up through the regional center for discussion and approval by the Permanent Secretary and the National Agriculture Research Committee.

The supervisors of the Agriculture Research programs will be located at the stations. Each center will have a full complement of disciplines that addresses the activities of all stations and substations under them. Management will be located closer to the level of research extension, allowing it to be more responsive to farmers' problems and to react promptly in devising solutions.

B. POTENTIAL PROJECT IMPLEMENTATION CONSTRAINTS

Environmental Constraints

There are a number of environmental constraints affecting farmers growing sorghum and millet. The spacing and interval of rains, as well as a lack of rainfall inhibit growth. Soils are poor in nitrogen and phosphorus and are fragile and degraded. There are large grain losses to insects, phacochere, monkeys, baboons and

birds. When the rainfall is higher leaf diseases, grain molds and parasitic plants (Striga) are increased. At this time the technical packages available for the farmers are inadequate; the local varieties of sorghum are poor. Research is needed to produce technical packages which can deal with some of these problems.

Technical Constraints

Farmers sometimes apply the recommended techniques incorrectly. There is a poor execution of farming activities such as weeding, use of herbicides, use of adequate labor, use of equipment and following of planting dates. Too few farmers use rotation of crops, the fallow period is too short. There is unbalanced use of fertilizer, nonuse of harvest residue, poor water conservation techniques and degradation of the soil.

Certain problems can accompany new technology. Farmers assume a risk of a poor harvest when they try new plant varieties and techniques. New varieties may be less drought or pest resistant, require more labor (for women) in preparation, present difficulties in pounding and sifting, or have unacceptable qualities for preparation of the traditional dishes. The introduction of new techniques into the ecological system usually has unexpected effects which have to be dealt with. Monocultures encourage an increase in the pest/parasite population. Improper use of technical packages by farmers, for example the use of a nitrogen fertilizer on fragile soils making the soil more acidic, can effect the soil for many years afterwards. There is a risk of the farmer abandoning and forgetting traditional methods after adopting new technologies, and not having them to fall back on.

Farmers experience similar problems with cowpeas. They are attacked by insects, susceptible to diseases especially in the humid zones, and drained by parasitic plants (Stryga). One of the major problems with cowpeas occurs during storage when they are destroyed by insects. This discourages farmers from increasing production.

One of the problems experienced with forage crops is that the farmers plant them too late, because it conflicts with the cultivation of millet. There is another conflict for the farmer who grows cowpea for forage. He doesn't want to harvest the green plants for fodder if he is not certain of having enough food for his family. He may decide to leave the plants in the field until the beans mature to use as food, but by that time the plants have passed their usefulness as fodder. There is a need to find species which can be adapted to different ecological zones. Or rather than focusing on one species, to diversify to have species for different ecological zones. Restoration of the soil and the use of crop residues are important considerations for forage crops.

Cereal researchers in Mali are working on many of these problems and a few local varieties have been selected and extended to farmers, but their adoption rate is difficult to measure because

farmers tend to give a Bambara name to a new variety forgetting the identification number assigned by the station. Thus when farmers are surveyed to find out how many have adopted a new variety, this confusion results in findings which are lower than the actual adoption rate. To overcome this problem, research stations should consider giving a local name to new varieties so that they can track adoption rates.

Social Constraints

Extension agents generally deal with male farmers and not female farmers, even though women do much of the agricultural work. Indeed, in some villages, a male agent would not be allowed to meet with women of the village. In the DHV and CMDT regions there are some female agents or animatrices to work with village women. In CMDT the strategy is to integrate men and women so that the extension agents will consider the problems of both males and females, and not define problems as specifically feminine. Although there is now more sensitivity to the problems of women by the agents, they still seem to have a low priority among all the tasks they are charged with. CMDT Action Feminine recognizes several factors which inhibit the extension of agricultural techniques to women in the zone: There is no research on women; women are considered labor not decision makers; women don't have enough time to work in their own fields after helping in their husband's field; access to labor is limited because it is all used in husband's fields; they have no access to equipment when they need it; they have no access to inputs such as compost.

Institutional Constraints

Training is lacking in certain methods, techniques and approaches in applied research. There are few trained women at all levels within IER. These problems can be resolved by training more scientists, which the project will support, including 25% women.

With the reorganization of IER a new level of cooperation between departments and disciplines will be needed. A certain spirit of competitiveness may hinder effective working relationships between specialists who are being asked to accommodate different points of view. The problem can be addressed by team-building seminars. Such seminars to aid the integration of different disciplines should be organized on an annual basis.

A disparity may be created between those researchers working in programs supported by SPARC and those in other programs. Wherever feasible collaborative programs should integrate personnel who are not directly involved in the project.

There are few incentives for agricultural researchers. There is not much prestige accorded to them by comparison to the level of education they have achieved, and the dedication that they show to their work. They are often asked to live in remote locations, with inadequate housing, health and education facilities. Their

families are moved away from urban areas where the wives may have jobs, and there are social contacts and family ties, and outlets for leisure and entertainment activities. There is a serious lack of infrastructure at the research stations. Living conditions at the stations will have to be upgraded, or severe problems with morale will be experienced among researchers who are expected to bring their families to live there. The stations need housing for researchers, health/family planning clinics plus pharmacies, schools, transportation, a maintenance garage with spare parts, and training for health facility staff and mechanics.

Economic Constraints

Among the major constraints to the SPARC project is the question of profitability of using inputs. Can the farmer make a profit on his crop, while paying for inputs, in years of good rainfall and bad? When rainfall and production are high, the prices are low. When rainfall and production are low the farmer doesn't have surplus to sell to cover the costs of inputs.

Given the high price of fertilizer and the low price of grain, it is not profitable to fertilize millet, and only barely profitable to fertilize sorghum. The natural phosphates of Tilemsi are a more economical substitute. Farmers resist using Tilemsi phosphate because in its solid state it is difficult to add to the soil, but experimentation has shown that by adding it to manure and compost, its spreadability and solubility are improved.

The poor return that farmers get for their produce and the lack of access to credit results in their being under equipped. Farmers have to have access to resources to buy inputs and the means of production.

V. RECOMMENDATIONS TO ENHANCE TECHNOLOGY GENERATION AND ADOPTION

Development experts with an acute historical perspective can cite innumerable technological failures that resulted from a lack of understanding of the smallholder perspective. Conversely, the successes that can be cited--the acceptance of intercropping, for example--have resulted from an awareness of what the small farmer seeks to accomplish, what he or she views as feasible and desirable, his and her capability to pursue their objectives, the measures by which they seek to address constraints, and the values--not always monetary--by which smallholders assess costs and benefits. The Farming Systems Research perspective prominent over the past 15 years grew out of an acknowledgement of the importance of these factors. The limited accomplishments of FSR do not demean the importance of this perspective. Rather, scientists are required to reexamine the validity of their research objectives, the appropriateness of their methods, and the utility of their results. Scientists must assure themselves that their work remains focused on the well-being of the rural producer.

Two simple yet essential strategies must be employed to realize this basic goal: participation and communication. At the same time, however, complementary research will be conducted to provide baseline, specific topical information (e.g., gender-related), or longitudinal/time series data. This data will satisfy comparative or evaluative analytical requirements. Finally, implementing a strategy to promote effective collaboration among various governmental agencies will be important to the success of the project.

Multi-disciplinary teams, located at each research center, will incorporate these strategies in their research agenda. Expertise of the economic and behavioral scientists will be particularly important but the input of the biological scientists will be equally indispensable for the multidisciplinary nature of the effort to be fully exploited.

Operational Research

For planning purposes and to ascertain the effectiveness of the implementation of the project participation and communications strategies, Focus Group Research should be undertaken on a quarterly basis each project year. Results will be expected to guide the formulation of communications packages and to determine whether the messages are understood, are convincing, and are acceptable.

After the preliminary choice of project focus villages has been made, Comparative Village Profiles must be compiled by the researchers. The profiles should be created by means of discrete but uniform research modules. Once again, the intent will be to gather specific information for specific analytical objectives, rather than amass reams of inconsequential data. By the same token, researchers will intentionally limit the amount of time demanded of the project's smallholder collaborators on any single occasion. The content of the profiles should be limited to basic demographic and production information, environmental and economic factors that govern decision-making and the employment of specific technologies (e.g., rainfall regime, market opportunities, input cost and availability), and the organization of production. To the extent possible, the Comparative Village Profiles should include ethnic identification determined by a separate and discrete module (see further discussion of ethnicity below). The profiles will be important for comparing and projecting the feasibility of technology within a particular region, but may as well point to innovations useful for other regions.

An annual assessment of the multidisciplinary teams should be conducted to determine their effectiveness. The assessments will be expected to indicate the adequacy of the disciplinary make-up of the teams or supplementary needs for additional expertise. They will review achievements versus annual plans to estimate successes and identify deficiencies. Likewise, they will examine the team methodology to determine what changes, if any, will be required in

the subsequent campaign. Included in the assessment process should be an annual workshop that gathers the teams from each region to exchange information and experience that written reports cannot adequately provide. The locus of the workshop should rotate each year.

Topical Socioeconomic Research

There are many variables which affect the responsiveness of farmers to new technologies. The multidisciplinary research teams must determine what supplementary or complementary study must be undertaken to provide information on specific topics that will affect either technology generation or technology adoption. The discussion below is intended to highlight factors that can affect project objectives.

The identification or categorization of ethnicity with specific production techniques or propensities is problematic. Few villages in Mali are made up of one homogenous ethnic group. Each village has a unique combination of ethnic groups whose customs may differ. It can be difficult to label ethnic groups because of historical reasons. People who move sometimes try to assume the superficial ethnic identity of the majority group of the village. For example Peul who become sedentary farmers in a Minianka village may adopt Minianka names, and therefore be identified by the uninformed as Minianka. Clan names can be indicative of ethnic identity, but many names are used by several ethnic groups interchangeably across the Western Sudan, and people sometimes change their names along with their ethnic identity to suit a particular social need or setting.

Social identity can govern the devotion of time or effort to specific productive endeavors. For instance, within each ethnic group, families are divided into occupational castes, such as blacksmiths, leather workers, weavers and griots. Distinctions are also drawn between freemen or nobles and the descendants of captive or client families. Some of these groups have very distinctive characteristics associated with them. Blacksmiths work metal but are also well known for practicing traditional medicine and sorcery, and are thus very powerful people. Griots are speakers, masters of ceremony, historians, singers, and storytellers, and play an integral role in every important event in a village.

The village chief is usually one of the eldest men of a noble family. A few people in a village may make a living as merchants, but despite social or caste differences the majority of rural dwellers support themselves in large part through agricultural production. A council of elders generally exerts a great influence over village activities. The personalities involved may be cooperative and receptive to new ideas, or they may be closed to outsiders and secretive. Input from other villagers, including women, may be restricted or it may be extensive.

Religion is another factor which restricts or effects cultural

change, particularly in women's roles. In villages which have a strong Islamic influence, women's activities have been diverted away from agricultural and commercial pursuits, and concentrated more in the home, as among the Soninke and Songhrai Wahabiyya, for example.

As mentioned above, there are often several traditional organizations which exist in the village, grouping people by age or sex for particular purposes, such as community action, ceremonial events, credit or savings. These are also mobilized to perform agricultural tasks on selected occasions. Thus, technology that responds to the objectives identified for production by individuals or small family units may be less appropriate for settings in which cooperative work groups execute specific tasks.

The most important topical research that the project must undertake will focus on women. Gender-specific baseline data and time series data on women's role in production will be required to enable the teams to focus station and field trials on relevant techniques. The amount of land cultivated, crops, cultural practices, timing, ecological regime (e.g., residual moisture), productivity, labor requirements, input use and source, processing, storage, the disposition of the crop (consumption, gifts, marketing, barter), aggregate production costs, and income will all be key elements of the topical research on women. In this endeavor, it will be important to ascertain women's perceptions of opportunities and constraints as well as costs and benefits. The baseline information must be collected ancillary to but separate from the establishment of Comparative Village Profiles. The time series data will supplement the baseline data on an annual basis thereafter. The medium-term result will be pertinent data on women's role in rural production systems which will facilitate the commodity research agenda and focus. The ultimate result will be a longitudinal comparative view of female production, which, among several uses, can be employed to gauge the success of the project.

References

Berger, Marguerite, V. DeLancey, and A. Mellencamp. 1984. Bridging the Gender Gap in Agricultural Extension. Washington D.C.: International Center for Research on Women.

Cernea, Michael M. and S.E. Guggenheim. 1985. Is Anthropology Superfluous in Farming Systems Research? Washington D.C.: World Bank Reprint Series: Number 367.

Eicher, Carl K. and D. Baker. 1982. Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey. East Lansing, Michigan: Michigan State University.

Frankenberger, Timothy R. 1985. Adding a Food Consumption Perspective to Farming Systems Research. Washington D.C.: U.S. Department of Agriculture.

Horowitz, Michael M. 1979. The Sociology of Pastoralism and African Livestock Projects. Washington D.C.: USAID.

Institute For Development Anthropology. 1980. The Workshop on Pastoralism and African Livestock Development. Washington D.C.: USAID.

Jahnke, Hans, D. Kirschke, and J. Lagemann. 1987. The Impact of Agricultural Research in Tropical Africa. Washington D.C.: The World Bank.

Johnston, Bruce F., A. Hoben, D.W. Dijkerman, and W.K. Jaeger. 1987. An Assessment of A.I.D. Activities to Promote Agricultural and Rural Development in Sub-Saharan Africa. A.I.D. Evaluation Special Study No. 54. Washington D.C.: USAID.

Little, Peter D. 1982. "Risk Aversion, Economic Diversification and Goat Production: Some Comments on the Role of Goats in African Pastoral Production Systems," in Goat Production and Disease. J. Ayers and W. Foote, ed. Tucson: University of Arizona.

Norman, D.W. 1987. Communication and Information Systems in Farming Systems Work: An Overview of the Past and Present. Paper given at the 1987 Farming Systems Research Symposium, University of Arkansas, Fayetteville, Arkansas.

Office of Technical Assessment. 1984. Africa Tomorrow: Issues in Technology, Agriculture, and U.S. Foreign Aid--A Technical Memorandum. Washington D.C.: U.S. Congress, OTA.

Office of Technical Assessment. 1986. Continuing The Commitment: Agricultural Development in the Sahel--Special Report. Washington D.C.: U.S. Government Printing Office.

Rhoades, Robert E. 1984. Breaking New Ground: Agricultural Anthropology. Lima: International Potato Center.

Rivera, William M. 1986. Comparative Extension: The CES, TES, T&V and FSR/D. CIED Occasional Paper Series: University of Maryland, College Park, Maryland.

Stone, Priscilla. 1986. Farming Systems Research Along The Senegal River Valley. USAID/Dakar: Senegal Agricultural Research Project II.

U.S. Agency for International Development. 1986. Mali Orientation Handbook. Washington D.C.: Bureau for Science and Technology Farming Systems Research Project.

Winter, Michael. 1981. Pastoralism among the Ikawalaten Kel Areris of East Central Gourma, Mali. A Preliminary Description. University of Cambridge. (mimeo).

World Bank. 1984. Toward Sustained Development in Sub-Saharan Africa. Washington D.C.: World Bank.

ANNEX F-7
ECONOMIC ANALYSIS

Introduction

The Malian government in its various development plans has emphasized four priorities since Independence: satisfy the food needs of its population; provide a sufficient supply of primary materials to meet the requirements of its processing industries; promote the development of, and encourage investment in, agricultural exports; and, especially since the droughts of the early 1970s, improve the management and preservation of the natural resource base, particularly water, to enhance production and income security (PID, Mali SPARC project).

The Mali SPARC project, a seven-year activity, was developed by the IER and the USAID mission to alleviate three principle concerns. First, create a research system that is well administered and increasingly self-financed by the Government of the Republic of Mali (GRM), and capable of setting priority research themes and analyzing the cost-effectiveness and impact of major research investments. Second, establish commodity-based research teams that promote farmer usable and sustainable technologies. And third, promote and maintain effective linkages with regional research programs and the international agricultural research system. These activities are aimed at the overall priority of increasing agricultural productivity, incomes, and nutrition through: the development and dissemination of improved technologies suitable to small farm conditions; improved grain processing techniques; fewer distortions in agricultural markets; and improved incentives for producers.

The purpose of this paper is to propose priorities for economic research under SPARC that complement the IER technical research programs, and to conduct an economic analysis of the Mali SPARC project. Section I of this paper is introductory. Section II evaluates selected key factors that will influence the economic benefits to agricultural research and extension. Section III identifies priority areas for economics research, proposes a strategy for monitoring on-farm adoption rates and production impacts, proposes alternative ways for integrating economic research with the work of other technical and social scientists, and evaluates the IER's capability in undertaking these economic studies. In the final section, a benefit-cost analysis of the SPARC project is conducted using net present value techniques (net present value and internal rate of return) and sensitivity analysis of key assumptions on adoption rates and productivity gains.

Factors Influencing Economic Benefits

Economic benefits to investments in research and extension under SPARC will be heavily influenced by three factors: yield improvements associated with new technologies generated under the project; the economic cost of the technologies and market conditions (prices and market access) affecting their profitability; and rate of diffusion of the improved technologies measured by area covered and speed of adoption. The greatest social benefit will accrue to investments in those sectors where Mali holds a comparative advantage (i.e. commodities in which Mali is a low-cost producer relative to the rest of the world). Profitability is the single most important factor affecting speed of adoption (farmer demand). Potential size of markets (size of area suited to the technology) is important for spreading the costs of technology development. Yield improvement and potential area are clearly not independent. A large potential area but low income gains, or high income improvement but low potential area, would both have a dampening effect on aggregate economic benefits to investment in agricultural research and extension.

System of Price Incentives[1]

A number of external and internal factors, beginning in the 1980s, contributed to a low rate of output growth, rising inflationary pressures, worsening balance of payments in trade, and an accumulation of domestic and foreign payment arrears. Weak controls over current public expenditures combined with an overly ambitious public investment program, led to rising budget deficits and heavy government borrow in domestic and external markets. Mali's balance of payments has consistently been arrears, due to low world wide prices for primary commodities, low value added on its principal exports of agricultural products, an over-valued exchange rate that lowers the price of import goods and increases the cost of exports, and the environment of reoccurring drought[2].

During the 1980s, the government took steps to improve the deteriorating economic situation. The marketing systems for groundnuts, maize, millet, sorghum and rice were liberalized in a series of steps during the early and mid - 1980's. Attempts were made to rehabilitate key public sector enterprises, financial management was strengthened, and domestic and external arrears of the public sector were reduced. Inflationary prices have now stabilized at moderate levels. Course grain production and prices continue to experience large fluctuations. The lengthy procedures still required to export livestock and its products distort marketing costs and encourage widespread smuggling.

Comparative Advantage

The theory of comparative advantage states that a country should produce and export those goods in which it has a relative productivity advantage and import those goods in which it holds a comparative disadvantage. Economic growth is enhanced through specialization and reallocation of resources to those sectors where the country is relatively the low-cost producer. If for example the domestic resource costs in producing rice are relatively higher than the price of imported rice, the country would be better off importing rice and reallocating scarce resources to those sectors where it holds a comparative advantage (i.e. coarse grains).

A recent study by AIRD (Stryker et al. 1987) assessed Mali's comparative advantage in a number of key commodities and sectors using Domestic Resource Cost analysis. It provides rather robust evidence that Mali holds a considerable comparative advantage in cereals excluding rice (for domestic consumption) and for several important export commodities (cotton and livestock). The potential for further exploiting Mali's comparative advantage is considerable. The Mali-South region with favorable rainfall and low population density offers substantial potential for mixed farming systems. The interior delta of the Niger river also offers considerable potential, though at current world prices it would be difficult to profitably exploit rice production.

The AIRD study also concludes that Mali holds some comparative advantage in agricultural equipment manufacturing, cottonseed oil, textiles, and processed fruits and vegetables. USAID/Mali's recent Business Climate Review (Grant and Hanel, 1988), using different methods and data, reached a similar conclusion, i.e. that Mali's comparative advantage is in agricultural production, and in processed agricultural commodities or agricultural equipment (plows, cooking oil, textiles, processed milk, tea, skins and hides, and animal feed).

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[1] This section draws heavily on Stryker et al., 1987.

[2] Stryker et al. (1987) estimate that the exchange rate alone is over-valued by about 33 percent.

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Crop Area

The vitality of the agricultural sector is central to employment and economic growth of the Malian economy. It accounts for 50% of GDP, 75% of exports, and 70% of employment. Data on the percentage of land area devoted to respective crops in the agricultural sector by region of the country are presented in Table F-7 (1). Inter-cropping systems, particularly mixtures of cereals and cowpeas, tend to predominate. The data in Table F-7 (1) are adjusted figures showing the approximate area covered by each crop within pure and inter-cropping systems.

Table F-7 (1): Percentage of Principal Crops by Region, Mali, 1989[a]

Crop	South			Central		North		National Total (ha)
	Kayes (%)	Kouli-koro (%)	Sikasso (%)	Segou (%)	Mopti (%)	Tombouctou (%)	Gao (%)	
Millet	10.2	24.6	20.8	63.2	56.1	49.8	1.7	1,083,090
Sorghum	54.4	41.1	30.1	14.0	6.1	41.2	4.5	774,469
Rice	0.6	0.7	1.8	1.4	31.0	6.7	93.7	197,427
Maize	10.3	5.6	14.0	1.7	0.4	-	-	174,611
Fonio	1.8	0.3	1.3	1.3	1.0	-	-	29,637
Wheat	-	-	-	-	-	0.3	-	755
Other Cereals	-	-	0.0	-	-	-	-	67
Tubers	0.4	-	0.2	0.0	0.6	0.5	-	6,548
Cowpeas	1.2	11.4	3.2	10.3	2.8	0.8	-	160,406
Bambara Nuts	0.1	0.3	.7	1.1	.4	-	-	16,160
Other legumes	-	-	0.0	-	-	-	-	102
SugarCane	-	-	0.0	-	-	-	-	394
Groundnuts	20.6	4.8	5.9	3.2	0.9	0.1	-	146,924
Tobacco	-	-	0.0	-	-	0.0	-	86
Cotton	-	10.7	21.1	3.2	-	-	-	233,937
Dah (fiber)	0.2	0.0	0.0	0.1	0.8	0.0	-	4,119
Other Indust.	-	-	0.0	-	-	-	-	178
Vegetables	0.1	0.4	.8	.3	.0	.6		11,479
Other Crops	0.1	.1	-	0.1	-	0.0	-	793
Total (ha)	259,031	414,286	795,193	690,545	415,375	240,815	25,936	2,841,182

a. Percentages are of column totals.

Source: Crop area adjusted for multi-cropping effects. Direction Nationale de la Statistique et de l'Informatique, 1989 Annuaire Statistique du Mali.

1. Millet and sorghum offer the largest potential markets in terms of area for spreading the costs of research investments. Over 38% of crop area nationwide is planted in millet, and 27% in sorghum.

2. Investments in agricultural research on millet and sorghum would have differential impacts on income by region. Millet represents between 56-63% of land area in the central region, north 2-50%, and south 10-25%. Sorghum represents 6-14% of the land area in the central region, north 5-41%, and south 30-54%.

3. Maize and rice tend to show higher yield responsiveness than millet and sorghum to improvements in fertility and water. However, the adjusted area under maize is 174,611 ha or 6% of the land area nationwide, and rice 197,427 ha or 7% of land area.

4. Maize tends to be concentrated in the southern zones of the country, and rice in the central and northern zones. About 92% of maize area is located in the southern regions of Kayes, Koulikoro and Sikasso; 79% of the rice area nationwide is located in the central zone (Segou and Mopti), and 20% in the northern zone (Tombouctou and Gao).

5. Cowpeas are normally intercropped with cereals. According to official statistics, cowpeas in inter-cropping systems comprise nearly 375,000 ha nationwide. After adjusting data to show actual coverage, cowpeas comprise about 160,406 ha nationwide, or about 6% of total crop area.

6. Groundnuts occupy 146,924 ha nationwide or 5% of total area. About 82% of the groundnut area is found in the southern regions of Kayes, Koulikoro and Sikasso.

7. Cotton, the principal industrial crop, is cultivated on 233,937 ha nationwide (8% of the land area); 91% of this area is located in the southern zone (Kayes, Koulikoro and Sikasso).

Yield Response to Improved Technology

Experimental trials are conducted both on-station and on-farm involving different crops, varieties, chemical treatments (fertilizers, pesticides, herbicides), and agronomic practices (planting densities, crop rotations, ridging and tied-ridging, mulching) (IER 1989). Results of on-farm trials are more appropriate than on-station trials for gauging returns to a given technology because they represent the culmination of years of on-station tests and selection, and because they are tested under real environmental conditions and socio-economic constraints. However, actual data on the results of on-farm tests are more limited in depth and scope. The following data reported in the 1988 and 1989 Rapport Annuel (IER) for the Farming Systems Research component provides some sense of the potential for technology improvements on farms in the CMDT region.

Millet

* Fields fertilized with manure from transhumant herds had an average yield of 540 kg/ha, 75% or 232 kg/ha higher than on farmers fields not receiving manure (1989).

* Fields with tied-ridging technology had average yields of 695 kg/ha, 19% higher than fields with simple ridging (1989).

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* The combination of tied-ridging and one dressing of phosphate had a yield of 755 kg/ha, 29% or 171 kg ha superior than the simple ridging technology (1989).

Maize

* Recommended fertilizer applications (dose not mentioned) increased yields 66% or 849 kg/ha compared with fields without fertilizer (1989).

* One-half application of urea at the tillering stage and one-half application at the flowering stage increased yields 31% relative to on-farm plots without fertilizer. No effect was observed on the millet planted in association with the maize (Fonsebougou 1989).

* The tendency of farmers to reduce the quantity of fertilizer applied to fields resulted in the following trials (recommended dose 100 kg/ha complex cotton + 150 kg/ha urea) (Gladie 1989):

	Maize (kg/ha)	Millet (kg/ha)
Recommended dose	2,338	705
(1/2 dose)	1,752	468
(1/4 dose)	1,382	441
(none)	1,216	307

Rice

* Two improved varieties were tested against local varieties at Sakoro and Monzondougou. At Sakoro, yields were 2357 kg/ha for the local variety and 3,691 kg/ha for the improved variety BD2. At Monzondougou, two varieties were introduced (1988):

  2730 kg/ha for variety C74 versus 1,920 kg/ha for the local variety.
  3904 kg/ha for variety BD2 versus 2,512 kg/ha for the local variety.

Forage

* Millet forage was introduced into the zone at Fonsebougou. Field trials with 100 kg urea and 100 kg complex cereal fertilizer per hectare produced yields of 6,100 kg dry matter M.S./ha.

* A study conducted in the CMDT region between July 1988 and December 1990 indicated that the number of cattle (unites betail tropicales) is limited by the amount of forage available for nutrition (1989).

Rice de-hulling

* The CMDT installed a rice de-hulling machine at Doumanaba to create a source of revenue for women's groups. Based on the first year of operation, utilization of the machine was not sufficient to cover financial expenses. Utilization was particularly weak given the large quantity of rice produced in the region (1989).

Although the above data provide some indication of potential yield improvements generated by past research, they yield little insight into the benefits of future investments in agricultural research and extension. Estimates of future yield gain potential relies on expert opinion, coming from those researchers most knowledgeable of current crop performance, and prospective potential yield gain likely to result from upcoming research.

Table F-7 (2): Yield Response to Introduction of New Technical Packages

		North	Central	South
Millet and Sorghum	Traditional	600	735	930
	Improved technology	750	825	1,200
	Yield improvement	150	90	270
Maize	Traditional	-	-	1,600
	Improved technology	-	-	2,300
	Yield improvement	-	-	700
Immersed Rice	Traditional	1,050	1,050	1,050
	Improved technology	1,400	1,400	1,400
	Yield improvement	350	350	350
Fonio	Traditional	350	350	350
	Improved technology	420	420	420
	Yield improvement	70	70	70
Cowpeas*	Traditional	-	50	-
	Improved technology	-	150	-
	Yield improvement	-	100	-
Groundnuts	Traditional	890	890	890
	Improved technology	1,480	1,480	1,480
	Yield improvement	590	590	590

* 50 kg/ha corresponds to 5,000 plants per ha; 150 kg/ha corresponds to 15,000 plants per ha.

Source: Yield estimates of commodity groups, IER.

Technical working groups for each of the major commodity groups within the IER have been working during the past year on developing future research programs. The results in Table F-7 (2) are yield improvements considered by each group to be reasonable prospective outcomes of the proposed agricultural research programs (data should be interpreted as the consensus of scientists working in the group).

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The estimates of incremental yield potential in table F-7 (2) serve as the basis for the project benefit-cost analysis. Several factors and adjustments were considered in using these estimates. First the yield improvements proposed by the IER working groups in no case exceeded and tended to be very conservative compared with the few estimates available from on-farm trials. Thus, the estimates do not appear to be exagerated. Second, the claims of those agronomists predicting miracle technologies and "big" improvements were heavily discounted. Even if such technologies are developed, adoption still depends on good extension ; the experience from elsewhere in Africa has not been good in this regard. Further, based on the rates of return calculated for the project even the lower yield improvement figures result in reasonable return to project investment. Third, the worse case scenario--i.e. no yield improvement possible--was resoundly renounced by all the agronomists that I spoke with. All felt that some improvement was possible. This led to a "middle ground"--i.e. the consensus of agronomists within the IER using their estimates (of a 25% increase in millet/sorghum yields in the north, central 12 %, and south 29%) is not being overly optimistic, yet still a challenging goal to achieve. These potential yield gains are consistent with past farm-level experience in Mali and elsewhere in West Africa, and are substantially less than achieved on these crops by functional research systems in other parts of the world.

The highest potential improvement in crop yields per hectare is predicted for maize in the south, groundnuts in all regions, rice in all regions, millet and sorghum in the north and south, and cowpeas. However, highest, potential yield per hectare is not neccesarily correlated with highest economic impact for research. Profitability of research to attain these technological improvements would depend on economic costs of production and economic prices for calculating revenues. Potential economic returns to research depend equally on extent of area planted to those crops. While maize might appear to have the highest economic potential (because of the potential increment in yield per hectare which is possible), the limited area currently planted in maize, combined with substantial marketing bottlenecks, would result in a more limited return to research than might appear from a simple examination of yield potential. As shown later in this analysis, research on millet, sorghum and cowpeas-- despite potential increases in yield per hectare which are lower than those for maize-- is expected to generate substantial returns to research, adequate to justify SPARC research investments, under reasonable assumptions. Additional managment reasons for focusing project research support on these commodities (focusing SPARC management improvements on a few prototype commodity programs with strong personnel and team-based planning already in place) is provided in the main body of the PP. Finally, support to improved millet, sorghum and cowpea productivity would have important distributional impacts.

Multiplier Effects

With 80% of all economic activity derived from agriculture, large increases in the market for goods and services will depend on the success of agriculture in increasing disposable income. For many years the formal private service sector (banking and input supply) has largely ignored the agricultural market due to high perceived risk and low anticipated returns. In addition, government (or parastatals) controlled the distribution of inputs and credit, the marketing of crops, and access to most resources in the rural sector.

Many of these structural constraints have either been corrected or are in the process of being alleviated. Benefits to agricultural research and extension within this more favorable policy environment would affect not only producers, but also the non-farm sector through linkages with input suppliers, processors, retailers, wholesalers, and manufacturers. The southern zone of Mali where CMDT has increased cotton

productivity and production over the past fifteen years has witnessed tremendous growth in the private sector provision of non-agricultural goods and services in secondary cities. The World Bank has calculated, for other countries (Sierra Leone, Togo), that every 10% increase in farm income leads via these linkages to an additional 5% increase in non-farm income (Atwood and Elliot, 1989).

Aggregate Food Supply and Demand

Selected data on production, private and official imports, stock adjustments, and per-capita consumption of millet/sorghum/fonio, maize, rice and wheat are reported in Table F-7 (4). While aggregate data should be viewed with caution, a number of salient features can be gleaned from the data:

First, production of millet, sorghum, fonio and maize have been highly erratic over time. Technical research aimed at both increasing food production in good rainfall years, and at stabilizing yields during poor years (i.e. decreasing inter-year variations) would have important benefits for reducing storage costs (infrastructure and losses) and price fluctuations.

Second, government and private imports have generally comprised rice. Over the period 1981-2 to 1987-8, rice imports averaged 80% of total private imports, wheat 17%, and sorghum, millet, and maize 3%. Private imports had sharply declined in the latter part of the 1980s, mainly due to higher rainfall and to fiscal imbalances. Some fraction of rice imports (and substitution of rice for coarse grains) have occurred during drought years because of poorly developed international trade in sorghum and millet. Drought will continue to be a reoccurring phenomena. However, threat of drought does not imply the need for agricultural research in rice and wheat, or the need to adopt an import-substitution strategy. Mali does not currently hold a comparative advantage in either of these crops. Studies by Humphrey and Pearson (1979) for Sahelian West Africa and Martin for Senegal show that the irrigated rice sector is not competitive with imported rice at current world prices and exchange rates. Superior rates of economic growth could be achieved by continuing to import rice, and by enhancing efficiency and investment in the cotton and livestock sectors. No data are available to assess the comparative advantage of indigenous immersed rice production systems.

Third, food aid reached a high of 237 thousand tons in 1984-85, but fell to minimal levels with good rains in the latter part of the 1980s. Over the period 1981-2 to 1987-8, food aid comprised on average 46% maize, rice 31%, wheat 7%, and millet and sorghum 16%. Food aid when delivered to populations with little or no effective demand (no purchasing power) does not dampen prices. However, food aid sold at official or private market prices reduces price incentives for technology adoption (Roth and Abbott, 1990). Storage is the mechanism by which farmers carry food stocks from good years to poor years. Investment in storage facilities and the incentive to carry stocks (and to bear the risks of losses from storage) fundamentally depends on the prices farmers expect to receive in bad years. Food aid, in dampening prices (particularly in drought years), decreases stocks demand and the overall demand for cereals in good years. Investing in agricultural research, while at the same time undermining prices through food aid imports, raises a fundamental dilemma that will need to addressed by donors. This problem is potentially severe for the maize sector, where food aid represented 131% of national production in 1985. Ample rainfall has sharply increased maize production in recent years, and prices have plummeted in the CMDT region. Whether stocks are being built up in expectations of the next series of droughts is an important empirical question.

Table F-7 (4): Food Production, Consumption and Trade, Mali							
	1981-1982	1982-1983	1983-1984	1984-1985	1986-1987	1987-1988	1988-1989
Gross production (000 tons):							
Millet/sorghum/fonio	1,195	1,322	1,507	1,111	1,670	1,737	1,464
Rice	135	153	216	109	232	236	189
Maize	61	89	144	101	193	213	178
Net production (000 tons):							
Millet/sorghum/fonio	849	918	975	766	1,058	1,095	932
Rice	69	78	110	56	118	120	96
Maize	49	71	115	81	154	170	142
Govt. & private imports (000 tons):							
Millet/sorghum/fonio	0	0	6	13	0	0	0
Rice	40	80	140	170	100	29	16
Maize	0	0	0	4	0	0	0
Wheat	30	16	20	0	20	20	20
Food aid (000 tons):							
Millet/sorghum/fonio	0	18	11	47	18	0	0
Rice	15	27	42	48	33	0	21
Maize	32	24	60	132	30	0	0
Wheat	6	14	14	10	0	0	0
Official stock adjustments (000 tons):							
Millet/sorghum/fonio	-	-	-	-	(60)	(4)	49
Rice	-	-	-	-	32	34	5
Maize	-	-	-	-	(22)	14	15
Wheat	-	-	-	-	0	(5)	5
Available supply (000 tons):							
Millet/sorghum/fonio	849	936	992	826	1,016	1,091	981
Rice	124	185	292	274	283	183	138
Maize	81	95	175	217	162	184	157
Wheat	36	30	34	10	20	15	25
Population (000 persons)	7,123	7,244	7,367	7,492	7,620	7,812	8,015
Consumption (Kg/capita):							
Millet/sorghum/fonio	119	129	135	110	133	140	122
Rice	17	23	40	37	37	23	17
Maize	11	13	24	29	21	24	20
Wheat	5	4	5	1	3	2	3
Total (w/food aid)	152	172	204	177	194	189	162
Total (w/o food aid)	146	161	185	145	184	189	160

Source: Atwood and Elliott, 1989.

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Fourth, compared with the FAO recommended cereals intake of around 180 kg/capita/annum, aggregate food consumption in Mali over the past decade has been low and highly variable. Aggregate food supplies (w/o food aid) fell below the 180 threshold four times over the period 1981-2 to 1987-8, reaching a low of 145 kg/ha in 1985-86. Even in the more abundant rainfall years, food supplies (w/o food aid) have only just exceeded the FAO minimum. Mali's demand for coarse grains will continue to grow for a number of reasons: high income elasticities of demand for rice and coarse grains (i.e. demand increases as incomes rise); continued population growth; and growing demand for coarse grains in the poultry and livestock industries. This potential for increasing demand if confronted with stagnating output would impose significant demands for cereal imports.

Specific Gender Issues

Increased agricultural productivity in the cereals sector would provide benefits to men, women and children through improved nutrition. However, there are certain aspects of SPARC that could significantly benefit women and children. DRSPR (Direction for rural production systems research) has been conducting on-farm surveys including 80 production units (households) in 8 villages in the OHV zone (IER 1988 and 1989). Their findings raise a number of important gender issues and research needs:

Average farm size in the study villages is 8.6 ha, 6.6 ha of which are communal fields, and 2.0 ha of which are private fields. Of the individual fields reported in the survey, 46% are considered to be held by men, 54% by women. To assure condiments for the household, farming an individual field is essential for all women. However, productivity of these fields is often weak due to the fact that women often lack access to inputs and to improved technologies.

Over 70% of crop area, regardless of tenure (communal vs. private fields), is occupied by sorghum and millet. Animal traction is used on 59% of planted area. The percentage of communally operated fields tilled with animal traction (64%) exceeds that of individual fields (42%). Communal fields on average received 82 person days of work per year compared with in excess of 106 person days on private fields. Higher labor inputs on individual fields can largely be explained by: the lack of animal traction on individual fields; the fact that women spend a greater number of hours than men working in private fields (the number of female days worked per hectare on individual fields is 68.9 versus 26.4 days for men); and more intensive labor requirements of secondary crops on private fields. Families perceive inadequate family labor to be an important constraint for tasks of land preparation, weeding and harvesting under the current system of extensive agriculture. Although intensification would increase labor for such tasks as ridging, manuring or fertilization, it would decrease total labor at the particularly arduous tasks of land preparation and weeding (i.e. full employment of family labor combined with a higher ratio of labor per area of cultivated land would imply some reduction in area cultivated).

Only two villages in the eight were self-sufficient in aggregate food production, mainly due to the enormous production of 2-3 families within the village. The majority of families experienced deficits for the year. Increased production of cereals and cowpeas would benefit the entire family through improved nutrition. Improved returns on secondary crops (Dah grain, groundnuts and vegetables), would most directly improve incomes of women (MOA 1988). "Pounding" of millet and sorghum also consumes considerable labor throughout the day. Improvements in food processing technology (milling, de-hulling) could decrease labor demands for these activities, and allow a shift in labor to leisure or other more productive activities.

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Men and women are both involved in animal production. About 88% of the sheep are held by men and 12% by women. Conversely, men manage only 29% of the goats, and women 71%. Women invest 89% of their crop revenue in purchases of small ruminants. Principle uses of small ruminants include sacrifices 17%, family consumption 20%, sales for the purchase of cereals 40%, exchange for outside labor and clothing 20%, and other 3%. Small ruminants thus appear to serve as an important savings mechanism for transferring capitol from present earnings to future periods for consumption. Investment in forage production technology would help improve small ruminant production, and improve the economics of animal traction on farms. Also, increased labor productivity on coarse grain fields would permit the opportunity to free labor for forage or other activities. Until food security is achieved, however it is unlikely that substantial labor would be shifted to forage activities (ILCA).

Implications

The above analysis raises a number of implications for the SPARC project:

1. An emphasis on millet/sorghum, although they offer lower yield improvement potential, would have important economic as well as equity benefits by benefiting a larger proportion of the farming population.

2. Droughts will return. Improvement in millet/sorghum striga resistance and drought tolerance would help to stabilize yields. Demand for coarse grains should continue to be firm, and prices should strengthen, due to rising incomes, population growth, lower rainfall, and increased demand for meat.

3. Considerable technology potential already exists in the CMDT region and elsewhere. Economics research under SPARC should emphasize marketing studies that seek to improve marketing efficiency and to enhance demand and trade.

4. Economic studies of the economic profitability of immersed rice production systems should be undertaken to evaluate the economic viability of rice commodity research.

5. Emphasis on improved legume rotations, socio-economic studies emphasizing gender, improved forage technologies, and a refocusing of extension and on-farm testing to address women's concerns, could collectively generate important benefits to women under the SPARC project.

Economic Research Priorities

The fundamental purpose of agricultural research is to develop and disseminate improved technology. The IER recognizes the need for integrating economists and sociologists with technical scientists on production systems teams to monitor and evaluate technology adoption. The importance and role of sociologists under SPARC is covered under the social soundness section. The role of economics research can be sub-divided into three areas: evaluating the profitability of technology adoption; identifying on-farm and off-farm opportunities and constraints; conducting market studies of key inputs required for the respective technologies, specifically their availability, quality and costs; and conducting market studies of output markets, specifically demand, distribution, transport costs, and potential for market expansion. IER economists are beginning to see these three different sets of research as part of a coherent long-term research agenda, calling it the "subsector approach" or "approche filiere". With the assistance of

Michigan State University through central AID funding, they have recently embarked on a one-year subsector research approach to undertake many of these research activities in an integrated fashion for the maize subsector. Subsequent research under SPARC will build on the experience with the current maize subsector research.

Cost of Production Studies (Financial Analysis)

The IER already computes cost of production figures based primarily on the results of on-station research. Net revenue per hectare is calculated as revenue (yield times price) less costs of production. Cost of production studies based on on-farm results are more limited, in part because of fewer resources devoted in the past to on-farm trials, and to greater difficulties in gathering quantitative data. The far greatest problem in interpreting the results of these budgets is ambiguities surrounding the exact conditions under which the technology is being tested. Staatz (1989) also points out problems associated with valuing output and defining factor costs. These problems would present a useful starting point for economists to begin working with technical scientists on the economic evaluation of technology.

Partial crop budgets linking revenue and cost of production represent the basic building blocks for a variety of economic studies. The budget illustrated in Table F(7)-8 is indicative of the detail that is needed to understand both profitability and the circumstances under which the technology is being tested. Crop budgets for existing on-farm technologies are needed for each agro-ecological region/zone, crop or crop mixture grown, the soil or land type on which the crop or mixture is grown, and whether it is on communal or private fields. Input parameters would need to be collected on yield, labor input by family members and hired labor by task and time of season, mechanization by task and time of season, and quantity and price of purchased inputs applied. Partial budgets thus estimate the incremental returns to family labor and capital, by comparing the new with existing technology.

Technical scientists first and foremost view the role of the economist as one of conducting partial budgeting analysis of on-station and on-farm results. As technical scientists understand the basic principles of partial budgeting, it serves as a useful starting point for building collaboration between technical scientists and economists.

Cost of Production Studies (Economic Analysis)

Financial analyses are conducted at prevailing market prices, which may be highly distorted by government policy. Economic analyses are conducted in terms of the marginal costs and benefits of technical innovation in terms of the true scarcity value of resources. While financial analysis measures the profitability of a technology to the farmer under prevailing prices, economic analysis measures the social costs and benefits of a technology to society as a whole. There are a number of sectors where economic distortions still remain, even after liberalization. First, overvalued exchange rates (33-40%, Stryker et al.) lower the price of imports and increase the price of exports. Thus, financial prices of imported nitrogen fertilizer, other things constant, would understate its true economic cost, while the financial price of cotton would understate its true economic value. Second, official prices on rice may either overstate or understate its economic price depending on the border price of Thai rice. Careful studies need to be conducted on measuring international prices of key commodities, calculating marketing costs from border to farm gate, and computing the above partial budgets using economic prices rather than financial prices.

Farm Models of Technology Adoption

Costs of production of certain technologies are more easily evaluated than others. Improved varieties requiring no additional inputs are easiest to evaluate; one need only compare the marginal change in revenue with marginal seed costs. Technologies involving fertilizer applications are slightly more complicated; marginal benefits must be gauged against higher fertilizer costs, and also higher costs of labor at weeding (based on crude estimates of the family wage rate at that time of the season). However, technologies recommending crop rotations, tied-ridging, manuring, mechanization, and changes in time of operation) are very difficult to evaluate using crop budgets. These technologies involve sizable changes in labor requirements; because the opportunity cost of family labor can vary enormously from period to period during the season it is difficult to evaluate their impact on changing labor costs and on profitability.

Farm modeling using linear programming techniques for evaluating technology under certainty, and MOTAD or quadratic programming techniques for evaluating technology under risk are well-suited to technology evaluation, and should be the ultimate target following the construction of a comprehensive set of crop budgets. Farm models, integrating the different crop and livestock enterprises (i.e. crop budgets) would then be numerically solved to determine the most profitable crop and technology mix, given constraints identified for the household. An indicative set of constraints might include: the availability of family labor by gender, task and time of season; the availability of different types of land quality; time requirements for activities of marketing, grazing livestock, or seeking firewood or water; availability of capital; feed demands for livestock; or favored crop rotations. Opportunities can be added for off-farm employment. New technologies are evaluated entering their coefficients in the model to determine if farm income improves. Labor and land costs are explicitly assigned dual prices by the model based on the opportunity cost derived from other activities on the farm. For example, the benefits of food processing technology derive from the shift of women's labor to other activities that are more remunerative or productive.

Production Studies

Current agronomic studies base fertilizer recommendations on experimental results that aim to maximize yields. Producers in practice would a priori be expected to apply fertilizer at rates that maximize financial returns based on principles of declining marginal productivity, and on expected output and input prices. Production function studies estimate the relationship between yields and fertilizer use on farms. Comparing the marginal productivity of fertilizer and its variability with existing prices would enable estimates of farmers risk averseness to the financial risk of fertilizer use. Studies would help predict fertilizer domains acceptable to farmers which in turn would encourage technology generation more adaptable to farmers needs and preferences.

Evaluating Farmer Socio-Economic Constraints

Evaluating socio-economic constraints and opportunities is the main rationale of farming systems research. Under SPARC, a variety of approaches should be used, including rapid reconnaissance, intensive village level surveys, regionalized surveys, ethnographic observation by researchers, participatory approaches, etc. The ultimate purpose of such surveys is to diagnose, evaluate and reevaluate opportunities and constraints confronting farmers in their decisions whether or not to adopt a technology, and the factors that determine or separate adopters from non-adoptors. Periodic studies will need to be conducted on:

* Identification of on-farm consumption and production constraints.

* Time flow studies of men and women on-farm and non-farm activities (% time spent on gathering fire wood and forage, agricultural fieldwork, gathering water, collecting herbs and condiments for the household, feeding children, processing food, marketing, etc.) Technologies requiring increased labor on certain tasks (tied-ridging, manuring) or that tend to reduce labor per hectare of land (animal traction or the introduction of milling machines) fundamentally depend on labor flow data.

* Evaluation of risk via multi-year studies to illuminate agronomic response to rainfall.

* Calendar of labor activities by crop and task.

* Access to inputs, prices paid, and general difficulties in acquisition.

* Importance of socio-economic factors (gender, land tenure) on ability or willingness to adopt new innovations.

* Crop enterprise mix (percentage of pure crops and various crop rotations in the farm plan), principle crop rotations, and frequency of use.

* Adoption and application of new technologies (when adopted, why, how altered from original recommendations, and performance).

* Measurement of marketed surplus, on-farm storage, losses, prices received for output, and seasonal price variability.

Market Studies

The single most important issue currently being raised by technical research scientists is the need for "les etudes filieres". Many if not most technical scientists feel that technologies are available for adoption if only input costs were lower and output prices were higher. Viable maize technologies are available in the CMDT zone that offer the potential of doubling or tripling yields, but due to favorable rainfall in recent years, maize prices have plummeted (Working group on rainfed crops, 1988). The same experience is reported for millet and sorghum in very specific locales. These concerns of inadequate price incentives come dangerously close to recommending or hoping that the government would reinstate price subsidies on inputs to lower input costs, and reestablish price floors on cereals to stabilize prices and to improve incentives. These are the same genre of policies that led to disastrous financial results for most African governments in the 1970s and 1980s.

The above argument put forth by scientists raises a number of fundamental issues about the extension and profitability of technologies generated by the research system, and the functioning of input and output markets. Staatz (1989) raises the following questions in an attempt to untangle the observation that technologies are unaffordable:

First, given the current price structure, the new technologies are less profitable on average across years than technologies currently used by farmers, implying that unit costs (CFA/kg) are higher under the new technology. One cannot assume that purchased inputs and fertilizer-responsive varieties will decrease costs of production. If the government subsidizes inputs and establishes a price floor, technology adoption is made easy, and farmer profits increase, but the government is simply transferring a

component of production costs from the farm to society at large. Price-led strategies to spur technology adoption (versus strategies to reduce costs of production and the cost of food to consumers) adversely affects rural families who are net purchasers of food (Dembele and Staatz 1989). It would also raise costs of food to consumers in the urban area and increase costs of production in the poultry and livestock feeding industry.

Second, new innovations may be more profitable than traditional technologies on average, but returns in any single year are highly unpredictable. For family's with incomes close to the margin of survival, many are unable to withstand the financial losses of cash input purchases from drought. The technology may thus be too risky to afford. Such risk may derive from unpredictable rainfall, volatile output markets, unreliable input supply, or imperfect capital markets (if markets were perfect, farmers could borrow in bad years and repay in good years).

Third, technologies appear profitable (and are not risky) but farmers have cash-flow constraints that limit the purchase of inputs. Such constraints are most likely to be severe in the case of investments requiring large capital outlays (machinery, animal traction, wells) or that have a long pay-back period. Studies of formal and informal credit and savings transactions in rural areas would be important to assess the importance of this constraint. However, it should also be recognized that the real cost of capital in Mali is high and will likely remain so for the foreseeable future. Capital constraints will not be easy to relax in the intermediate run, at least for the poorest households. Hence technology development will need to also emphasize technology domains emphasizing use of locally available resources.

Fourth, farmers may want to adopt the new technology, and have the liquidity to do so, but markets for the input simply do not exist (Working group on production systems and rural economy, 1988), or the farmer must incur considerable transactions costs in acquiring the input over and beyond the purchase price. Private merchants may view the market potential to be too small to be worth entering, or charge exorbitant prices to cover distribution costs. Farmers are sometimes reluctant to apply fertilizer until good rains are assured, leaving merchants to bear the risk of carrying the cost of fertilizer inventory.

No doubt, concerns over the structure, operation and performance of markets are crucial to the analysis of profitability, input supply, marketed surplus, and prices. Price incentives in agriculture can be improved by a number of strategies: reducing transport and marketing costs, thereby lowering prices paid by consumers, and increasing prices received by producers; reducing input costs to farmers by increasing the efficiency of input supply industries; and enhancing demand for coarse grains through income generation, increased use as animal feeds, and increased demand by processing industries (beer, flour, ethanol). An indicative list of marketing studies follows (Goita 1990):

Input Markets

A study of the availability, cost, and problems of input supply (improved seeds, fertilizers, agricultural chemicals, machinery, animal traction and credit) at the farm level. Macro studies should carefully examine marketing cost of imported inputs (import taxes, handling charges, and transport costs, from the border to farm level). Macro studies of domestically produced inputs would need to examine firm efficiency, transport costs, and marketing costs.

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Commercial Markets for Food Grains (Sorghum, Millet and Maize)

All efforts at intensification would be vain if the potential for commercialization (demand, supply, distribution) is not well understood (MOA 1988). Better understanding is needed of marketing costs, on-farm storage costs, on-farm price variability, and on-farm demand. A better understanding is needed of trader's constraints, and market structure. Studies should examine opportunities for enhancing demand, and the cost effectiveness of existing technologies (de-hulling machines) aimed at improving food quality, and reducing the work load of women.

Credit

Low incomes in the rural sector and the limited capacity of producers to borrow to invest in inputs and equipment are important constraints limiting intensification. Studies are needed to improve researchers understanding of local informal savings and credit mechanisms, costs of disbursement and repayment by the formal banking sector, and of market inefficiencies that may be constraining credit supply. More detailed research is needed on distinguishing between those situations where adoption is blocked by lack of farmer liquidity versus lack of functioning input markets (Staatz). Because of imperfect credit and commodity markets, farmers rely on proven cash crops (i.e. cotton) to generate cash to purchase inputs (animal tractions) which then benefit cereal production. Researchers may need to consider whether initial emphasis needs to be given to cash crop production in the area to stimulate food crop production rather then focusing on credit policy reforms.

Land Tenure

Land tenure is constantly cited as a problem by working groups in the IER. Entrepreneurs are reported to have difficulty gaining access to land, or lack adequate tenure security to make investments in land. Women are unable to legally own or hold land under indigenous rules. Private benefits to intensive forage systems are unclear, as access to grazing under customary systems has traditionally been considered common property. Improved understanding is needed of local indigenous rules governing land access and transfer, and also how the formal land codes are either benefiting or detracting from economic development.

Environmental and Natural Resource Concerns

Fundamental questions should be raised about the long-term social costs of chemical use in agriculture in terms of soil erosion, and declining water quality. Such issues are now a fundamental concern worldwide. Environmental studies of toxicity, soil erosion, and environmental degradation should be carefully integrated with agronomic and economics research. Greater attention may have to be placed on locally based sources of plant nutrients such as composts, and control of pests through breeding for resistance rather than through chemical control.

Post-Extension Rate of Adoption Monitoring

Unlike the economic assessment of agricultural research at the farm level, a rate of adoption study measures the economic benefits to agricultural research and diffusion. Economic benefits to SPARC will be heavily influenced by two factors: the increase in yields associated with new technologies generated under the project, and the extent of diffusion of the new technologies measured by area covered and speed of adoption. Technology diffusion is in part determined by the success of the research and extension programs, but also by the extent to which farmers spread technologies themselves.

On-farm studies of agricultural research prior to extension are generally not appropriate for assessing the rate of adoption because farm inputs and extension advice are heavily subsidized by the research program, and results are biased by the involvement of researchers at the site of the on-farm research. Farming systems programs also typically suffer the disadvantage of collecting data very intensively for a limited number of villages. Technologies may thus be adopted in the immediate vicinity of the research program where the on-farm studies of adoption are taking place, while diffusion beyond is limited.

The economic evaluation of rate of return to investment in agricultural research and extension must obtain an unbiased measure of both the increase in yield from technical change, and the area covered by new technology. Data on these variables are not currently collected at the regional level, although the FSR/E project has collected these data for the specific villages in which they are working. The implementation project will need to design a research methodology to collect and evaluate these data. An indicative research methodology is outlined below that could help meet the monitoring objectives of the project, and provide key information on the rate of technology adoption over a large survey area.

Sampling Frame

The most recent population census from 1987 contains data on villages and population for each of the regional centers. A survey would be administered to a randomly selected group of 200-400 households in a cluster of villages within a region or extension domain. An alternative would be to use the sample, or a subset of it, already used for the past several years in the national agricultural production survey of the DNSI (Department of Statistics and Computing) in the Ministry of Plan, in collaboration with the Ministry of Agriculure.

Survey Design

Two different options can be considered for selecting villages: 1) random selection of approximately 20-40 villages depending on population density in the region; or 2) stratify and pre-select villages according to factors known to influence rate of adoption:

* Proximity to the station and/or on-farm research (villages nearer to or further from research sites) to assess the impacts of on-farm trials and extension services in technology diffusion.

* Proximity to roads and markets (i.e. villages nearer to, or further from, principal or secondary roads and/or markets) to evaluate the impact of marketing costs on the rate of technology adoption.

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Questionnaire

A one-round questionnaire would be administered to a random sample of 10 or so households within each village. The farming systems group would meet with technical scientists and extension agents to clearly define a list of technologies that have been promoted through on-farm research and through agricultural extension. These technologies would be included in a questionnaire and questions included on:

* Whether or not the technology (or modified version) has been adopted by the farmer.

* If the technology has been adopted, how many years has the farmer been using it, on what types of land is it being used, on how much area (hectares or percent) is it being used, and about what level of yield increase is being achieved relative to the previously used technology.

* If the technology has not been adopted, key questions would need to be asked on whether the farmer is aware of the technology, and if so, why it is not being adopted

Scheduling

Surveys can be undertaken January-March when other activities on the research station are at a lull. This study is intended to be carried out rapidly, suing a combination of rapid appraisal techniques and short and focussed surveys. However, due to human limited resources, it would probably not be possible to carry out surveys in every region in all years of the project. Surveys may thus need to be staggered every other year, for example, Sotuba and Mopti in 1992, 1994 and 1995, and Cinzana and Sikasso in 1993, 1995 and 1997.

Assessment of Human Resources in the IER

The above agenda of economic research is ambitious and will need to be gradually and carefully phased in over the entire length of the project. The agenda would exceed the IER's capacity under even the best of circumstances, yet the issues posed are fundamental to any program expected to understand constraints to technology adoption, to provide meaningful feedback to technical scientists, and to make intelligent recommendations for improving the design, adoption, and profitability of technology.

A list including level of education by discipline and source (where the degree was obtained) is included in Table F(7)-9. Current staff in the DPE, DET and DRSP includes 17 agricultural economists, 2 economists or rural economists, 2 agronomists, 1 animal scientist, 1 geographer, 3 demographers with emphases on economics or sociology, and 4 sociologists. The level of training is weak. Among agricultural economists, only two currently hold Ph.D. level degrees (1 Doctorat de 3 cycle from France, 1 Ph.D. from the USSR), and 6 M.S. degrees (1 M.S. from Montpellier France, 3 from Nigeria, and 2 from the US). Agricultural economics training in Nigeria is relatively weak, although comparisons would depend on the school, program and student. However, it would be difficult to justify much further training in agricultural economics given the relative weakness of other disciplines in IER, and the fact that a number of students are already studying abroad: 2 M.S. students are currently or are about to depart for training in the US and the UK; 3 Ph.D. students are currently training in the US and France.

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Implications for Short-Term Technical Assistance and Capital Procurements

The Scope of the proposed research agenda, and current shortage of economists and sociologists in the IER pose a number of implications for the nature and phasing of work under SPARC:

1. Careful planning of the socio-economics research program should be initiated as early as possible in the first year of the project, with research beginning the second year, to ensure that the research program is well focused and tailored to meeting the needs of technical scientists.

2. Certain types of socio-economic work can be conducted by people on the production teams (socio-economic surveys, cost of production studies, farm modeling), other research activities (marketing studies, national agricultural policy) will best be handled by economics staff centered in the IER or at Sotuba. Some of the survey work can be conducted in the off-season to minimize conflicts with technical scientists (i.e. for vehicles). However, the volume of work will be heavy. Successful and timely implementation of studies, and close collaboration between national level and center level staff, will crucially depend on availability of transport, funds to hire enumerators, and on access to computers.

3. Heavy reliance will need to be placed on short-term technical assistance throughout the life of the project. Many of the trainees currently studying abroad will not be returning until 1992-94. It should not be expected that they will immediately be prepared for work upon their return. The suggestions in the PID, of having a long-term economist for 1-2 years, does not provide the long-term support needed. Short term technical assistance is a useful compromise and can be provided in two ways: (a) frequent visits by short-term expatriate staff to Mali to assist the IER in research planning, survey design, rapid reconnaissances, questionnaire development, data analysis, economic modeling, short-courses, and report writing; or (b) IER staff visiting universities in the US for short-term training and analysis of field level data. Both approaches should be encouraged in a fully collaborative mode.

Benefit-Cost Analysis

Studies of rates of return to investment in agricultural research, extension, and human capital (Griliches, 1957; Hayami and Ruttan; Evans, 1967) have consistently estimated returns to investment between 25-50%. Rates of return in semi-arid areas, particularly in Africa, have not been well documented or rigorously studied, although one might assume based on the experiences of the 1980s that the risks of payoff are higher and that the benefits will be longer in coming. This section estimates the rate of return to agricultural research and extension resulting from the SPARC investment using discounted present value methods, measured by Net Present Value (NPV), and Internal Rate of Return (IRR).

Social-Nutritional Benefits Excluded from the Analysis

Benefits to the SPARC project fall into one of two categories: those that are difficult to quantify and thus difficult to include in rate of return calculations given existing data and time constraints; and those with benefits that are numerically quantified and included in the rate of return analysis. Assumptions used to estimate the latter benefits are discussed shortly. The following benefits will be generated by investments under SPARC. As they are excluded from the NPV and IRR calculations, however the rates of return indicated in this section slightly understate the "true" rate of return to the project:

1. **Millet-cowpea flour composite.** The benefits derive from introducing a millet (3 parts)/cowpea (1 part) flour composite to improve the nutrition of very young children. This benefit is important but is applicable to only a small proportion of the total population.

2. **Milling technology.** This technology could potentially ease the workload of women. Benefits in the aggregate are offset by the fixed cost of milling equipment and operating costs, and the extra time that women must devote to other activities to generate revenue to pay for the service. On balance the benefits would be positive, but are relatively small compared with production impacts mentioned below.

3. **Intensive forage production.** Introducing forages in the farming system will benefit small ruminant production, and improve the nutrition of animal traction animals. However, as intensive forage systems in Mali are now very rare, any increase in area would imply a reduction in acreage of other crops assuming that labor is now fully employed. Animal traction, as primarily a labor-reducing technology, facilitates an expansion in farm size, and mainly in cereals. This effect of area expansion can be evaluated with the model below, but the result would tend to over state benefits if their are other constraints impinging on animal traction use (i.e. cash constraints).

B. Assumptions

Assumptions upon which the cost benefit analysis is based are as follows :

1. As IER develops profitable farm-level technologies, those technologies will move from multi-locational trials to IER pre-extension to ODR or PNVA or ONG extension in a steady and effective fashion. (This process is discussed in more depth in section V.E. "Technology Transfer Analysis" in the main body of the PP.)

2. Profitable technologies made available to farmers through pre-extension and extension will be adopted by farmers at a moderate but steady pace accross a substantial portion of the national area currently planted to the same CMPS crops in the appropriate ecological zone, as discussed below.

3. The project benefit strean, built upon assumptions 1) and 2) above, has two important features. First, the crop mix (proportion of different crops out of total cultivated area) does not change with technology adoption. This is unrealistic, but models to predict these adjustments are quite complex. Second, the rate of return model estimates the internal rate of return and cost-benefit ratios based on marginal changes in yields and marginal changes in imput use. A farm-level financial analysis is thus unecessary. Rather, changes in yields (i.e. the change in revenues or benefits accruing as a result of new technology adoption) are compared with the changes in inputs (land, labor and capital inputs representing marginal variable costs) to adopt that technology. The important question that needs to be asked is how does the new technology affect input parameters in a farm budget, i.e. do inputs of labor and capital inputs increase or decrease. New varieties for example increase yields but require no additional inputs as seeds can eventually be reproduced on farmers' fields. A new fertilizer technology increases yields but also requires additional fertilizer. These marginal changes can be calculated in the absence of complete knowledge about farm budgets. However, not all technologies are so transparent. Mulching increases human labor requirements per unit of land area for transport of mulch, but animal traction normally decreases human labor requirements at weeding.

Because of this complexity, and given the dearth of good farm level financial data, the marginal approach was used in estimating the rate of return to investment in agricultural research and extension. One composite technology for each crop was chosen, otherwise the discounting of net returns for 4+ crops, in 3 or more regions, for 2+ technologies per crop, over a 25 year time period would have greatly exceeded the complexity of what is already a complex rate of return model. Benefits in the model are the additional yields achieved by adopting the composite technology. Costs are derived from additional investments in research and extension (i.e. the SPARC project costs) and from changes in input use. The emphasis on plant breeding and variety selection in the agronomic section led to the conclusion that labor changes would be minimal and/or very difficult to predict (adoption of animal traction technologies or tied-ridging technologies would dramatically alter labor requirements, but these technologies are not a central focus of the project). Changes in land (for any given year) remain constant as a result of the assumption that crop-mix is not allowed to change. Seed costs increase in the first year with the purchase of the new seed varieties, but are animal thereafter as seed is reproduced on farmers fields. The additional fertilizer required to produce the higher yield is accounded for in the model. However, the composite technology paradigm means an "average technology". The total area covered by the diverse array of new varieties (some for striga resistance, others for drought resistance, etc) will likely exceed the area fertilized as not all technologies necessarilly require fertilizer. Fertilizer and pesticide use rates in the model have thus been down-sized to account for this phenomena.

The above assumptions help datermine the costs and benefits of adopting a new technology. Other features of the model--i.e. growth rate in extension domain, growth rate in adoption, growth rate in yields, growth rate in prices--determine an adoption curve. That is, the model permits an evaluation of the effects of changes in adoption rates and changes in yields and prices over time on the economic rate of return of the project.

4. Benefites from the Mali SPARC project derive from several potential sources: On-farm testing of existing improved technologies ; station testing and on-farm testing of new technology ; and extension and dissemination of existing and new technology.. The aggregate effect of all these benefits is assumed to start in year 6 of the project (i.e. the yield gain represents the aggregate effect of existing and new technologies being adopted). It is not known a priori which technologies will be adopted by farmers. The adoption of technologies now in the pipeline will be necessary if yield improvements are to start by the 6th year. New varieties may be generated by that time or within 5 years thereafter. There are two ways to look at this in the model : a) by adjusting the average yield levels, or b) by changing the growth in yields over time. Yield improvements in the analysis are now assumed to remain constant over the life of the project. Thus, the yield figures represent the average effect of technologies now in the pipeline and the average gains of technologies that may be developed over the next 6 to 10 years.

5. The analysis assumes that market prices are close proxies for economic prices. This assumption, which would clearly have been incorrect a few years ago, is a reasonable one now in light of the current economic policy environment. Market and trade liberalization, tax reform, and the elimination of official prices have led to a situation where market prices and economic valves are closely aligned.

Base Model[3]

The major potential benefits of SPARC are improved agricultural productivity and producers income. Institutional strengthening, training, and improved financial management are important objectives. However, unless these activities ultimately improve economic growth or productivity in terms of improved technology adoption on farms, they arguably should not be considered substantial benefits in and of themselves. The following model was developed to calculate the rate of return to SPARC based on expected production benefits under the project:

Pjm = Economic price of the j-th commodity in the m-th region (in thousand CFA).

pjm = Rate of growth in the price of the j-th commodity in the m-th region.

Yjm = Yield differential between the new and existing technology of the j-th commodity in the m-th region (kg/ha).

yjm = Rate of growth in yield improvement (Yjm) of the j-th improved technology (e.g. due to a learning curve of farmers in adopting the technology over time).

Ajm = Extension domain of the j-th crop in the current time period in the m-th region (total crop area will usually exceed the extension domain either because of limited resources funneled to station research or extension services, or because crop areas are highly dispersed) (ha).

ajm = Rate of growth in the m-th extension area or domain (Ajm).

ANjm = Initial area covered (critical mass) of the new technology on the j-th crop in the m-th extension domain (ha).

anj = Rate of growth in area under the new technology of the j-th crop in the m-th extension domain.

Sjm = Quantity of improved seeds (kg/ha) required by the j-th technology in the m-th region.

sm = Economic cost of the improved seed variety in the m-th region (CFA/kg).

Nj = Quantity of nitrogen fertilizer (kg/ha) required by the j-th new technology in the m-th region.

nm = Economic cost of nitrogen fertilizer in the m-th region (CFA/kg).

Pjm = Quantity of phosphate fertilizer (kg/ha) required by the j-th new technology in the m-th region.

pm = Economic price of phosphate fertilizer in the m-th region (CFA/kg).

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[3] This model was developed with Quattro Pro software and requires a minimum of 1mb RAM to operate.

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Three regions are included in the model: north, central and south, covering all cropping zones of the country. Crops or commodities in the model include millet, sorghum, maize, irrigated rice, immersed rice, rainfed rice, upland rice, cowpeas, groundnuts and forage. Based on discussions between the IER and technical groups on the design team, the team is recommending that SPARC focus on four commodities: millet, sorghum, cowpeas, and forage. Based on discussions between the IER and technical groups on the design team, the team is recommending that SPARC focus on four commodities (millet, sorghum, cowpeas, and forages), although the project would provide important secondary benefits for other commodities as well. The following are extension domains (Ajm) for all commodities and regions proposed by the IER (areas are roughly equivalent to unadjusted crop areas reported in official statistics):

Extension Domains in Initial Time Period (ha)

	North	Central	South
Millet	15,000	450,000	335,000
Sorghum	15,000	450,000	335,000
Cowpeas	-	316,000	-
Groundnuts	230	17,700	82,000
Maize	-	-	125,000
Rice - dryland	-	-	13,000
Rice - immersed	9,000	48,000	9,000
Rice - irrigated	-	43,000	5,000
Rice - lowland	-	-	20,000

Rates of growth in extension domains (aj) based on IER estimates depend on crop and region. Investment in stations and extension staff will most benefit the north under current IER plans. Area expansion of maize is highest in the south. Based on IER data, the following rates of annual growth in area can be expected (these growth rates were derived from a 2005 or 15 year time horizon; this study applies them to a 25 year time horizon. However, the terminal area of extension domain is equivalent to IER estimates):

North

Millet/sorghum 3.8% per annum; cowpeas (none grown); maize (none grown); immersed rice 0.6%; and groundnuts 0.2%. No extension domain is foreseen for irrigated rice, lowland rice, rainfed rice or cowpeas.

Central

Millet/sorghum 0.2% per annum; cowpeas 0.0%; irrigated rice 1.6%; immersed rice 0.6%; and groundnuts 0.2%. No extension domains are foreseen for maize, lowland rice, and rainfed rice

South

Millet/sorghum 0.9% per annum; maize 3.2%; irrigated rice 1.4%; immersed rice 0.6%; lowland rice 0.0%; dryland rice 0.0%; groundnuts 0.2%; and cowpeas 0.0%.

Benefits to technology adoption are counted in the model once the critical area (ANj) is reached, assumed in the base case to be equal to 5% of the initial extension domain. It is further assumed that this critical area is achieved starting in the 6th year of the project. Any benefits that may accrue prior to this point would add only minor improvements to the rate of return to the project. The rate of spread in technology

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acceptance by farmers starts with this area then increases by the variable (anj) set initially to 15% (i.e. the area under improved technology grows at 15% per year start from point ANj). Note that the area under the extension domain and the area under the improved technology are of different sizes, and grow at different rates. Area constraints are included in the model to ensure that the area under the improved technology (ANj) never exceeds the area under the extension domain (Aj).

IER estimates of yield improvements (Yjm, Table F-7 (2)) are used for the productivity benefits associated with investments in agricultural research under SPARC. These figures are average yields of the composite package of technologies focusing on (see technical section):

Millet

Expanded on-farm trials and demonstrations, plant breeding, introduction of improved varieties, agronomic work on millet-groundnut and millet-manioc intercropping, Guinean fonio evaluation (south), collection of materials for breeding cantharis beetle tolerance, and composite flour

Sorghum

Support evaluation of local varieties, plant breeding with emphasis on medium-early varieties and on striga resistance, agronomic trials involving cowpea and groundnuts, introduction of improved varieties, and possible introduction of "Sori" parboiled product, and processed sorghum products (grits, meal flour).

Cowpeas

Plant breeding, practical technologies for on-farm cowpea storage losses, genetic resistance to floral insects, bruchids and Striga, research on innovative food products such as Acara, and composite flour diffusion.

Forages

Evaluation of Bourgou biomass and grain production under existing farming systems, agronomic packages for animal traction forage production, cowpea forage intensification, and millet-cowpea intercropping with focus on cowpea forage.

Other Research Programs Benefitting from SPARC Support.

Investment in institutional capacity, in economic and socio-economic studies of farming systems and markets, and in improved financial management would stimulate benefits in other research programs as well. Although uncertain and very difficult to estimate, a crude attempt is made to account for them in the model by assigning a 25 kg/ha yield improvement for all other commodities (those with existing current extension domains) in the respective regions. Yields (Yjm) are assumed to remain constant over the life of the project (yjm=1), although simulations are possible to evaluate drought and learning curve effects through manipulation of variable (yjm).

Gross economic benefits are calculated as price (Pj) times yield improvement (Yj) times area under improved technology (ANj x anj). The following prices are assumed (in CFA/kg):

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North

Millet/sorghum 50, and rice 70.

Central

Millet/sorghum 40, rice 70, cowpeas 100, and groundnuts 50.

South

Millet/sorghum 30, maize 20, rice 70, lowland and rainfed rice 60, and groundnuts 50.

Prices are assumed to remain static through the life of the project (i.e. pj=1.0). Prices would be expected to increase in situations: of land scarcity and rising land values; where good rainfall of the last 3.5 years is replaced by drought and aggregate production declines (regardless of whether technology is improving yields through improved drought resistance); or of successful demand enhancement strategies. Conversely, prices may decline under situations of good rainfall and/or substantially expanded supply from technology adoption. The assumption of stagnant prices is based on a medium year rainfall scenario, and on successful marketing and economic research aimed at lower marketing costs and enhancing demand in face of expanded supply.

Costs in the model are of two types: fixed and variable. Fixed costs include investments in short and long term technical assistance, the IER's operating costs to support the above research agenda, short and long-term training, and procurement costs. Rate of return calculations are based on the following estimate of total cost and schedule of disbursements:

	(000) Dollars
Year 1	2,300
Year 2	3,000
Year 3	4,000
Year 4	4,000
Year 5	4,000
Year 6	2,166

Most of the benefits to the SPARC project involve technologies comprising varietal improvement for drought, pest and Striga resistance, and improved farm management practices (inter-crop, better timing of operations). Improvements in soil fertility (fertilizer or manure) would enter extension recommendations in certain instances. Current doses being recommended by extension agents would generate yield increases far in excess of those in Table F-7 (2). The following fertilizer applications and costs apply to a subset of the area covered by the new technology; the averages here are low because they are divided by total area under the composite technology:

	Application kg/ha	Price CFA/kg
Urea	15	145
Phosphate	5	110

Seed costs are assumed to be negligible. Research supported under SPARC will not result in hybrids, whose seed needs annual replacement. Improved varieties which are not hybrids can be replicated on farms and distributed by farmers, with negligeable cost.

Net benefits (NB), or gross benefits less total variable and fixed costs, are used to calculate rate of return to the investment in research and extension using two measurements (Levy and Sarnat, 1990):

$$NPV = \frac{NB^1}{(1+r)^1} + ... + \frac{NB^{25}}{(1+r)^1}$$

$$IRR = \frac{NB^1}{(1+R)^1} + ... + \frac{NB^{25}}{(1+R)^1}$$

The Net Present Value (NPV) is the present value of all future flows of capital discounted by the opportunity cost of capital, assumed in this analysis to be r=.12. Net benefits from the project are discounted over a 25 year time horizon, through the life of the project. A positive NPV coefficient would indicate under perfect certainty that the project has positive net benefits, and should be accepted. The Internal Rate of Return (IRR) is the discount rate (R) that just equates the present value of the stream of positive net benefits, with the present value of the stream of negative net benefits. The IRR model is incorrect in the sense that it assumes that project net benefits can reinvested at the project's IRR. Nonetheless, it provides useful insights for gauging the magnitude of net benefits generated under the project, and is the most direct measure of the rate of return to investment in agricultural research and extension. In general, the NPV will approach "0" as "r" approaches "R".

Benefit-Cost Analysis

The rate of return on investment in agricultural research and extension depends fundamentally on four factors: (1) yield improvement over existing technology; (2) output prices; (3) area covered by the technology; and (4) speed of adoption. The results in Table F-7 (5) examine the base case rate of return to the SPARC project, with simulations on five levels of yields: 20% below base yield improvement, 10% below, base yield improvements (Table F-7 (2)), 10% above, and 20% above.

The rate of return of the project based on base model assumptions is around 14% with a positive NPV of $3,526 (thousand). If the government had to borrow money at a real rate of 12% to finance the project, it would find it profitable to do so given model assumptions[4]. However, the project's rate of return is quite sensitive to changes in yield improvements. If yield improvements ultimately materialize

[4] The BCEAU special inter-banking rate is currently 11% plus 1 to 5 percentage points added as a risk premium, depending on riskiness of the project. Because of Mali's favorable liquidity position, a 12% discount rate seems appropriate.

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at 80% or less of current predictions, the project would cease to be profitable. Conversely, if yields exceed current predictions by 20%, the NPV increases to $9,201 (thousand) and the IRR increases to 16.9%.

The simulations in Table F-7 (5) evaluate the sensitivity of the project's return to alternative assumptions about the initial scope and speed of adoption. Columns (1) to (3) assume that for reasons of low profitability, poor extension service, etc., the technology is initially accepted on only 5% of the extension domain. Columns (4) to (6) assume that due to high demand by farmers, good input distribution and good extension support, the technology is initially accepted on 10% of the extension domain. Under each of these scenarios, three rates of speed of adoption are examined: slow (area under improved techhologies grows 5% per year), moderate 15%, and rapid 25%.

Table F-7 (5): SPARC Project NPV and IRR Calculations, Yield Simulations

		.80	.90	Base yields	1.10	1.20
NPV (discount rate = 12%)		-2,148	690	3,526	6,364	9,201
IRR		10.5	12.4	14.1	15.6	16.9
Extension Domain Under Improved Technology (%):						
North:	Millet	28	28	28	28	28
	Sorghum	28	28	28	28	28
	Cowpeas	0	0	0	0	0
Center:	Millet	68	68	68	68	68
	Sorghum	68	68	68	68	68
	Cowpeas	71	71	71	71	71
South:	Millet	57	57	57	57	57
	Sorghum	57	57	57	57	57
	Cowpeas	0	0	0	0	0

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Table F-7 (6): SPARC Project NPV and IRR Calculations, Area Simulations							
	A:	.05	.05	.05	.10	.10	.10
	B:	.05	.15	.25	.05	.15	.25
NPV (discount rate = 12%)		-5,690	3,527	20,598	1,729	19,492	37,430
IRR		6.3	14.1	20.3	13.4	21.1	26.1
Extension Domain Under Improved Technology (%):							
North:	Millet	5	28	100	10	56	100
	Sorghum	5	28	100	10	56	100
	Cowpeas	0	0	0	0	0	0
Center:	Millet	12	68	100	24	100	100
	Sorghum	12	68	100	24	100	100
	Cowpeas	13	71	100	25	100	100
South:	Millet	10	57	100	20	100	100
	Sorghum	10	57	100	20	100	100
	Cowpeas	0	0	0	0	0	

A = initial area established with improved technology; B = rate of growth in area

A slow rate of adoption in terms of initial scope and speed results in disastrous returns for the project. Under the scenario of 5% initial scope and 5% growth in rate of adoption, NPV is -$5,690 (thousand) with an IRR of 6.3%. Millet/sorghum technology is ultimately adopted on only 5% of the area in the north and 10-12% of the area in the central and south regions. When the rate of adoption is increased to 25%, however, the NPV rises to $20,598 (thousand), the IRR to 20.3, and improved technology is adopted throughout the entire extension domain. Rates are even more robust if one assumes that, due to solid returns from investments in extension, on-farm testing, and socio-economic and marketing studies, the initial scope of adoption is 10%. Under the moderate speed of adoption scenario, NPV is $19,492 (thousand). Increasing speed of adoption to 25%, achieves full adoption over the entire extension domain earlier in the project, and the NPV rises to $37,430 with an IRR of 26.1%.

Price levels of cereals have been an important concern of technical scientists. Yield improvement in face of declining marketing prices would decrease project benefits. Prices may fall due to robust supply response relative to demand, or because marketing studies under the project fail to improve market efficiency or to enhance market volumes. Conversely, the relatively plentiful rains of the last several years cannot be expected to continue. Returns to less then favorable rainfall would imply lower aggregate production and higher real prices, other things equal. The results in Table F-7 (7) examine three price scenarios: prices change by an annual rate of -3%, -2%, -1%, +1%, 2% and 3%.

Table F-7 (7): SPARC Project NPV and IRR Calculations, Output Price Simulations						
pjm =	-3%	-2%	-1%	1%	2%	3%
NPV	-3,841	-1,683	760	6,663	10,221	14,258
IRR	8.6	10.7	12.5	15.6	16.9	18.2

A downward trend in real price levels would place heavy pressure on the economic rate of return of the project. A 1% annual decline in real prices for all commodities would decrease the NPV to $760 (thousand). If prices declined at an average annual rate of 3%, a very unlikely scenario, the NPV would decline to -$3,841 (thousand). A more like set of scenarios is that real prices will increase slightly on average over time. A 1% annual increase in prices would increase the project's rate of return to 15.6% and the NPV to $6,663 (thousand). A 2% annual increase would increase the IRR to 16.9% and the NPV to $10,221.

Implications

Results of the Benefit-Cost analysis have a number of implications for the target objectives of the project. For the project to break even:

1. Technologies need to be rolling off the station and onto farmers fields by around the 6-th year of the project.

2. Yield levels at least 90% of those reported in Table F-7 (2) need to be achieved based primarily on low input agriculture (reduced emphasis on fertilizers and biological chemicals).

3. The rate of return depends crucially on the speed of adoption and on the success of agricultural extension. At a minimum, at least 5% of the extension domain needs to be improved in the 6-th year of the project, and grow at a 15% annual rate thereafter.

4. Marketing studies must increase market efficiency and sufficiently expand market demand to ensure that real prices remain stable, or at least do not decline.

Should these minimum target levels not be met, the project would fail to have a positive net payoff, the rate of return would fall below the opportunity cost of capital, and the project would essentially be consuming capital that donors or the GRM could be allocating elsewhere (other countries or sectors) to achieve higher growth. Conversely, should yield improvements be higher than expected, should adoption be higher than expected, and should real prives rise slightly over time, the SPARC project offers substantial potential pay off to investment in agricultural research and extension.

Table F-7 (8): Indicative Crop Budget by Zone or Region

	Traditional Technology	Improved Technology
1. Communal or private field:		
2. Type of crop (pure stand or inter-crop)		
3. Type of land (highly manured soils around compound, lowland deep soils, upland shallow soils, etc.)		
4. Average yield (kg/ha):		
Primary crop:		
Secondary crop(s);		
5. Average market price(s) (price per kg)		
6. Amount of family and permanent labor by task (hours/ha):		
Male workers period 1		
.		
.		
period n		
Female workers period 1		
.		
.		
period n		
7. Amount of hired labor by task (hours/ha):		
Male workers period 1		
.		
.		
period n		
Female workers period 1		
.		
.		
period n		
8. Quantity of manure applied		
9. Quantity of purchased inputs		
Nitrogen fertilizer (kg/ha)		
Phosphate fertilizer (kg/ha)		
Other agricultural chemicals (CFA/ha)		
Improved seed varieties (kg/ha)		
Depreciation on tools and equipment (CFA/ha)		
Transport costs to market (CFA/ton)		
Mechanization (by task) (CFA/ha)		
period 1		
.		
.		
period n		
10. Average input prices paid.		
11. Net cash returns (4 x 5 - 7 x 10 - 9 x 10)		

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F-7 (9): Level of Training of Socio-Economists by Discipline and Source			
Degree	**Number**	**Level**	**Place Degree Received**
DPE (Present):			
Agricultural Economist	1	Doctorat de 3 cycle	France
	1	M.S.	USA (7)
	1	Diplome de specialisation	France
	1	Diplome d'ingenieur	France
Economics/Demography	1	Diplome de 3 cycle	Belgium
Agronomist	1	M.S.	USA
Geography	1	Doctorat de 3 cycle	France
Sociology/Demography	1	M.S.	USA
DET (Present):			
Agricultural Economist	1	Ph.D.	USA (94)
	1	M.S.	USA (92)
	1	M.S.	France
	3	M.S.	Nigeria
Rural Economy	1	DEA	Mali (93)
Sociology/Population	1	Diplome de 3 cycle	Belgium (92)
Animal Scientist	1	ISA	Mali
Agronomist	1	DEA	Burkina Faso
DRSP			
Agricultural Economics	1	Ph.D.	USA (92)
	1	Doctorat de 3 cycle	France (94)
	2	M.S.	USA
	1	Ph.D.	USSR
	1	Diplome d'ingenieur	IPR Katigoubou
	1	M.S.	UK (debut 92)
Economics	1	Stage	France (91)
Sociology	2	Prof. Ens. Second	ENSUP Bamako
	1	M.S.	USA (92)
	1	Ph.D.	USA (91)

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References

Atwood, David and James Elliott. 1989. "Economic Growth, Food Crop Research and Agriculture in Mali." Bamako: mimeograph, March.

Dembele, Manadou Augustin. 1990. Regard sur l'Adoption de Technologies Agricoles au Mali. Bamako: USAID.

Grant, William and Petr Hanel. A Study of the Business Climate in Mali. 1988. Report prepared for the U.S. Agency for International Development. Bamako: USAID, September.

Griliches, Z. 1957. "Hybrid Corn: An Exploration in the Economics of Technical Change." Econometrica. Vol. 25:501-522

Hayami, Yujiro and V.W. Ruttan. 1971. Agricultural Development: An International Perspective. Baltimore: Johns Hopkins University Press.

Humphreys, C.P. and S.R. Pearson. 979. "Choice of Technique in Sahelian Rice Production." Food Research Institute Studies, Vol. XVIII, Noc. 3, pp. 235-277.

Levy, Haim and Marshall Sarnat. 1990. Capital Investment and Financial Decisions. London: Prentice Hall International.

Martin, Frederick. "Food Security and Comparative Advantage in Senegal: A Micro-Macro Approach." 1988. Ph.D. Thesis, Department of Agricultural Economics. East Lansing: Michigan State University.

Republique du Mali, Ministere de L'Agriculture, Institut d'Economie Rurale. Rapport Annuel 1988 and 1989. Bamako.

Republique de Mali, Ministere de l'Agriculture. 1989. Determination des Couts Moyens de Production des Principaux Agricoles, Campagne 1989/90. Bamako, Fevrier.

Republique de Mali, Ministere de l'Agriculture. 1988. Programme Nationale de la Recherche Agronomique a Long Terme. Rapport du Groupe Systeme de Production et Economie Rurale. Bamako, Decembre.

Republique de Mali, Ministere de l'Agriculture. 1988. Projet Plan National A Long Terme de Recherche Agronomique. Rapport Groupe Cultures Pluviales. Bamako, Novembre.

Republique du Mali, Ministere du Plan, Direction Nationale de la Statistique et de l'Informatique. 1991. 1989 Annuaire Statistique du Mali. Bamako, June.

Roth, Michael J. and P.C. Abbott. 1990. "Agricultural Price Policy, Food Aid, and Input Subsidy Reforms in Burkina Faso." Journal of Agricultural Economics, Vol. 41, No. 3, September.

Staatz, John M. 1989. The Role of Market Conditions in Influencing the Adoption of New Agricultural Technologies in Mali. Bamako: Projet Securite Alimentaire C.E.S.A., USAID, October.

Stryker, Dirck J., Jean-Jacques Dethier, Ignatius Peprah, and Donald Breen. 1987. Incentive System and Economic Policy Reform in Mali. Washington, D.C.: Associates for International Resources and Development, June.

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ANNEX F-8

TRAINING ANALYSIS

As part of its long-term strategic planning activity, the Rural Economy Institute (IER), with support from the International Service for National Agricultural Research (ISNAR), has evaluated its professional training needs based on current staffing levels and the estimated staffing of research scientists needed to meet the objectives of the Institute's long-term research strategy.

The proposed long-term training programs to be financed under the SPARC Project are based on the training priorities identified in this initial plan and on the project's priorities for specific interdisciplinary research programs (sorghum, millet, cowpeas, forage crops, and food processing) and in research management (financial management, research planning/evaluation). (See Table F-8 (1)).

Some of the key operating assumptions to a successful long-term training component in the SPARC Project are as follows:

- Within one month of project authorization, and in order to plan departures for long-term training in accordance with the needs for the continued execution of priority research activities, the IER should prepare an indicative list of long-term training nominees that is keyed to the Institute's research implementation and planning. (Such a list might also help in assuring program continuity by identifying program gaps that could be filled with short-term technical assistance under the contract or through CRSPs active in Mali.)

- Upon nomination by the IER, all long-term training candidates should be interviewed by a joint IER-AID-TAMU committee in order to help identify the most appropriate program and university. It is understood that on the basis of this interview a nominee may be rejected and an alternate candidate requested. (Universities and programs to be considered for long-term training will be proposed by IER and by the contract consortium management committee.)

- Subject to acceptance by a university, assignment of a Thomas Jefferson Fellow to a particular university program will based upon: the appropriateness of the degree program for the Fellow's future IER assignment; and, upon successful completion of the degree program, an agreement by the candidate's major professor to provide, under the contract or through another mechanism, such as a CRSP, at least one short, follow-up and support mission with the candidate in Mali.

- All Fellows accepted in US university graduate programs who need additional training will take their English-language training in the United States. When possible, Fellows will be sent for this training to the Economics Institute in Boulder, Colorado.

- All Fellows will attend at least one short-term training workshop or seminar during their long-term degree program.

- Funds for PhD field research in Mali are not available in the project, but project staff and the contractor consortium will encourage fellows when appropriate to seek research funding for in-country research. Any in-country research will require approval of relevant IER research program leaders. The training budget includes a second round trip airfare for each participant, permitting transportation for in-country research where appropriate.

- The contractor coordinating office will maintain regular contact with all Fellows and their major professors during the period of their degree studies in order to assure a close relation between project activities and each candidate's program.

- Accompanying spouses of long-term trainees will have access to long-term training in the same location, appropriate to their interests and skills.

A. Long-Term Training

1. US Training Programs

Each Fellow's degree program and the relationship between classroom studies and research will vary by discipline, school, and the individual's specific circumstances. Two general types of US-based programs can be outlined as a basis for estimating Fellow trainee program costs:

a. Master's Degree Candidates

A standard Masters program, including the thesis, will take approximately 30 months. Participant trainees with the required TOEFL score for unconditional admission to graduate studies should be programmed to begin their degree program during the Fall term. An additional 6 months for English language training should be planned for participants without English language skills to meet the TOEFL requirement.

b. PhD Degree Candidates

A PhD program should be expected to take from approximately 4 years, including up to 6 months for English language training, course work, preliminary examinations, research and dissertation preparation. It is assumed that all PhD candidates will not require English-language training. Depending upon the specific degree program and other funding opportunities, a PhD candidate may be able to conduct dissertation field research in Mali during this period.

c. Note on Graduate Programs for Social Scientists

When possible, training programs should be planned so that MS students would be able to write their thesis on a pre-existing data set from associated work in Mali. If PhD candidates have the opportunity to return to Mali for field research, enough time and logistic support must be planned to enable rapid appraisals, key informant interviews, ethnographic observation, random and stratified-random sampling designs, the development of questionnaires, data collection, and perhaps computer data entry.

d. An Indicative Training Program

Table F-8 (1) below presents a listing of indicative academic training disciplines and degrees for SPARC.

Note on the Indicative Long-Term Training: The indicative long-term training programs are based on several considerations. First, the proposed training programs respond to the long-term training needs identified by the IER during its long-term strategic planning process. Second, the selected degree programs are parallel to the project research priorities (breeding, soil fertility, pest control, improved agronomic practices) for sorghum, millet, cowpeas and forage crops. Third, given the relative prevalence of MS degree holders among IER scientists, the number of proposed PhD programs approximately equals the number of proposed MS programs. Fourth, the proposed degree programs are spread over several disciplines in order to encourage a more even distribution of scientific disciplines and expertise within the Institute.

Table F-8 (1): Indicative Training Programs

	MS	PhD
Accounting/Fin. Mgt.[a]	2[b]	0
Agricultural Economics[c]	0	1
Agronomy	0	1
Applied Anthropology/ Rural Sociology	1	1
Biometrics (Agronomist Biometrician)	0	1
Food Science Technology (Cereals)	2	0
Entomology	0	1
Forage Crops	1	0
Plant Breeding	1	1
Plant Pathology	1	1
Plant Physiology	0	1
Soil Microbiology	1	0
Weed Science	1	1
Total	10	9

a The degree training should be based in Public Finance and through a School or Program in Public Administration which also permits coursework in business management. Graduate work in human resources management might substitute for or complement the financial managment training in one of these cases.

b Should a relevant PhD program in this category be identified, one MS degree will be changed to a PhD degree.

c Given the number of agricultural and/or socioeconomists in IER, this training program could begin in the 2nd or 3rd "wave" of PTs.

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e. Gender

Every effort will be made to allocate at least 25% of the long-term training opportunities to qualified women candidates. This goal should effectively increase the number of women scientists in IER while accounting for staffing constraints confronted by the Institute (the IER currently employs only 5 women researchers).

f. Spouse Training Program

Costs of long-term training include provision for up to 2 years of long-term academic training for spouses of Fellows. Where academic training is not appropriate or desired, training funds can be used for training of spouses in professional, technical or other fields, at the discretion of the Fellow's spouse in consultation with the consortium's training staff. The spouse training program will be made available on the initiative of the spouse. Spouses who take the initiative to learn English (for which costs are not budgeted in the spouse training budget) and to identify a course of work or degree or non-degree program which suits their needs, will be eligible to enter the program. It is likely that not all spouses will be interested in the program or available to participate in it, although costs for all 19 spouses are budgeted for.

g. Schedule of Training

Table F-8 (2) provides an indicative schedule for 10 MS candidates and 9 PhD candidates. Completing the procedures for placing candidates in selected US universities will be managed by the in-country contract coordinator.

Table F-8 (2): Proposed Schedule of Long-Term Training

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
MS Students						
Number Departing	5	4	1			
Number Abroad	5	9	10	5	1	
Number Returning				5	4	1
PhD Students						
Number Departing	4	4	1			
Number Abroad	4	8	9	9	5	1
Number Returning					4	4

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B. Short-Term Training

Short-term training is designed to improve the professional skills of IER scientific, technical, administrative and support staff through special short-courses, workshops, conferences or seminars in the US, another country or in Mali. The program for short-term training will be prepared during the first 3 months of project implementation and revised annually in response to project needs and training opportunities. Getting a better assessment of the short-term training needs for researchers and senior technicians should be one of the top priority tasks for the in-country Contract Coordinator.

Some of the short-term training to be considered under the contract might include:

- Experiment Station Operations Management, either in-country or at the ICRISAT Sahelian Center with support from the University of Arkansas.

- Statistical analysis packages and data management for scientists and senior technicians to be held in-country, through the regional international research centers (ICRISAT, IITA, WARDA) or through US universities. These might include: a course on SAS or SYSTAT tailored to research designs and biometric analysis of IER data (in Mali); or, a course on LINDO tailored to applications of farm modeling, transportation problems, and policy analysis (in Mali).

- Special university-level short-courses for selected scientists or managers (e.g, the University of Michigan/CRED short-course on Agricultural Policy Analysis, University of Pittsburgh management training, the University of Wisconsin Summer Institute for Agricultural Research and offerings through institutions such as Wageningen, Montpelier or the University of East Anglia.

- Food processing short courses with emphasis on low cost, appropriate technologies (FTRI, India).

- Combined English-language and statistical analysis skills training for experienced technicians at the Economics Institute, Boulder, Colorado.

- Especially designed on-the-job training for secretarial and other support staff in word processing, data entry and other computer skills.

- Technician - level training courses at ICRISAT or other International Center.

In addition to specific training opportunities, the short-term training component of the contract will also include travel for professional staff to present research results at international professional meetings in Africa, Europe and the U.S.

Table F-8 (3) presents an indicative schedule of short term training visits and costs.

Table F-8 (3): Short-Term Training Schedule and Costs (000 US dollars)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	TOTAL
Short Courses	No.Participants	5	10	10	10	10	5	50
	Cost	65.9	136.5	143.3	150.5	158.0	83.0	737.2
Workshops and Conferences	No.Participants	5	5	5	10	15	15	55
	Cost	26.3	26.3	26.3	52.6	86.9	91.3	309.7

A major component of short-term training does not appear in the above budget. In-country training courses organized by the PC and PD and relying on IER staff or TAMU short-term TA will be a significant project activity in upgrading IER skills. These courses are included as part of the short-term TA and administrative operating expenses budget items, rather than as part of the training budget item.

ANNEX G

TECHNICAL ASSISTANCE SCOPES OF WORK

POSITION 1: **In-Country Research Management Specialist/Project Coordinator (PC)**

DURATION: Seven (7) years

A. Responsibilities:

1. Under the guidance of the IER Project Director:

   (a) Assist the IER in implementing an operational national agricultural research strategy and program, endorsed by the GRM;

   (b) Facilitate the smooth functioning of and improvement in IER research planning, management, and approval process regarding the IER research program to be supported under SPARC;

   (c) Assist in launching and supporting interdisciplinary commodity-based research teams for sorghum, millet, cowpea and forages;

   (d) Assist as required with the installation of the program planning and budgeting system;

   (e) Assist the IER to develop and implement a Monitoring and Evaluation (M&E) system that tracks on-farm adoption, assesses research cost-effectiveness, and provides critical farm-level information to research and extension staff

   (f) Help in the development of an effective system of information and active linkages with: rural development and extension organizations; CRSP's; IARC's; regional, national and international agricultural research networks;

   (g) Coordinate with ISNAR regarding TAMU and ISNAR short-term research management advisory services;

   (h) Work with IER leaders, administrators and researchers in the development of Scopes of Work for short-term technical assistance, and coordinate implementation of their programs;

   (i) Collaborate with IER in development, and coordinate implementation of the project short and long-term training programs;

(j) Assist in preparation of workplans for IER activities funded by SPARC;

(k) Prepare semi-annual (6-month) reports;

(l) Perform other project-related duties as requested by IER administration.

2. Serve as in-country representative of the TAMU Contractor Group, with full responsibility for all contract-related issues, and serving as the administrative liaison between the TAMU CG and USAID/Mali and the IER.

3. Serve as counterpart to Project Director and serve as Interim as requested by IER Project Director.

4. Report to AID Project Officer.

5. Perform duties consistent with IER work regulations (e.g., regarding 6-day work-week that includes Saturday, IER travel authorization, etc.)

B. Qualifications:

PhD in Agricultural discipline, with relevant research management experience; excellent knowledge of agricultural research and research management issues; good agronomic and quantitative skills; experience in monitoring and evaluation system design and implementation; familiarity with operations of the Collaborative Research Support Programs (CRSP's), International Agricultural Research Centers (IARC's), and regional agricultural research programs; experience in West African agricultural research projects preferred. French at the FSI 3 level.

POSITION 2: **Financial Management Specialist (FMS)**

DURATION: Five (5) years

A. Responsibilities

1. Work with the Project Director, Project Coordinator, and Director of the General Services Bureau to ensure that financial management improvements serve the needs of IER researchers and research managers, and are implemented in a way that supports the research programs.

2. Temporarily, in collaboration with the short-term design team:

   (a) Assist in the collection and analysis of data regarding reporting and control requirements of other donors who contribute funds in support of IER activities;

   (b) Review the work of the financial management design team and provide inputs regarding implementation;

   (c) Advise IER administrators in the selection and training of IER personnel chosen to assist in the operation of the system.

3. On a continuous basis, work in close collaboration with the General Services Director and the Accounting Department staff to:

   (d) Help ensure the proper operation of the financial management system used at IER;

   (e) Assist in review of the transactions processed by the system during the month and prepare the general ledger postings;

   (f) Provide technical advice in preparation of all monthly financial reports required the donors providing funding to IER;

   (g) Assist in preparing a monthly narrative report addressed to the donors using the system regarding the status of their funds, problems with internal controls or any operational problems that affect the integrity of the financial system;

   (h) Assist IER in organizing and conducting periodic meetings with representatives of donor organizations to resolve problems and obtain feedback;

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(i) Assist in coordination of the preparation of the annual capital and operating budgets.

(j) As required, train IER accounting personnel in the use of the system and in accounting and financial management principles.

(k) Update the written procedures manuals whenever changes are made to the system or new controls imposed by the donors.

(l) Organize an internal audit function that performs periodic reviews of records, controls and procedures at the regions and other organizations that are recipients of IER funds.

4. The Financial Management Specialist will, in general, serve as a trainer, facilitator, and coordinator, assisting the management and staff of IER in establishing and implementing new procedures, rather than conducting the actual work himself.

5. Perform duties consistent with IER work regulations (e.g., as regards 6-day workweek including Saturday, IER travel authorization, etc.).

6. The Financial Management Specialist reports to the Project Coordinator.

B. Qualifications:

The long-term financial manager should have at least ten years experience in accounting or auditing. The ideal candidate will have a mix of private and public sector experience in a developing country setting. An MBA or CPA is preferable. Strong microcomputer skills are required, including knowledge of common business software, such as Lotus 1-2-3 and dBASE, or equivalents. Proficiency in French at the S-3 level is required.

POSITION 3: **In-Country Administrative Assistant**

DURATION: Seven (7) Years

A. Responsibilities:

(1) In coordination with the Research Manager/In-country Contract Coordinator, carry out all lower-level logistical arrangements related to developing and implementing long- and short-term training programs, and long- and-short-term technical assistance; the training program arrangements will also be carried out in collaboration with the IER Training Division;

(2) Carry out routine administrative functions in support of the responsibilities of the In-country Contract Coordinator, including operating word processing and data management software.

(3) Serve as logistical liaison between In-Country Contract Coordinator and the USAID/Mali Contract Manager;

(4) Arrange for in-country maintenance and repair of long-term contractor TA housing, appliances, and electrical and plumbing systems, and other logistical details related to long-term TA residence in Mali;

B. Qualifications:

Excellent English/French; experienced computer/word processing and data management skills; capable of providing logistical support for short- and long-term technical assistance; design/willingness to perform varied activities necessary for day-to-day contract management; excellent interpersonal skills.

POSITION 4: **In-Country Project Secretary**

DURATION: 7 years

A. Responsibilities will be determined by Project Director and Project Coordinator at project start-up.

POSITION 5: On-Campus Project Coordinator

DURATION: Seven (7) Years (Full-time position for 1 year, Half-time position for 6 years)

A. Responsibilities:

(1) Serve as the U.S.-based representative of the SPARC Project;

(2) Serve as administrative liaison between TAMU and USAID/Mali, In-Country Research Management Co-Coordinator, and IER;

(3) Serve as a TAMU representative on the TAMU Contractor Group Executive Management Committee;

(4) Assist in identification and selection of short-term technical assistants, CRSP collaborators, and other consultants;

(5) Assist in arranging short- and long-term training for Malian trainees;

(6) Coordinate all procurement of project material in the U.S.;

(7) Assist in preparation, review, and approval of contract-related budgets and reports;

(8) Assist in project monitoring and evaluation.

B. Qualifications:

PhD in any agricultural discipline; at least 5 years of experience in overseas project management and administration; familiarity with USAID-funded projects; familiarity with University administrative procedures; good computer (word processing) skills; french language capability at FSI-3 level.

POSITION 6: On-Campus Staff Assistant

DURATION: Six (6) Years - Half time position

A. Responsibilities: To assist the On-Campus Project Coordinator, as required, in providing administrative and logistical support to the project.

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ANNEX H

COMMODITY PROCUREMENT

SPARC is a complex project including new research components, modification of financial management and administrative procedures, training and an array of technical assistance. Implementation of the components of the project will result in transportation needs well beyond existing capabilities of IER and the regional centers and stations. Similarly, new management and administrative procedures as well as expected research results necessitate computer capabilities that do now exist within IER and the research stations and centers. Consequently, SPARC will include a significant commodity procurement component. Planned capital procurements under SPARC include vehicles, micro-computers and related items, limited amounts of laboratory and field research equipment, and office and household furniture and equipment sufficient to meet the administrative and financial management needs of the project, to provide the necessary infrastructure to carry out the commodity and socio-economic research programs, and to support the related technical assistance. The table below lists commodities to be purchased. A significant part of these commodities will be purchased in-country in Years One and Four of the project as in-country purchase will result in significant cost savings as well as provide electronic appliances built for 50-cycle, 220-volt current.

A. Off-Road Vehicles

An adequate supply of passenger vehicles will be essential to support project-related administrative, management and research programs. All terrain vehicles will be essential to all programs because of the rugged conditions (virtually no paved roads) throughout most of Mali. Vehicles assigned to IER/Bamako will support administration, financial management, short-term TA and socio-economic research. In all cases, these vehicles will be frequently used for extended field trips to the research centers and stations as well as villages in the commodity research areas. Vehicles assigned to the research stations will be used almost exclusively in off-road conditions.

Fifteen 4x4 passenger vehicles will be purchased over the life of the project, nine in the first year, and six in the fourth year. Of the first nine vehicles, three will support the central project management team, one supporting the Project Director and Project Coordinator, a second supporting the General Services Bureau management (Head of the GSB and the Contractor Financial Management Specialist), and a third serving as the primary transport vehicle for short-term TA. Two additional vehicles will be located at IER/Bamako for general research use (mainly for economics and socio-economics staff and food technology staff as most technical scientists will be transferred to the field). The four remaining vehicles will support commodity research with one being assigned to each of four research stations or regional centers: Mopti, Niono, Sotuba and Koporo.

B. Motorcycles and Mobylettes

Motorcycles and mobylettes represent cost-effective solutions for many of the transport needs of SPARC, both in Bamako and for on-station research personnel. Transportation needs of station scientists, multilocational researchers, and enumerators for many on-farm sites and village surveys can also be met using motorcycles. Twelve motorcycles and six mobylettes will be purchased during the first year of the project. Two will be assigned to management and administrative components of SPARC at IER. The others will be assigned to the five research stations to be supported by SPARC. Half the vehicles are expected to need replacement after four full years of service.

C. Spare Parts, Registration and Insurance, and Routine Repair and Maintenance of Vehicles

All vehicle procurement includes spare parts equaling 15% of the cost of the vehicles purchased from procurement funds. All costs associated with the operation of all vehicles in this section (fuel, oil, lubrication, filters, and hoses) will be paid by the IER out of the project-supported operating funds budget, as will costs of insurance, registration, repair and related costs. Initially all of these aspects will be managed by the SPARC central management unit at IER. Once a station has its own financial management unit in place and fully operational, it will assume responsibility for its vehicles.

D. Micro-Computers

Micro-computers will be essential for financial management and planning, monitoring and evaluation, statistical analysis of socio-economic survey data, statistical analysis of data from experimental trials, economic modeling, budgeting, correspondence, and report writing.

There are two feasible alternatives for meeting the computer needs of the project: (1) provide laptops with external VGA monitors; or (2) provide desktop models. The former are cheaper and do not need UPS systems (they include batteries); they are also more difficult to repair and are more vulnerable to theft and environmental problems (they operate in more stressful environmental conditions once taken out of the office). Desktop models, if installed in an air-conditioned environment, are easier to maintain over time, and can be chained or locked to desks or tables. However, they require an uninterrupted power supply to protect equipment, and to ensure uninterrupted operation. The total cost of desktop systems is higher than portable computers.

It is recommended that desktops be purchased and to the extent possible placed in group working environments. Once equipment is placed in individual offices, the presence of meetings, telephone calls, and an individual's need for privacy effectively tends to block others from using equipment and fully exploiting its use. Grouping machines together in a pool forces a synergism among researchers, enables central coordination and management of software, and facilitates environmental control.

Thirty computers are needed over the life of the project, 20 in the first year, and an additional ten as replacements in the fifth year. Desktops at a minimum should include the specifications: CPU 386, 80 MB hard disk, one 5.25" and one 3.5" floppy diskette drives, and lock down cables). Ten computers will be assigned among the five primary research sites (Sotuba, Niono, Cinzana, Mopti, Koporo), 3 computers to financial management (with a fourth already provided through pre-design financial management and administration at the national level (with a fourth which will already have been provided through financial management design work prior to execution of the long term TAMU TA contract), 4 computers to the project coordination (PC, PD, and secretaries) and 3 computers to economics/sociology and technical sciences at the national level. Computers as much as possible should be configured into centralized computer laboratories or working environments supervised by a computer technician. Peripheral hardware components should include 10 dot matrix wide-carriage printers, 5 laser printers, 20 UPS "on-line" power supplies, and cables.

The 3 computers to be assigned to financial management, personnel and administration at the national level should include the same specifications mentioned above with the exception that hard disks with minimum 120 MB capacity be installed to handle the requirements of the financial and administrative programs.

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In conformity with U.S. copyright protection laws, each computer will have a valid license to the software it is running. Computer software will be selected, configured and installed according to the specifications determined by the technical assistance team and IER management. All computers will carry standard software for word processing (Word Perfect), spreadsheets (LOTUS 123 or Quattro Pro); DOS and DOS utilities, and anti-virus software. Certain machines depending on the department (location) and center will need specialty software, including packages for statistical analysis (SPSS and SAS), operations research (LINDO), and data management (DBASE. FAXPRO or PARADOX). The financial management system will run on a top-of-the-line package appropriate for the financial management needs of the project. Other software to be purchased might include graphics and desktop publishing programs.

During the early implementation phase of the project, the IER should develop with the assistance of short term TA a computer plan stating at a minimum where computers will be placed (national versus centers; individual offices or central computing labs), specifying rooms and computing environments being made available, and showing a schedule of computer needs.

E. Field Research and Food Technology Laboratory Equipment

On-station commodity research will require electronic balances, power tillers, animal traction implements, motor pumps, irrigation units, and miscellaneous supplies. The socio-economic research will require surveying equipment or tapes and compasses, and hand held calculators. Experiments and studies at the Food Processing Laboratory will require processing (milling, grinding) and analytical equipment (fat extractor, protein analysis).

A covered area for milling and grain processing is required at Sotuba lab. Some renovations may also be needed in the fruit and vegetable lab. These needs have not yet been clearly assessed.

F. House and Office Furniture

Two sets of household furniture will be purchased for the houses of the project coordinator, and the financial management advisor. Furniture for the PC will require refurbishing after 3 years.

Office furniture will be required for the offices of the Project Coordinator, Financial Management Advisor, IER counterparts/collaborators, support personnel, and short-term TA. Furniture will include executive desks and chairs, secretary's desks and chairs, filing cabinets, storage cabinets and book cases, typewriters, air-conditioners, copying machines, fax machines, and modems, as noted in the table below.

G. Generators

Five generators will be procured, 2 for each of the long-term contractor houses, and 1 for each of 3 experiment stations to be designated. Niono, Koporo, and Mopti are the likely stations or centers to receive generators, subject to verification of need. All generators are expected to last through the life of the project.

H. Transformer

A transformer will be provided for the Sotuba Regional Research Center. With the exception of the DRSPR headquarters at Sotuba (where FSR/E provides a transformer adequate only to the needs of DRSPR) research at Sotuba is constrained by frequent power problems and constant risk to hardware (computers and laboratory equipment) much of it purchased under earlier AID projects. Subject to verification by USAID's Engineering staff SPARC resources will be used to purchase a transformer to ensure uninterrupted research and equipment protection at Sotuba.

Table F-10 (1): SPARC COMMODITIES

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
U.S. Procurement:								
Household Furniture	2 sets			1 set				3 sets
Office Furniture	6 sets							6 sets
Computers & Programs	20			10				30
Printers & Accessories	20			10				30
Field Research Equipment	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Food Tech Lab Equipment	misc.	misc.	misc.	misc.	misc.			
In-country Procurement:								
4 x 4 vehicles / parts	9			6				15
Motorcycles / parts	12			6				18
Mobylettes / parts	6			3				9
Generators / parts	5							5
Photocopiers (large)	1			1				2
Photocopiers (small)	2			1				3
Fax machine	1			1				2
Typewriters	3			1				4
Refrigerators	2			1				3
Freezers	2			1				3
Stoves	2			1				3
Air Conditioners	14			6				20
Washing Machines	2			2				4
Clothes Dryers	2			2				4
Food Tech Equipment	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Field Research Equipment	misc.	misc.	misc.	misc.	misc.	misc.	misc.	
Transformer	1							1

ANNEX I

INITIAL ENVIRONMENTAL EXAMINATION

INITIAL ENVIRONMENTAL EXAMINATION

- Project location: Mali

- Project Title: Supporting Research Planning and Research on Commodities (SPARC)

- Project Number: 688-0250

- Funding: FY 92: 1.8; LOP: $18 million

- Life of Project: FY 92 - FY 98

- Determination prepared by: George R. Thompson, Mission Environmental Officer

- Threshold Decision Recommended: Categorical Exclusion

Project description: Agriculture is the dominant economic sector in Mali. One of the constraints to the ability of the agricultural sector to achieve its potential in providing food security, raising farmer incomes, and earning badly needed foreign exchange, is the low level of appropriate agricultural technologies. This project will assist Mali to establish an agriculture research system that can generate the technologies necessary to increase productivity and incomes. The project has three major objectives: to assist in developing a national agriculture research system administered and managed by Malians: to promote growth through agronomic and livestock research that generates additional export earnings; and to increase food security by continuing technical assistance in food grain research. Technical support helps to implement a national research strategy, manage the research institutions, and undertake applied research. Institutional capacity will be built by providing additional participant training and research equipment. Thus, the basic project qualifies for a categorical exclusion under Reg 16, Section 216.2(c)(2)(ii) "Controlled experimentation exclusively for the purpose of field evaluation confined to small areas and carefully monitored."

Insecticides: No pesticides will be procured under the project, and any assistance for the use of pesticides will be only for research and/or limited field evaluation purposes by or under the supervision of project personnel. This research and evaluation will be conducted within research and/or field stations as part of the normal work carried out in these stations. Project personnel will ensure that the manufacturers of the pesticides will provide toxicological and environmental data necessary to safeguard the health of research personnel, field labor, and the quality of the local environment in which the pesticides will be used.

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In the future, perhaps during subsequent phases of this project, pest control techniques may be extended to outgrowing areas. In this case, the above manufacturer information, as well as any other pertinent information gathered by project personnel on efficacy and safety of individual formulations, will be used to prepare a risk/benefit analysis (as per Section 216.3 (b)(1)(i) of Reg16). The Mission Environmental Officer and/or project personnel can be guided in this process by the Regional Environmental Officer. Thus, the use of pesticides qualifies for an exclusion under the A.I.D. pesticide procedures (Section 216.3 (b)(2)(iii).

Recommendation: Based on the above discussion, a categorical exclusion is recommended, with the provision that if the project objective changes, or if project personnel decide to extend pest control technologies to areas outside the research/field stations, this IEE will be revised to include a risk/benefit evaluation as discussed above.

Concurrence: _____ Date: 8/2/90
Africa Bureau Environmental Officer
John J. Gaudet

Approved: ✓
Disapproved: _____
Date: 8/2/90

Clearance: AFR/GC CFM DATE 8/2/90

AFR/TR/ANR:JGaudet:7/17/90:JG:K:\data\nr\iee\jjgmal01