

POBAH 878

615-0190

KENYA

ON-FARM Grain Storage

Project Paper

FY 80

**KENYA**  
**ON-FARM GRAIN STORAGE PROJECT**

**PROJECT PAPER**

**615-0190**

**August 1980**

**Agency for International Development**  
**Washington, D.C. 20523**

APR 10 1981

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA (ACTING)

FROM : AAA/AFR/DR, <sup>John W. Koehring</sup> John W. Koehring

SUBJECT: Kenya On-Farm Grain Storage Project 615-0190

Problem: Your approval is requested to execute a loan of \$7,800,000 from Section 103 (Food and Nutrition) Development Assistance funds to the Government of Kenya for the On-Farm Grains Storage Project 615-0190: for a source/origin and proprietary procurement waiver for vehicles; and, for AID direct contracting for construction of technician housing and a laboratory/office facility.

Discussion:

A. Project Description

The proposed loan, in conjunction with efforts of other donors, will help alleviate critical food grain shortages in Kenya by reducing crop losses which result from inadequate harvesting and storage at the small farm level. Up to 30% of Kenya's annual grain production is estimated to be lost through damage to harvested grain caused by birds, insects, molds and rodents. This is particularly critical for maize, the nation's staple crop, which is produced almost entirely by smallholders. A recent AID-financed study concluded that storage losses amount to at least 16 percent of annual maize production. Nationwide grain losses, at 16 percent, would have equalled approximately 65 percent of food grain imports in 1980, a significant loss for any developing country.

The proposed project is designed to increase the use of more effective on-farm grain drying and storage practices in Kenya. To accomplish this purpose, the project will: (1) adapt and test improved grain drying and storage technology in Western and Nyanza Provinces, a major grain production area of Kenya which contains an estimated 17 percent of the country's poor smallholders; (2) test methods for facilitating adoption of improved harvest/storage technologies among rural male and female smallholders; (3) strengthen the capability of agricultural schools and the extension service to teach farm-level grain drying and post-harvest storage techniques; and, (4) establish an on-farm storage monitoring and evaluation capability to provide the GOK with data needed for policy and planning purposes vis à vis national food grain requirements.

The project supports the strategy outlined in the 1982 CDSS for expanding Kenya's food supply and improving the welfare of AID's target group rapidly and directly.

Target group for the project are poor smallholders who comprise almost half of the nation's smallholder population of 10.5 million. This latter group produces about 90 percent of Kenya's total maize production. Principal beneficiaries of the project will be some 10,000 farm families who will participate in the demonstration and testing of new harvest and storage methods. They will benefit from an increased quantity and improved nutritional value of the grain stored (it is anticipated that over half the grain saved through reduction of losses will be consumed by producers' households), and additional income through sale of surplus grain. It is expected that losses of on-farm, stored grain will be reduced by 50 percent for those smallholders adopting the improved technologies.

Ultimately, it is intended that improved harvest/storage technologies be extended to food grain producers throughout Kenya; recommendations for accomplishing nationwide coverage in the most effective and efficient manner will be included in the end-of-project evaluation.

#### B. Financial Summary

The total estimated project cost is \$11.7 million of which AID would finance \$7.8 million and the GOK \$3.9 million in Kenyan shillings. Of the AID share, \$6.0 million would be in foreign exchange and \$1.8 million in local currency.

Project loan funding requirements are summarized as follows (\$000):

Technical Assistance	3,445
Commodities/Vehicles	1,093
Training	846
Construction	532
Evaluation and Studies	189
Inflation and Contingencies	<u>1,695</u>
Total	\$7,800

The host country contribution of \$3.9 million will finance salary costs, including salaries of participants during training; operating and maintenance expenses for project vehicles; transportation costs for participants; and certain in-country training costs.

#### C. Social, Technical, and Economic Considerations

The analyses presented in the Project Paper show the project to be socially, technically, and economically feasible. The proposed project is based on a careful assessment of Kenyan smallholder culture and agricultural practices including an analysis of the pivotal role rural women play in harvest and post-harvest activities such as shelling, treating, storing and

sorting grain. If the project is to be successful, rural women must be persuaded to adopt new practices. For this reason, special measures will be taken under the project to recruit female staff and provide extension services to female farmers and heads of households in recognition of women's key role in harvest and post-harvest activities.

From the technical standpoint, the project is sound. The technological innovations to be introduced to smallholders cover practices, equipment, materials, and structures for the drying and storing of maize. Technologies to be tested, including those which represent only minor modifications in present practices, will be selected with full participation of smallholders, thus assuring that insofar as possible, drying and storage innovations tested under the project are technically, culturally and financially acceptable to smallholders.

The project has been shown to be economically feasible and should result in significant foreign exchange savings through reductions (as much as 47 percent at present levels) in annual maize import requirements.

#### D. Environmental and Human Rights Considerations

It has been determined that a negative determination is appropriate in regard to the anticipated environmental impact of the project with the stipulation that prior to the use of any pesticide under the project, the FIDU will complete any necessary risk/benefit analysis and submit its conclusions to AID for review and approval. This requirement will be included in the project loan agreement. At the time of PID approval, the IEE facesheet was inadvertently not forwarded to AA/AFR for approval; therefore, your approval is requested at this time on the facesheet located at Tab C.

Under the 1981 human rights project review procedures established by the Bureau of Human Rights and Humanitarian Affairs, this project has been approved.

#### E. Conditions and Covenants

No special problems are anticipated in negotiating the project loan agreement. Government of Kenya officials have worked closely with USAID/Kenya staff in developing the proposed project and have informally approved the draft loan agreement in substance including a special covenant whereby the GOK agrees to establish new post-harvest storage positions and assign qualified staff, 15 percent of whom will be women, to those positions. It is expected that AID and the GOK will be able to sign the loan agreement within a month from the date of authorization.

#### F. Waivers Requested

Authorization of a source/origin waiver from AID Geographic Code 941 to Code 935 for all project vehicles and a proprietary procurement waiver

for Land Rovers and Suzukis for approximately \$309,000 is requested to permit procurement of 14 right-hand drive vehicles and 50 125cc motor-cycles, none of which are manufactured in the United States.

#### G. Committee Action and Congressional Notification

The Africa Bureau Project Committee reviewed the project on September 11, 1980, and recommended its approval. At a meeting of the Executive Committee for Project Review chaired by AA/AFR on September 19, 1980, the project was recommended for authorization.

The project was not included in either the FY 1980 or 1981 Congressional Presentation. Therefore, an Advice of Program Change was provided to the Congress on February 12; the waiting period expired without objection on February 27.

#### H. Implementation

The project is designed to make maximum use of existing organizations and communications networks and to be carried out in close coordination with other activities in food production and storage.

USAID/Kenya's Agriculture Division will have direct responsibility for project administration under the direction of the USAID Director and in cooperation with support offices in the Mission.

The Ministry of Agriculture, through its Crop Production Division, will be responsible for implementing the project on behalf of the GOK. A host country contractor will provide all long- and short-term technical assistance; procure commodities and vehicles (with the exception of two project vehicles); organize all long- and short-term participant training; and arrange financing for test platforms and cribs.

Peace Corps Volunteers will be utilized as appropriate to augment MOA extension capability.

AID will contract directly for construction of housing for six long-term technicians and a combined laboratory/office facility utilizing local Kenyan firms for engineering and construction services, pursuant to AID Handbook 11, Chapter 2, paragraph 2.1.2. Direct contracting is proposed in order to reduce construction time by six months which will result in more timely project implementation and limit inflation-induced cost escalation.

The Project Committee, in its review of the implementation plan contained in the Project Paper, concluded that the plan is realistic and establishes a reasonable time frame (five years) for carrying out the project.

Because significant behavioral changes are required for the project to succeed, however, consideration will be given at the time of the mid-term evaluation scheduled for late 1983 to an extension of the project beyond April 1986 if adoption rates are slower than anticipated.

The Project Paper demonstrates satisfactorily that the requirements of Section 611(a) have been met; project funding is based on sound estimates and is adequate to achieve planned outputs.

The USAID project manager responsible for the project is Gary Lewis; the Africa Bureau Project Officer responsible for the project is Christina Schoux, AFR/DR/EAP.

Recommendations:

1. That you sign the attached IEE facesheet thereby approving a negative determination; and,
2. That you sign the attached Project Authorization, and thereby approve (a) the proposed project at a life-of-project level of \$7,800,000; (b) the source/origin and proprietary procurement waiver requested in Section F, above, for which a detailed justification is provided at Tab B; and, (c) direct AID contracting for construction of technician housing and a laboratory/office facility for which a detailed justification is set forth in Exhibit A, Annex F to the Project Paper located at Tab D.

Attachments:

- Tab A - Project Authorization
- Tab B - Source/Origin and Proprietary Procurement Waiver for Vehicles
- Tab C - IEE Facesheet
- Tab D - Project Paper

Clearances:

	Date:
A/DAA/AFR:RStacy	
A-AA/SER:JFOwens	4/9/81
AFR/DR:NCohen	4/29/81
AFR/DR/EAP:SCole	4/7/81
AFR/DP:JMartin	4/2/81
AFR/EA:DPfeiffer	4/7/81
GC/AFR:GLecce	4/7/81
AFR/DR/ARD:HJones	4/21/81
AFR/DR/SDP:BBoyd	4/21/81
SER/COM:WCSchmeisser, Jr	4/2/81

## PROJECT AUTHORIZATION

Name of Country: Kenya  
Name of Project: On-Farm Grain Storage  
Number of Project: 615-0190  
Number of Loan: 615-T-016

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the On-Farm Grain Storage Project for Kenya ("Cooperating Country") involving planned obligations of not to exceed \$7.8 million in Loan funds over a one-year period from date of authorization, to help in financing foreign exchange and local currency costs for the Project.

2. The Project will provide technical assistance, training, commodities and construction in order to increase the use of more effective on-farm grain drying and storage practices in Kenya. As its intermediate objectives, the Project will seek to increase the capacity of the Postharvest and Storage Branch of the Ministry of Agriculture (MOA) to conduct adaptive research field testing; to increase MOA extension capacities; to increase the capacity of agricultural education institutions to provide grain drying and storage training; and to create a nationwide capacity to monitor and evaluate grain losses.

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

### 4. a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the Date of the first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by AID under the Project shall have their source and origin in the Cooperating Country and in countries included in AID Geographic Code 941, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the Project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States or the Cooperating Country.

c. Conditions Precedent.

The Project Agreement shall contain conditions precedent substantially as follows:

(1) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement, the Cooperating Country shall furnish in form and substance satisfactory to AID:

(a) Evidence that the GOK has made available for the project five acres of land with adequate services at the Maseno Farmer Training Center for construction of an office and laboratory facility for use by the Field Testing and Demonstration Unit and the Grain Monitoring Unit.

(b) Evidence that the GOK has made available for the project six improved lots suitable for the construction thereon of staff housing for six project technicians. One such lot shall be located proximate to Kakamega and five such lots proximate to Kisumu. Improvements to be provided at Cooperating Country expense shall include adequate provision of water, sewage, electricity, and year-round serviceable road access to each lot.

(2) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance participant training, the Cooperating Country shall furnish, in form and substance satisfactory to A.I.D., evidence that qualified persons selected for training under the Project will be assigned to on-farm postharvest storage related positions and that their terms of employment after training will provide reasonable assurance that such individuals can be retained in such positions.

(3) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance the purchase of bicycles and motorcycles for Government of Kenya

employees, the Cooperating Country shall furnish, in form and substance satisfactory to A.I.D., an employee purchase plan for such vehicles.

d. Covenants

The Cooperating Country and the MOA shall agree in substance to officially establish all new postharvest storage positions as described in the Detailed Project Description Section of the Project Paper and to assign qualified staff, 15 percent of whom will be women, to assume these positions on a timely basis.

5. Waivers

Notwithstanding paragraph 4.b. above, the following waivers are hereby approved, based upon the justifications contained in Attachment B hereto.

— — An origin waiver from AID Geographic Code 941 (United States) to Code 935 (Special Free World), in the amount of approximately \$309,000, a waiver of Section 636(i) of the Foreign Assistance Act of 1961, as amended, and with respect to brand-named items, a proprietary procurement waiver, to permit procurement of the following commodities in Kenya: seven small four wheel drive Suzuki vehicles, four Land Rovers, one stake bed truck, one sedan, one pickup, and fifty motorcycles.

I hereby certify that exclusion of procurement of the subject vehicles from Free World countries other than the Cooperating Country and countries included in Code 941 would seriously impede attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

Date: 4/13/81

  
\_\_\_\_\_  
W. Haven North  
Acting Assistant Administrator  
for Africa

Clearances: As shown on Action Memorandum

## SOURCE/ORIGIN AND PROPRIETARY PROCUREMENT WAIVER FOR VEHICLES

**Problem:** Approval is requested for a source/origin procurement waiver from Geographic Code 941 to Geographic Code 935 for all the vehicles indicated below and for a proprietary procurement waiver to obtain the Land Rovers and 1000cc Suzukis required for the Kenya On-Farm Grain Storage Project (615-0190).

- A. Cooperating Country : Kenya
- B. Authorizing Document : Project Authorization
- C. Project : On-Farm Grain Storage Project No. 615-0190
- D. Nature of Funding : Loan (Section 103)
- E. Description of Commodities : One sedan, one pick-up, four long wheel base four-wheel drive Land Rovers, seven four-wheel drive Suzuki Jeeps, fifty 125cc motorcycles, and one stake bed truck.
- F. Approximate Value : U.S. \$309,000
- G. Probable Procurement Origin : United Kingdom (UK) and Japan
- H. Probable Procurement Source : Kenya, UK, and Japan

**Discussion:** Section 636(1) of the Foreign Assistance Act of 1961, as amended, prohibits AID from purchasing motor vehicles unless such vehicles are manufactured in the United States. Section 536(1) does provide, however, that ". . . where special circumstances exist, the President is authorized to waive the provision of the act in order to carry out the purpose of this act." Additionally, in accordance with AID Handbook 1, Supplement B, procurement of motor vehicles of other than U.S. manufacture requires a waiver. The Handbook provides that a waiver may be granted when necessary to carry out the purpose of the FAA and if, inter alia, there is a present or projected lack of adequate service facilities and supply of spare parts for U.S.-made vehicles.

The Government of Kenya has requested AID assistance in reducing on-farm grain storage losses. The above requested project vehicles are required to provide needed mobility for project technicians and Kenyan personnel assigned to the project, all of whom must work in areas where roads are usually rugged, unimproved tracks. For purposes of safety, it is extremely important that vehicles financed under this project be right-hand drive, since by law all traffic in

Kenya moves on the left side of the road. The types of vehicles required for the project are not manufactured in the U.S. with right-hand drive.

The right-hand drive sedan and pick-up are for use by project technicians and short-term consultants primarily for transport between Nairobi and the project area. Vehicles with right-hand drive and which are locally assembled would contribute to driving safety and assure a timely and adequate supply of spare parts and maintenance. Since no U.S. manufacturer can supply such vehicles and support services, a source/origin waiver is requested for the sedan and pick-up.

The long wheel base four-wheel drive/right-hand drive Land Rovers are for use throughout the project area by project technicians in order to complete their assigned tasks, distribute commodities (e.g., training aids) and transport personnel. While U.S. manufactured right-hand drive vehicles normally would have been satisfactory for the project, it has been determined through experience that the constant shortage of spare parts and non-availability of qualified mechanics to work on U.S. vehicles in rural areas have caused major implementation problems where U.S. vehicles are utilized. The Government of Kenya through the Ministry of Agriculture depends primarily on Land Rover type vehicles for its transportation requirements. Unless project vehicles are compatible with the country's maintenance system, adequate maintenance and ability to obtain spare parts cannot be assured.

Since no manufacturer can supply the Land Rovers except British Leyland, source/origin and proprietary procurement waivers are required for the Land Rovers. Land Rovers have been previously approved for financing under the Kenya National Range and Ranch Project.

The small four-wheel drive/right-hand drive Suzukis are for use in district sub-locations in the project area by district project personnel in order to complete their assigned tasks, distribute commodities and transport personnel. These 1000cc vehicles are required for tasks that would overtax a bike or motorcycle and yet are not sufficient to justify using a Land Rover. The vehicles are also cheaper to maintain and operate (average 30 mpg of gasoline), and spare parts are available in rural areas of Kenya. The vehicle would also have no difficulty in fitting into the MOA vehicle maintenance and support system. Since no manufacturer can supply these vehicles except Suzuki, source/origin and proprietary procurement waivers are requested for the Suzukis. Suzukis have been previously approved under the Kenya WID Extension Program Project.

The 125cc motorcycles requested are for use in divisional sub-locations in the project area by divisional project personnel in order for them to be able to cover the distances required in the completion of their duties.

The purpose of this project element is to supplement an existing Government of Kenya employee purchase plan using this type of motorcycle which is already familiar to extension employees, suitable for their needs, and readily serviceable in the relatively remote project area. Since no U.S. manufacturer makes 125cc motorcycles, a source/origin waiver is requested.

The right-hand drive stake bed truck is for use in distributing project commodities and grain drying and storage kits throughout the project area to those communities which have Farmer Training Centers, Cooperative Officers or Kenya Farmer Association stores. Use of a right-hand drive, locally assembled truck would contribute to driving safety and assure a timely and adequate supply of spare parts and maintenance. Since no U.S. manufacturer can adequately supply such a vehicle and support services, a source/origin waiver is requested.

Recommendation: Based on the justification above, it is recommended that the Assistant Administrator for Africa (1) grant a source/origin waiver from AID Geographic Code 941 to Code 935; (2) certify that special circumstances exist to justify waiving the requirement of procurement of U.S. manufactured vehicles under FAA section 636(i); (3) certify that special circumstances exist that justify, as stipulated in Handbook 15, 3C4e(2), that a proprietary procurement waiver be allowed for the Land Rovers and Suzukis; and (4) certify that exclusion of procurement of the above described project vehicles from ~~Free World countries other than the cooperating country and countries included in AID Geographic Code 941~~ would seriously impede attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Kenya  
Project Title: Food Crops Storage Project  
(615-0190)  
Funding: Five Years (1980-1984)  
\$10.9 million  
Life of Project: Five Years  
IEE Prepared By: Charles J. Patalive  
Capital Projects Development  
Officer  
Date: March 17, 1980

Concurrence:  4-24-80  
Glenwood P. Roane  
Director, USAID/Kenya

Assistant Administrator's Decision:

APPROVED 

DISAPPROVED: \_\_\_\_\_

DATE: 4/13/81

Clearance: REDSO: CAnderson: Draft  
(Environmental Officer)

AGENCY FOR INTERNATIONAL DEVELOPMENT  
PROJECT DATA SHEET

1. TRANSACTION CODE  
 A = Add  
 C = Change  
 D = Delete  
 Amendment Number: \_\_\_\_\_

2. COUNTRY/ENTITY: AFRICA  
 BUREAU/OFFICE: AFRICA AFR

3. PROJECT NUMBER: 615-0190  
 PROJECT TITLE (maximum 40 characters): ON FARM GRAIN STORAGE

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM DD YY 01/4/86  
 7. ESTIMATED DATE OF OBLIGATION (Under "B" below, enter 1, 2, 3, or 4)  
 A. Initial FY: 81  
 B. Quarter: 3  
 C. Final FY: 81

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

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	6,000	1,800	7,800	6,000	1,800	7,800
(Grant)	( )	( )	( )	( )	( )	( )
(Loan)	(6,000)	(1,800)	(7,800)	(6,000)	(1,800)	(7,800)
Other U.S.	1. _____					
2. _____						
Host Country	-	3,900	3,900	-0-	3,900	3,900
Other Donor(s)						
<b>TOTALS</b>	<b>6,000</b>	<b>5,700</b>	<b>11,700</b>	<b>6,000</b>	<b>5,700</b>	<b>11,700</b>

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH CODE 1. Grant 2. Loan	D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
			1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) FY	1503	024	-0-	-0-		7,800		7,800
(2)								
(3)								
(4)								
<b>TOTALS</b>			<b>-0-</b>	<b>-0-</b>	<b>-0-</b>	<b>7,800</b>	<b>-0-</b>	<b>7,800</b>

10. SECONDARY TECHNICAL CODES (maximum 3 codes of 3 positions each): 333

11. SECONDARY PURPOSE CODES

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)  
 A. Code: BSW  
 B. Amount: 7,700

13. PROJECT PURPOSE (maximum 40 characters)  
 To increase the use of more effective on-farm grain drying and storage practices in Kenya.

14. SCHEDULED EVALUATIONS  
 Interim: MM YY 01/4/84  
 Final: MM YY 1/2/85

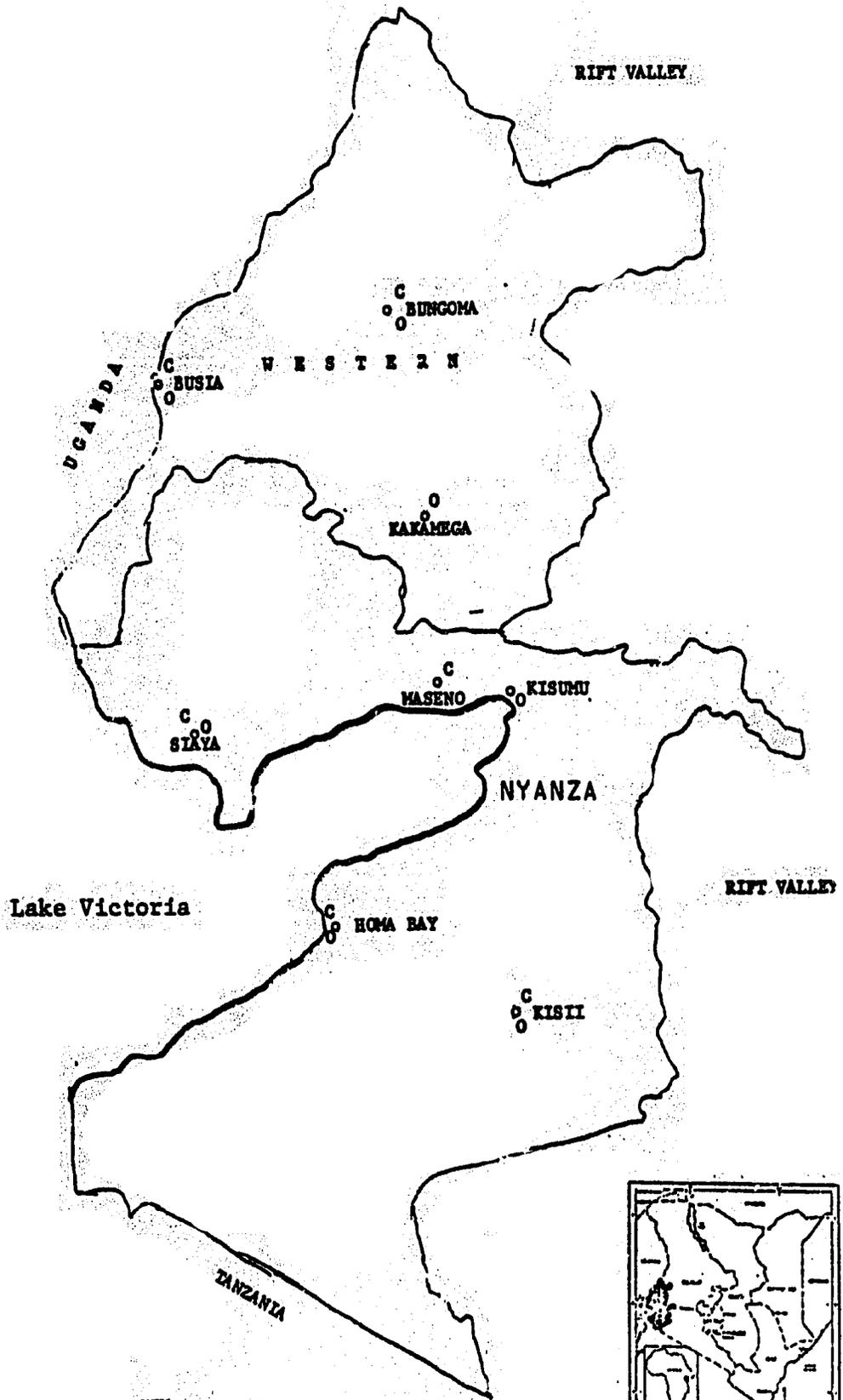
15. SOURCE/ORIGIN OF GOODS AND SERVICES  
 000  941  Local  Other (Specify) 935

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a \_\_\_\_\_ page FP Amendment)

17. APPROVED BY: \_\_\_\_\_  
 Signature: William S. Lofgren  
 Title: Acting Director, USAID/Kenya  
 Date Signed: MM DD YY 01/8/80

18. DATE DOCUMENT RECEIVED IN AID/FF, OR FOR AID/FF PURPOSES, DATE OF DISTRIBUTION: MM DD YY

MAP OF WESTERN KENYA



**KEY**  
 C Farmer Training Centers  
 O District Agriculture Offices

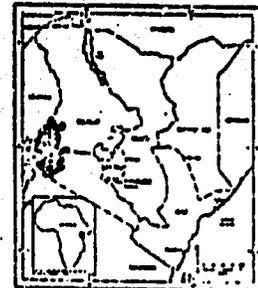


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## I. SUMMARY AND RECOMMENDATIONS

### A. PROJECT DESCRIPTION

Annual grain storage losses in Kenya have been estimated to range between 9 and 30 percent. A recent AID financed study concluded that the loss from birds, insects and molds amounted to about 16 percent and that no accurate estimate could be made of rodent losses. At 16 percent, nationwide grain losses would approximately equal 65 percent of anticipated food grain imports in 1980, a significant loss for any developing country.

In an attempt to reduce this loss and improve the welfare of smallscale farmers, the purpose of the project will be to increase the use of more effective on-farm grain drying and storage practices in Kenya. To accomplish this purpose the project is designed to test and adapt existing on-farm grain drying and storage technology in Western Kenya, a major grain production area of the country; investigate and test methodologies for facilitating adoption by small-scale farmers; strengthen existing agriculture extension and administrative systems in postharvest storage; increase the capability of agriculture educational institutions to teach grain drying and storage technology; and establish an on-farm grain storage monitoring and evaluation capability.

The proposed AID Loan will be \$7.8 million and the Government of Kenya (GOK) contribution will be \$3.9 million for a total project cost of \$11.7 million. The AID contribution will consist of \$3.6 million for technical assistance, \$0.9 million for training, \$0.5 million for construction, \$1.1 million for commodities, and \$1.7 million for contingencies and inflation, \$6.0 million of AID's funds will be expended in foreign exchange and \$1.8 million in local currency.

The project will be implemented by a host government contractor whose work will be supervised by the Chief of Crops Production Division, Ministry of Agriculture (MOA). The Chief has been designated as the GOK Project Coordinator. The project is designed to make maximum use of existing MOA's organizational and communications systems and to coordinate as closely as possible with on-going activities in food production and storage.

### B. SUMMARY FINDINGS.

The analyses completed as part of the Project Paper effort have concluded that the proposed design is technically, financially,

economically and socially feasible and environmentally sound and that the project is ready for implementation. The Government of Kenya has indicated substantial interest in postharvest storage activity by creation of a Postharvest Storage Branch (PHSB) within the Ministry of Agriculture and has demonstrated specific interest in this project by assignment of the new Head of PHSB to work full time on the Project Design Team. The GOK's written request for assistance with on-farm grain drying and storage is in Annex F, Exhibit 1.

C. RECOMMENDATIONS

1. That a loan of \$7.8 million on concessionary terms of 40-year amortization period at 3% interest per annum, with a 10-year principal repayment grace period with interest at 2% per annum during the grace period, be authorized for a five-year period for the On-Farm Grain Storage Project (Draft Authorization in Annex F, Exhibit 7).

2. That a nationality waiver from AID Geographic Code 000 (United States) to Code 935 (Special Free World) and a sole source procurement waiver be approved for approximately \$250,000 for training of an estimated 54 local extension agents in grain drying by the Tropical Products Institute of Slough, England (Annex F, Exhibit 5).

3. That a source/origin waiver from AID Geographic Code 000 (United States) to Code 935 (Special Free World) for all vehicles named and a proprietary procurement waiver for Land Rovers and Suzukis be approved for approximately \$309,000 for seven small four-wheel drive Suzukis, four Land Rovers, one stake bed truck, one sedan, one pick-up, and fifty 125 cc motorcycles. (Annex F, Exhibit 6).

## II. PROJECT BACKGROUND AND DETAILED DESCRIPTION.

### A. BACKGROUND.

#### 1. Introduction

The Government of Kenya (GOK) development strategy outlined in the 1979-83 Development Plan (the "Plan") is oriented toward those groups and regions within the country which did not benefit significantly from the country's earlier progress. This balanced growth strategy of poverty alleviation and employment generation, reviewed in the CDSS, is straining Kenya's financial resources. However, having recognized the strong link between development and the agricultural sector, the GOK is actively reviewing food production, marketing, and distribution policies and is attempting to develop a comprehensive national food policy.

The primary efforts of the GOK in the agricultural sector have been directed toward expanding the food supply by improving agricultural productivity. Some success in this area has been achieved but Kenya has a fast growing population of high density in production areas and is limited by the fact that a relatively small percentage of land is arable. For these reasons attention is now turning to the storage loss side of the food equation where, until now, GOK activities have been limited. A system for monitoring and evaluating Cereal and Produce Board (CPB) warehouses for large scale, centralized storage has been in operation for several years. Though the needs of smallscale farmers in grain storage are theoretically included under the present research, extension and storage efforts, there has been little evidence of actual attention to or solution of their problems. Recognizing the seriousness of on-farm food grain losses in particular, the GOK is beginning to focus on the problem, and Ministry of Agriculture (MOA) officers have been assigned to a newly created Postharvest Storage Branch (PHSB) whose mandate is to establish and develop an "advisory service in postharvest handling of crops and their on-farm storage techniques."

The USAID/Kenya development strategy in Kenya focuses on food production, population and energy. Food grain processing and storage is a priority sub-sector. Targeted beneficiaries in USAID's strategy are the rural poor. In Kenya "smallholders" are statistically defined by the GOK as farmers having less than 20 hectares. Only 3% of all smallholders have more than 8 hectares. Over 95% of all smallholders' families earn an average of \$900 per year or less. "Poor smallholders" are defined as those smallholders having an average household income of \$303 or less and holding an average of 2.1 hectares of land; among these 45% hold less than one hectare.

As part of the Mission's approach toward identifying and addressing the key constraints to food supply for its targeted population, a study of grain storage was conducted in 1978. This study, reported in "Smallholder Grain Storage in Kenya; Problems, Proposed Solutions", recommended AID assistance in training of storage staff and a nationwide study aimed at evaluating alternative means for alleviating grain storage problems. Following discussion and review in Kenya, USAID funded a six-person team from Development Planning and Research Associates, Inc. (DPRA) to conduct a national crop storage study (see summary in Annex A, Exhibit 1), the purpose of which was to conduct "a comprehensive evaluation of farm and village storage problems of smallholders in Kenya for the predominant grown food grains and pulses." The study began in August 1979 and ended in April 1980.

At one time the Mission considered a combined storage and marketing center development project. However, based upon its own analysis and that of a consulting team (which identified many difficult issues of an institutional and social nature) and because of the potential impact on AID's large target group of poor smallholders, the Mission has decided to proceed with the on-farm food grain drying and storage activity separately and defer the development of a rural marketing center component until a later date. Available information suggests that the primary target groups are overwhelmingly subsistence oriented and, thus, are less production responsive to national pricing and marketing policy changes than are commercially oriented farmers. Therefore, the success of this food grain drying and storage project is minimally dependent on the development of marketing centers as originally conceived or on national pricing and marketing policies.

The set of interventions proposed in this project was selected on the basis of extensive discussions and work with GOK officials, reports from three consulting teams, and analyses within the Mission and REDSO/EA. The Head of the new Postharvest Storage Branch participated as a full-time member of the Design Team. The Project Design Team included:

Tom Bebout, Project Design Officer (REDSO/EA)  
Gary Lewis, Agriculture Advisor (USAID/K)  
D. I. Kariuki, Head of PHSB (MOA/GOK)  
Dirk Dijkerman, Asst. PDO and Economist (REDSO/EA)  
Rob Morris, Food Loss Specialist, (DS/AGR)  
Carolyn Barnes, Sociologist (REDSO/EA)  
Charles Patalive, Capital Development Officer (USAID/K)  
Gary Bisson, Regional Legal Advisor (REDSO/EA)  
S. Silberstein, Population Advisor (USAID/K)

## 2. Setting and History

The bulk of the rural population lives on those arable lands fit for sustained agriculture, only 17.7 percent of the total land area. The Central Bureau of Statistics (CBS) estimated the population density on these lands to be 145 persons per square kilometer in 1979, as compared to the nationwide average of 19. Most of the land potentially cultivatable is already being farmed. Traditionally, increases in the food supply have come from increasing the agricultural productivity of land. Another way of increasing food supply as marginal gains from production interventions decline, is to reduce postharvest losses -- the focus of this project.

Kenya's economy is dominated by the agricultural sector which accounts for 80 percent of total employment and 60 percent of total exports. In 1979 nationwide production of maize, the primary food crop, was estimated at 1.45 million metric tons or about 16.1 million bags. Kenya's smallholder population produced an estimated 14.9 million bags or 92.5% of the total maize production.

In the past Kenya has been marginally self-sufficient in food grains, except wheat and rice. Presently, the country's farmers are not satisfying domestic food requirements due to difficulties caused by having one of the world's highest population growth rates (4 percent per annum) and other constraints to increasing food crop production as summarized in the CDSS. These difficulties combined with Kenya's deteriorating balance of payments situation and growing recurrent budgetary problems suggest rather somber development prospects. If domestic per capita food production does not keep pace with the population growth rate, the GOK will be forced to make difficult allocational decisions affecting the country's consumption-investment balance (i.e., importing basic food stuffs versus importing industrial and agricultural inputs).

Nutritionally, smallholders are believed to be satisfying 73 percent of the recommended minimum daily caloric intake and 78 percent of the recommended minimum daily protein intake. To bring the daily caloric and protein intake of these smallholders up to the FAO recommended minimum amounts and to feed recommended minimum amounts to its expanding population, Kenya's food availability has to increase by 4.5 percent over the medium term.

Many agriculture forecasters predict that the food shortage problem is going to become increasingly more serious over the next few years. Influenced by recent shortages of maize and Government encouragement, farmers have reportedly planted large quantities of maize in 1980 and the GOK is estimating a 1980/81 harvest in

excess of two million metric tons. Even with this level of production, import requirements are estimated at approximately 350,000 metric tons in 1981. In an attempt to alleviate these critical food shortages, the GOK has begun focusing on the reduction of postharvest losses through improvement of grain storage facilities and practices at both the national and individual farmer levels.

On the national level, for example, the GOK has developed a program with the World Bank to enhance the capabilities of the Cereals and Produce Board through improvement of port grain handling facilities, expansion of centralized warehousing and grain drying facilities, and increased transportation capability. This program will greatly assist the medium to large scale farmers and help assure an improved food supply for urban consumers. At the smallholder farm level, USAID/Kenya and the GOK are now focusing on the on-farm storage problems and have jointly developed this On-Farm Grain Storage project.

Other development programs in Kenya are addressing grain promotion, storage and processing problems directly related and complementary to this proposed project. Through the Collaborative Research Support Program in which small scale dairy goat projects are being introduced into smallholder farming programs, AID is attempting to promote earlier harvesting of maize (at physiological maturity) so that the stalks can be used as fodder for the goats. Harvesting at physiological maturity will also be one of the innovations investigated by the On-Farm Grain Storage Project to reduce grain losses. The Rural Access Roads Project is expanding accessibility and mobility for rural farmers. The Agriculture Systems Support Project (ASSP) will directly support this project through in-service training of extension agents and credit requirements analysis. The FAO's Rural Farm Structures project will benefit from and provide information to the proposed project with respect to types and acceptability of various grain drying and storage structures. The UNICEF supported structure demonstration project at Karen will be a source of information and technological demonstrations and a possible beneficiary of this project.

### 3. Problem of Postharvest Losses

For this project, postharvest losses are defined as those grain losses attributable to birds, insects, rodents and molds. In Kenya, postharvest losses can be most accurately referred to as postmaturity losses since most of the smallholders do not harvest their crop at physiological maturity as is customary in the developed world. Losses will be tabulated from the time the crop is ready

to be harvested (i.e., physiological maturity), because this is when the maximum quantity of grain is available for consumption (harvest). In Kenya most smallholders harvest one to two months after maturity.

The results of the AID financed study of storage losses in Kenya (See Annex A, Exhibit 1) estimated that Kenya's smallholder maize losses in 1979, a typical production year, averaged almost 16 percent of the potential nationwide harvest. This loss to smallholders is equivalent to about 227 thousand metric tons of maize, or about 65 percent of the planned grain imports for 1980, a drought year. The world market value of this loss in early 1980 prices exceeds \$42 million. Furthermore, an examination of the study reveals that it may have underestimated grain losses due to biases inherent in the methodology used and the exclusion of rodent losses. Crops other than maize were only briefly examined by the study. While not as great as for maize, those losses too must be considered in estimating the total quantity and monetary value of food crops lost.

In addition to the quantity losses, there are health hazards involved. A portion of the grain damaged by mold can contain aflatoxin, which is highly toxic and suspected of increasing the probability of liver cancer.

## B. DETAILED PROJECT DESCRIPTION

### 1. Proposed Strategy and Project Purpose.

The purpose of this project is to increase the use of more effective on-farm grain drying and storage practices in Kenya.

The strategy designed to achieve this purpose will be to test and adapt existing on-farm grain drying and storage technology to local conditions in the Nyanza and Western Provinces of Western Kenya through extensive participation of farmers in the identification of acceptable practices and through controlled testing in smallholder fields. Then, proven technological packages (practices, materials, equipment and structures) for appropriate micro-ecological areas will be widely demonstrated in smallholders fields on a subsidized basis. At the same time, to insure the spread and maintenance of the benefits gained, effective methodologies to promote the widespread use of suitable technological packages among Western Kenya's smallholders will be defined and strengthened; the capability of the Ministry of Agriculture (MOA) to monitor, evaluate, and expand this initial project will be enhanced; and the capability of agriculture educational institutions to teach grain drying and storage will be increased. After technological packages have been developed and tested, Peace Corps Volunteers can supplement the capacity of MOA institutions to extend these to farmers.

The proposed project interventions will utilize and strengthen the existing infrastructure (i.e., in-service training, applied research and the MOA grain monitoring capability) and communication networks, including agriculture and home economics extension services, and both formal and informal women groups in Western Kenya. This project supports the strategy outlined in the CDSS for expanding Kenya's food supply and continues the Mission policy of attempting to improve the welfare of the target group, rapidly and directly.

The primary beneficiaries will be the poor agricultural households, poor smallholders, who constitute 42 percent of the nation's smallholder population of 10.5 million and contain most of the country's low income consumers. (See Annex D, Exhibit 5, Table D-24.) Geographically the project will focus on the Western and Nyanza Provinces of Western Kenya (see map on page ii). The Central Bureau of Statistics (CBS) estimates that 17 percent of all poor smallholders reside in this major grain producing area of the country. Though the emphasis is on the poor smallholder, other better-off smallholders will not be excluded from receiving the technology to reduce on-farm grain losses and are also expected to benefit. Large farmers may also be exposed to new grain loss prevention technology because the MOA extension staff works with all categories of farmers in their assigned geographic area. The farmers who adopt the applied technologies will benefit by reduced on-farm losses and food contamination by mold (including aflatoxin), vermin waste and improperly applied pesticides.

A second category of beneficiaries are those who become part of the field testing, demonstration, and expansion systems developed and strengthened as part of this project. A third, more general category, is comprised of those citizens throughout the region who will benefit (a) from the increased availability and quality of food-stuffs and (b) from GOK savings resulting from the reduction of necessary purchasing, handling, and transporting of imported food grains into the remote Western Kenya area. However, it should be pointed out that increased consumption or improved nutrition is an additional benefit as mentioned in Annex C, Exhibit 2, but that this factor is not the main purpose of this project.

## 2. Project Outputs - General

To accomplish the stated project purpose, implementation will concentrate on six project outputs:

Creation within the Ministry of Agriculture (MOA) of the capacity to stimulate interest and participation of smallholders in identifying grain drying and storage problems; to organize the field trials necessary to test and adapt technology to local conditions; and to conduct demonstrations of that technology. (The Field Testing and Demonstration Unit - FTDU).

Improved MOA capacity to facilitate adoption of appropriate on-farm grain drying and storage technological packages by smallholders. (Post-harvest Storage Branch and Extension Service.)

Increased capability of agriculture educational institutions to provide training in on-farm grain drying and storage technology. (Embu, Bukura, Egerton and University of Nairobi.)

Creation of a Ministry of Planning/Central Bureau of Statistics (MOP/CBS) unit to monitor and evaluate stored grain losses. (The Grain Monitoring Unit - GMU.)

Written report and recommendations regarding the need for financial assistance to smallholders to support grain drying and storage activities and the most effective delivery systems.

Written report of the Contract Project Team Leader regarding how best to expand this initial regional effort on a nationwide basis.

Taken together, these outputs constitute a comprehensive and integrated approach to the purpose of the project. The keys to success for this project will be the identification of acceptable technological packages, the identification and enhancement of methodologies to facilitate adoption of improved technologies by targeted smallholders, and the strengthening of education and extension capacities to spread, maintain and update the field implementation of innovations. To succeed, an extension program must have locally adapted and proven technology to offer, competent informed extension personnel with skills necessary to stimulate action, and the means (materials and transportation) to transmit innovations to farmers. Therefore, any viable extension program must have close linkages with both agriculture educational and research institutions. Such relationships are mutually beneficial and, indeed, critical to the effectiveness of all three entities. The researchers must know what problems the farmers are facing. Extension must know and understand research results and be aware of farmers opinions regarding their problems and possible solutions. The agriculture educational institutions must be aware of the extension personnel's requirements so that appropriately trained students will be graduated to fill extension vacancies. This project's basic thrust is testing and

adaptation in smallholder's fields but project design must and does include the institutional building components necessary to make that effort effective.

a) Field Trials and Demonstrations.

While there are many theories regarding the reduction of on-farm grain storage losses and some successful interventions in other countries, recommended innovations have not been sufficiently tested and proven in Kenya. The purpose of the field trials and demonstrations element will be to involve the targeted beneficiaries directly in the identification and field testing of technological innovations. Such testing may include innovations suggested by the DPRA study, by the Appropriate Village Technology Unit operated by UNICEF in Karen (Kenya), by the Peace Corps, by the FAO, and/or by the Tropical Products Institute in England. To maximize coordination and linkages with existing MOA office and to help institutionalize project functions the MOA will be requested to identify an office at the NAL which will participate in the FTDU and GMU activities.

In order to develop, test and demonstrate technological packages (including practices, equipment, materials and structures as required), the project provides for establishment of a Field Testing and Demonstration Unit (FTDU). Initially this unit will be staffed by four expatriate technicians who eventually will be replaced by trained Kenyans.

<u>Speciality</u>	<u>Period of Contract</u>
Grain Drying and Storage Project Coordinator	4 years
Mycology/Entomology	3 years
Extension/Non-formal Education	3 years
Sociology/Economics	2 years

Counterparts will be identified for each position and will receive 2 years of M.Sc. degree level training in the United States followed by on-the-job experience with contract technicians. See Annex A, Exhibit 4 for a summary of all training being proposed under this project.

The Grain Drying and Storage Advisor will serve as the Contractor's Project Coordinator (CPC) and will be a senior, well-experienced individual with an agriculture engineering background. The CPC will arrive in Kenya about ten months ahead of his fellow advisors in order to provide operational guidance to the new PHSB, organize and coordinate the procurement of commodities and construction and participate in the selection of long- and short-term training participants. The FTDU advisor positions and their minimum requirements are discussed in more detail in the Technical Assistance Plan, Annex A, Exhibit 6. Briefly, the Mycologist/Entomologist will organize and administer the Grain Monitoring Unit (GMU) discussed under output (d) below and provide postharvest pest and mold expertise to the FTDU team. The Extension/Non-formal Education advisor will be concerned primarily with developing and testing extension methodologies and

assist in the design of an extension program to train personnel in the use of traditional and non-traditional methods of communicating with and stimulating action among targeted smallholders. The Social Economist's primary concern will be to establish an information system which will include baseline data, monitoring information from a sample of participatory sessions with farmers and data from the testing and demonstration of improved technological packages. This technician will recommend items for the "Kit Grants", provide an economic assessment of proposed innovations and participate in the design, implementation, and review of the mid-project evaluation to determine reasons for rate of change of smallholders behavioral practices and prepare an analysis and detailed report of the need for financial assistance to smallholders and of delivery systems.

The FTDU will work directly with smallholders, Farmer Training Centers, formal and informal women's groups in the seven districts of the Western and Nyanza Provinces. Initially, the team will hold several participatory meetings (See detailed description of the facilitator approach in Annex C, Exhibit 5.) with selected groups of smallholders to discuss reasons for current practices and identify innovations that they would be willing to undertake. The team will be aided in this process by the work of a short-term Anthropologist who will be completing a report about the time the team initiates its field activities. See Annex A, Exhibit 6 for the Anthropologist's scope of work. Data from the initial Anthropologist's study and the participatory meetings will provide information which will assist the FTDU team to design a widespread baseline study, probably combining survey and qualitative techniques. The data thus gathered will provide the FTDU team with information required to initiate selected tests of practices, equipment, materials and structures both at centralized sites, such as Farmer Training Centers (FTCs), and in participating smallholder's fields.

After about one year of testing it is hoped that technological packages, representing relatively small changes from current practices, in identified mini-ecological (farming) zones, will be ready for widespread demonstration because they have proven to be effective, economical and culturally acceptable. During this period of testing the FTDU will also be experimenting with methodologies of stimulating smallholder interest and participation and will be investigating appropriate selection methods for widespread demonstrations. The possibilities of promoting smallscale private enterprise activities will be examined carefully as well. Depending upon the types of innovations developed there may be substantial potential for the development of smallscale supply systems. Team members will also be providing general training to extension personnel, leaders of women's groups and to the teaching staffs at Embu, Bukura, Egerton and the University of Nairobi.

Once technological packages are selected for demonstrations, the FTDU will supervise selection of smallholders, the implementation of demonstrations and the initiation of farming training on a wider scale. Smallholders will be selected according to procedures developed by the FTDU in consultation with the Anthropologist mentioned above. Smallholders selected for demonstrations will be aided with "Kit Grants", packages of materials and possibly small pieces of equipment required for the demonstrations. See discussion of Kit Grants in Annex B, Exhibit 8. About this point in time, too, long-term trainees should return to begin on-the-job training with individual expatriot advisors. Even while this phase of the project is going on, the FTDU will continue to conduct field trials and attempt to improve adaptations of technology as deemed necessary. The demonstrations themselves, of course, will be a trial and will be carefully controlled to provide additional valuable information about the technology being demonstrated and the extension methodology. Testing and demonstrations will continue until such time as the CPC completes his evaluation report as required in output (f) below. Based upon the CPC's recommendations the GOK will then decide whether or not to continue the effort at its initial site and/or expand it into other Provinces.

Geographically the FTDU will be located at the approximate center of the Western and Nyanza Provinces, Maseno, near Kisumu. The FTC consists of approximately 107 acres of land and has existing facilities such as classrooms, dormitories and cafeterias, with a capacity to handle up to 90 participants.

The FTDU will share a new laboratory and office building, to be built on the site, with the Grain Monitoring Unit (GMU) discussed below. Administratively the FTDU will report directly to the Head of the Postharvest Storage Branch (PHSB) in Nairobi but will coordinate its activities closely with the Provincial Agriculture Officers (PAOs) and the agriculture educational institutions (See the Administrative Analysis section of the PP for details.) Technicians will reside approximately 28 Km. from Maseno in Kisumu which is the third largest city in Kenya and which can provide adequate housing, schooling and marketing for the technicians and their families.

AID inputs into the FTDU will include four technicians (12 person years), their housing, office and laboratory space; 8 person years of degree level participant training; and 32 person months of short-term consultants to address problems requiring special expertise and to assist with training and communications. (See Annex A, Exhibit 6.) A portion of these funds will be used to finance a short-term consultant to identify the determinants of current postharvest grain practices in selected areas and to recommend entry points where changes in practices might be promoted effectively. Although this technician may spend up to fifteen months in the field only about 5 months of

short-term consultancy funds will be required to finance this activity. Other examples of short-term consultancies, required include an audio-visual specialist to design educational/promotional material, or someone especially trained and experienced in the facilitator approach. AID will also fund four project vehicles; 2 4WD Land Rovers and a pick-up for the technicians, who will require maximum field mobility, and one stake bed truck for transport of large items or large quantities of materials required for testing and demonstrations. Finally AID will finance laboratory and test equipment and supplies, the purchases of maize required for testing and the materials and equipment required for demonstration cribs and platforms.

The GOK will provide all logistical and clerical support required by the FTDU, operating and maintenance expenses for vehicles, housing and furnishings, participant salaries and one half of their transportation, plus local hire salary support for 75 person years of assistance as required by the technicians to build test units, create demonstration and teaching materials, and monitor test sites.

b) Capacity to Transfer Technology.

While the FTDU is obtaining farmer input, field testing, adapting, and demonstrating new technological packages and investigating delivery methodologies, a simultaneous effort will be launched to strengthen the MOA's capacity to transfer new technology. As explained in the purpose and strategy introduction, strengthening of the general delivery and administrative systems is absolutely essential to achieving the project's purpose. Effective, economical and culturally acceptable technological packages cannot improve grain drying and storage practices unless they are effectively delivered to the farmers. At present the MOA Extension Service is under-utilized, lacks mobility, and does not focus on or have specialized training in grain drying and storage problems. The MOA already has plans for a development project to increase the general overall efficiency of the Extension Service and a project design team, partially funded by USAID/Kenya, is expected to begin work in the next few months.

The interventions proposed by this project will attack those extension weaknesses directly related to increasing the use of more effective on-farm grain drying and storage practices in Kenya but will, of course, help improve the overall effectiveness of the Extension Service. In addition, it is anticipated that this project's interventions will strengthen means of communications to effect technological changes.

Delivery system (extension) interventions will be made at all governmental levels: national, provincial, district, division, and

local (see MOA Organization Chart, Annex A, Exhibit 3). At the national level the GOK has already established a Postharvest and Storage Branch (PHSB). The planned staffing for the administration unit is 1 Head of Branch, 2 Postharvest Storage Officers and two clerical staff. The primary responsibility of the PHSB will be to coordinate field activities with basic research and educational efforts, to monitor and evaluate national grain losses and to provide a focal point and voice within the MOA for all postharvest storage problems and activities. The Contractor's Project Coordinator (CPC), in addition to directing the FTDU, will be responsible for assisting the Head of the PHSB to direct, coordinate and control all the various elements of this project and to establish and maintain the effective linkages necessary to the project's eventual success. Other USAID funded inputs at the national level will include six months of offshore training for two professional staff and one sedan to provide the necessary mobility for PHSB staff. The GOK contribution at this level will include logistic and secretarial support for the PHSB and short-term consultants; salaries and one half of transportation costs for participants; and operating and maintenance expenses for the vehicle.

At the provincial level two new Postharvest Storage Officer (PHSO) positions will be created, reporting directly to the Provincial Director of Agriculture, one in the Western and one in the Nyanza Province. It will be the responsibility of these officers to develop in-service training programs for all district, divisional and local level extension personnel and to provide backstopping and central focus for the implementation, monitoring and updating of all postharvest storage activities in the two Provinces. They will also establish and maintain provincial extension linkages with research and educational activities. These two positions will require persons with an M.Sc. level of education and a strong background in extension and in grain drying and storage. See Annex A, Exhibit 6 for position requirements. Since the MOA does not now have personnel with the necessary training and education, two expatriate technicians will be provided for three years each while two Kenyan counterparts receive formal and on-the-job training. Because of the importance of communicating with and obtaining the participation of female members of farm families in this project, one of the technician positions will be filled by a woman.

In addition to 6 person years of technical assistance, and 4 person years of long-term masters degree training, the project will also fund 24 person months of short-term consultants to help develop and implement systemized in-service training programs for provincial, district, division, and local level personnel including Local Extension Officers (LEOs) and Home Economists (HEs). Examples of the types of expertise that may be required from short-term consultants include specialists in mass media communications, agriculture extension in-service training methods, participatory communications (facilitators),

graphics, and audio-visual teaching aids. Each Provincial Post-harvest Storage Officer will also be provided with housing and a 4WD Land Rover for transportation to and from district and divisional offices, Farmer Training Centers (FTC) and other field activity sites.

The GOK contribution at the provincial level will include office space, office equipment and supplies, and secretarial support for the Provincial Postharvest Storage Officers; salaries, benefits and one half of transportation costs for participants; and operating and maintenance expense for vehicles.

At the district level the project will support both District Agricultural Office (DAO) and Farmer Training Center (FTC) activities. The GOK has indicated their desire to establish one new District Postharvest Storage Officer (DPHSO) for each of the seven districts in the two Provinces. DPHSOs will be responsible for in-service training of division level personnel and will serve as a central focus for postharvest storage problems at the district level. Provided that satisfactory personnel can be identified and are approved by the CPC for these seven positions, the project will provide each with six-months of short-term training offshore, a small 4WD vehicle for transportation, and the necessary audio-visual equipment and supplies. (One of the 4WD vehicles will be delivered early (Annex A, Exhibit 7) and will be used initially by the Anthropologist.) The short-term training is proposed to be carried out at the Tropical Products Institute (TPI) in England where especially suitable courses are available. See Annex A, Exhibit 4 for an overall description of the training proposed in this project and a description of TPI. In addition to salaries and one half of the transportation costs of the participants, the GOK would also provide operating and maintenance expenses for the vehicles and audio-visual equipment.

The FTCs (there are six in the two Provinces) will be used extensively for testing, demonstrating and teaching of grain drying and storage technologies and of extension methodologies. FTCs have relatively new and complete facilities including classrooms, dormitory facilities, adequate acreage and farming equipment. To support its new activities the project will provide teaching aids (See illustrative list, Annex B, Exhibit 2.); worksheds and equipment to allow trainees to construct cribs and drying platforms themselves and limited in-country training (25 person months) for FTC instructors. Most of the training of Local Extension Officers (LEOs), Home Economists (HEs) and FTC personnel completed at FTCs will be provided by FTDU staff, Provincial Postharvest Storage Officers, District Postharvest Storage Officers and/or short-term consultants.

The ratio of LEOs and HEs to rural farm families is about 2000/1. In some Divisions approximately 70% of the extension personnel have no transportation and most smallholders live in difficult to reach areas not always serviced adequately by public transportation. For these reasons the project proposes, at the divisional level, to supplement the GOK's existing motorcycle and bicycle purchasing fund by providing funds for approximately 50 motorcycles and 700 bicycles. The Contractor's Project Coordinator (with assistance from the Social Economist) together with the Head of the PHSB will determine how best to supplement the fund to insure that the needed transportation is provided to the target areas and serves the purpose intended.

Finally, project intervention at the divisional level will include a special three-month course incountry for one person from each of the 37 divisions (111 person months) to be prepared and presented by either TPI and/or other short-term consultants. In addition 1500 LEOs and HEs will receive at least four weeks of instruction in general grain drying and storage technology over the life of the project from sources indicated in the above paragraph.

c) Capability of Agriculture Educational Institutions.

By upgrading Kenya's agriculture educational institutions' capacity to teach grain drying and storage technology, the project hopes to assure an ample supply of technically competent Kenyans who will be able to maintain, monitor, evaluate, and expand this project into Kenya's other regions. The institutional enhancement is directed at three distinct levels: Local Extension Agents (LEOs and HEs) are supplied from Embu and Bukura National Agriculture Education Institutions which produce two-year Certificate graduates. District and divisional level personnel come primarily from Egerton College which produces three-year DipZoma graduates. Finally, provincial and ministerial office (national headquarters) candidates will come from the University of Nairobi which produces B.S. degree and advanced degree graduates.

Since the smallholder grain farmers must have competent LEOs and HEs (who understand the reasons for current practices) advising them about appropriate and effective grain drying and storage practices, the greatest human resource requirement is at the LEO and HE level. Thus, the largest educational intervention will be made at the two provincial agricultural institutions at Embu and Bukura. Assistance to these two institutions is divided into three parts -- improving the teaching staff's technical competence in grain drying and storage technology, enhancing the teaching aids required to teach the technology, and exposing teaching staff to the importance and techniques of the dialogue-facilitator approach (two-way dialogue between farmers and extension agents) and other extension methodologies.

The technical enhancement of the staff will be through off-shore, short-term, non-degree training at the Tropical Products Institute (TPI) in Slough, England. TPI is well known for its expertise in this field but other sources of training will also be investigated and used if appropriate. For each institution, Embu and Bukura, the participants are to be selected from the following fields: one from administration; two from teaching staff; and one of the institute's farm managers. This selection split is devised to achieve a sensitivity concerning the importance of grain losses at the administrative level and to assure an adequate number of trained personnel at the teaching and demonstration levels. The administrators' training will probably consist of a study tour to provide a greater general overview of grain drying and storage rather than attending a specific training program. Training of staff in participatory methods, such as the dialogue approach, will be done through short-term training, probably at the non-formal Education Center at the University of Massachusetts or, for other extension methodologies, at one of the many land grant universities that specialize in this field.

During the first year of the project, the farm manager, one of the teaching staff, and an administrator from each institution will go for training. The one remaining teacher from each institution will go for training during the second year of the project. Because the administrators will probably not need to attend the summer programs at Slough, their study tour can be scheduled at any convenient time during the year while the other participants attend regularly scheduled summer training programs.

In-service training of the other staff at Embu and Bukura will be undertaken by returning participants, by short-term grain drying and storage consultants, and by expatriate FTDU or Provincial Post-harvest Storage Officers. Eight person months of short-term consultants will be provided from AID funds for this purpose. In this manner, the staffs of the educational institutions will be exposed to the problems of grain losses and be kept up-to-date concerning recent on-farm grain loss reduction activities in Kenya. The in-service training sessions will be planned on an as-needed basis throughout the life of the project and can take place at any of the education institutions, provided that use of expatriate technicians is approved in advance and coordinated with Contract Project Coordinator's office. The returning participants, with the assistance of the PHSB and their teacher colleagues, will also be encouraged to adjust the current curriculum to include grain drying and storage as well as participatory and other extension methodologies.

With respect to teaching aids, a suggested equipment list for Embu and Bukura is detailed in Annex B, Exhibit 6 and includes moisture testing, grain testing, classroom audio-visual equipment, and other miscellaneous equipment and supplies. Furthermore, the libraries of both institutions will be enhanced with reference materials on grain drying and storage technology.

Egerton College presently has a large input of technicians under another AID supported project (Agriculture Systems Support Project, #615-0169). Therefore, the only assistance provided to Egerton is the grain laboratory equipment shown in Annex B, Exhibit 5 to enhance the college's ability to train students in grain drying and storage techniques.

The University of Nairobi departments related to grain drying and storage of food grains are Agricultural Engineering, Crop Science, Food Technology, and Zoology (which includes a sub-department of Entomology). Equipment is required only in the Agricultural Engineering Department, since the others are adequately equipped. Annex B, Exhibit 4 summarizes the equipment recommended for this department. In addition to this small input, the project will also fund a research program aimed at solving practical problems related to post harvest grain losses. Practical research will be supported by grants for short-term topics suitable for Master of Science candidates. The focus of the research effort is to investigate practical means of reducing grain losses. Topics and candidates will be approved in advance by the CPC and the PHSB. One requirement will be the mandatory publication of results of all project-financed research. Support will be provided for the costs of 10 Kenyans who will complete M.Sc. degrees (2 years each) during the course of research at Kenyan institutions. A detailed description of the types of research grants contemplated is presented in Annex A, Exhibit 5.

d) Capability to Evaluate Losses.

At the present time the MOA is unable to monitor the quantity or quality of grain in on-farm storage facilities. The lack of such information prevents accurate analysis of the food grain available for consumption which, of course, is necessary for policy formulation and planning. To remedy this situation the project will assist the MOA in the creation of a new Grain Monitoring Unit (GMU) for on-farm storage. Once fully staffed and operational the GMU will be able to provide accurate statistical estimates of the volume and quality of on-farm grain storage and how they are changing over time. This information combined with bulk storage data, production statistics, consumption requirements and food grain availabilities on the world

market will enable the MOA to recommend effective national policies and strategies for satisfying the food grain requirements of Kenya.

The on-farm grain storage monitoring activity will begin in the target area, Nyanza and Western Provinces, and, if possible, will be expanded to a nationwide basis during the life of the project irrespective of whether or not the basic FTDU function is expanded outside the Western region. If successfully expanded nationwide, it is estimated the GMU will have to collect approximately 10,000 grain samples annually and will require a staff of about 10 laboratory technicians who can be recruited locally and will require only minimal on-the-job training.

To initiate this effort the project will construct a laboratory and office space facility at the Maseno FTC. The reasons for constructing this facility at Maseno rather than at, say, more centrally located Nairobi are persuasive. At Maseno the physical facility and equipment will be able to serve both the FTDU and the GMU; a second laboratory for the FTDU's work will not be required. Second, it is believed by the project design team that regional GMU laboratories can provide more accurate and more timely data than could a national laboratory which, administratively, would come under the National Agricultural Laboratories. Given existing transportation problems it should be more timely and simpler to receive samples and transmit data from regional laboratories rather than transport thousands of kilos of grain samples to one national laboratory. Third, extensive grain storage monitoring is required in the project area to help identify problems, monitor the project's progress and develop a strategy for expanding the FTDU effort nationwide. Finally, with the GMU located in the Maseno area, the expatriate Mycologist/Entomologists assigned to the FTDU will be in a position to supervise construction, procurement of equipment and supplies, staffing, and on-the-job training of technicians.

Collection of samples required for GMU analysis will be performed in cooperation with the Ministry of Planning/Central Bureau of Statistics (CBS) who have expressed great interest in the project. To collect the estimated necessary 10,000 grain samples nationwide will require training of an estimated 800 CBS enumerators. The farmer may not provide totally accurate information on the amounts of on-farm stored grain to the CBS enumerators, but it is anticipated that CBS will be able to apply a factor to correct these figures and provide accurate information. All training of CBS enumerators and the design of grain collection methodology and survey questionnaires will be accomplished by the FTDU, and by short-term consultants as required.

In addition to the approximately 500 square meter laboratory/office building, necessary furniture and equipment to be furnished by AID (See Annex B, Exhibit 3), the GOK will contribute land for construction, maintenance of equipment, cost of grain samples purchased from farmers plus salaries of lab technicians and enumerators as required for this project output.

e) Financial Assistance Report.

It will not be clear to what extent smallholder grain farmers will need financial assistance until after the FTDU has identified packages of grain drying and storage technology for expansion. One of the major goals of the FTDU is to develop "economically feasible" grain drying and storage units to minimize the need for extensive capital outlay by the smallholders.

The preliminary mechanism for extending financial credit to rural smallholders in Kenya now is through cooperative societies. The USAID Mission has had extensive problems in working with cooperative societies, especially those in the targeted area, and is not predisposed to continue this experience. It is a well known fact, however, that subsistence farmers (smallholders) are more willing to experiment and adopt new technology when the risk factor has been minimized. For this reason, the Kit discussed above under output (a) is designed to minimize risk for cooperating smallholders serving the project as demonstration farmers. This project output requires the FTDU Social Economist to prepare a written report analyzing the need and potential delivery systems for risk modifications (grant or credit) considered necessary in order to expand the program beyond smallholders selected for demonstrations. The report shall be in form and substance satisfactory to the USAID/Kenya Project Manager, and the report is due before completion of the technician's contract.

f) Project Expansion Report.

The most important issues to be decided in developing a strategy for expanding this regional effort are where FTDU and GMU should be located, how they should be staffed, and how they should operate. This output requires the CPC to prepare a comprehensive report analyzing the efforts made under this project and recommending whether or not, and if appropriate, how best to expand the program nationwide. The Contractor's Project Coordinator will also be requested to make recommendations regarding the potential for follow-up AID assistance to this project as discussed more fully in the Evaluation Plan of this Project Paper. The CPC's report will be in a form and substance satisfactory to the USAID/Kenya Project Manager, and the report is due prior to the completion of the CPC's contract.

### III. PROJECT SPECIFIC ANALYSES.

#### A. TECHNICAL FEASIBILITY.

##### 1. The Technology Proposed.

The "technological innovations" introduced to smallholders under this project will include practices, equipment, materials, and/or structures for the drying and storing of maize. The most difficult part of this technology, in terms of skill and financial capabilities, may be the building of dryers and storage cribs to be tested (an illustrative example recommended by DPRA is in Annex B, Exhibit 1.); but this technology already exists in Kenya and demonstration models were observed at FTCs in the target area. In order to better understand current practices and identify possible entry points for promoting change, a preliminary study will be completed before arrival of the complete FTDU team. One of the things AID hopes to learn from this study, for example, is why smallscale farmers leave their maize to dry in the field and what obstacles might be expected in persuading them to harvest earlier and dry their grain more rapidly. Such information should give the FTDU team a running start and greatly enhance the total information system to be developed from FTDU, GMU and other extension activities.

Since the selection of innovations for testing will be made with the full participation of targeted smallholders, innovations selected, including changes in present practices, should be, by definition, "feasible." If smallholders, after discussion and consideration, decide to test earlier harvesting, for example, it will be because they believe it to be feasible. It is fully expected that smallholders will select innovations that are not only acceptable to them but also within their skill and financial capabilities.

##### 2. The Spread Effect.

The participatory methodology by which innovations will be identified for testing, tested and demonstrated should also greatly enhance adoption rates of new technology. The facilitator approach described in Annex C, Exhibit 5, has been successfully employed in East Africa and is considered one of the best means of developing a participatory, two-way dialogue with the smallholder. The technologies identified by the FTDU as having a reasonable pay-off in reducing grain losses but which require a greater input of labor and financial resources are expected to be adopted by the more progressive smallscale farmers and those with more land under grain crops.

If the recommended technologies are economically sound, this group of farmers will adopt them with a minimum of extension effort. These farmers will learn about the recommendations, details of inputs, costs and savings through the radio, pamphlets, newspaper articles and the Kenya Farmer Association Journal. Furthermore, they will be able to observe demonstration models at the FTCs and local agricultural shows.

The modules and supportive materials developed by the FTDU for extension of technology will also be made available to non-government agencies working in Western and Nyanza Provinces. These agencies will also encourage improved technologies to reduce grain losses. Furthermore, these modules can be used throughout Kenya since they will refer to an extension process rather than giving definitive solutions to problems associated with grain losses.

### 3. Delivery System.

The primary formal or traditional expansion of technological innovations will be through the existing MOA Extension Service. As discussed in the Detailed Project Description and in the Social Soundness Analysis, improvements are required in the Extension Service to make it more effective in communicating with and stimulating change among smallholders. This is especially true with respect to women members of smallholder families. This project will attempt to strengthen those areas of weakness in the Extension Service directly related to the success of this project. This will be accomplished through intervention at each organizational level of MOA. As previously described in detail, this intervention will be in the form of training, materials, equipment and transport designed to provide a post harvest storage technology focus, interest and capability. The key point of contact with the smallholder is, of course, the Local Extension Officer (LEO) and the Home Economist (HE). Given additional training in grain drying and storage technology, a better understanding of two-way communications, teaching aids, technical expertise backstopping at district and divisional levels, and improved mobility, the LEOs and HEs should have the motivation and the means to initiate, maintain, and update the delivery of selected technological improvement to the target poor smallholder.

### 4. Construction - Section 611(a)

The construction component of this project is relatively small, \$559,000 in total of which AID's share will be \$473,000. Construction will consist of six residence houses and one laboratory/office building. Standard GOK plans, with necessary modifications, will be used for the houses and the laboratory/office building. Building construction details are discussed in the Financial Analysis and Plan Section of this Project Paper. A potential site has been

inspected by a USAID/Kenya Engineer. This site is connected to the town's electric supply and water supply. The water supply system is being expanded by the GOK. A Condition Precedent to disbursement of funds will be the specific allocation of sites with services for construction contemplated under this project.

The MOW's standard design, specifications and the cost estimates have been reviewed by the USAID/Kenya Engineer and have been found sufficient to ensure that cost estimates are reasonably firm as required under Section 611(a) of the Foreign Assistance Act of 1961, as amended.

B. ECONOMIC FEASIBILITY

Maize losses due to birds, molds, and insects nationwide were estimated by DPRA to be about 227,000 metric tons in 1979. This is equivalent to about 16 percent of actual production at physiological maturity. Using world maize prices and the cost of shipping into Kenya this loss totals approximately \$U.S. 42.0 million (K.Sh. 305 million) on an annual basis. DPRA only briefly examined losses of other grains. Since, as DPRA noted in its report, those estimates were subject to considerable error, the other grains are not reviewed here.

The DPRA recommended intervention is to have smallholders begin harvesting maize at physiological maturity, sun dry on platform, shell half the maize and treat that half with insecticide, consume untreated half of maize first, and store treated maize in a traditional crib. Existing traditional cribs need not be replaced initially, but should eventually be modified to provide better ventilation and rodent protection. Indications are that adopting smallholders using the recommended practices can reduce maize losses by over 72 percent. For the average smallholder in the project area, who produces about 22 bags per season, the savings would be about 2.5 bags. The same recommended practices for maize can be used with similar success for other grains. DPRA estimated that a smallholding producing 4 bags of maize per season would be the smallest operation that would find the practices yielding any positive returns. Nationwide, the value of maize which potentially could be saved (72% of the total loss) is about \$U.S. 30 million (K.Sh. 220 million) per year or the equivalent of 163,000 MT.

For the individual smallholder, the benefits of adopting are not as obvious as on the national scale. The benefit-cost analysis examining the intervention by itself was favorable, but not overwhelmingly. The imputed returns to labor were slightly better than what other studies found smallholders to be achieving. Examining the benefit-cost ratios and internal rates of return of the recommended postharvest storage practices, in conjunction with current maize production practices, shows a marginal improvement for the adopting smallholder. However, this analysis could not factor in the added benefit due to the generally improved quality of the remaining grain, nor estimate how much the recommended practices would reduce rodent losses. Thus, the analysis is an underestimation of the potential benefits to adopting smallholders. The analysis does suggest that a

considerable communications effort must be made to inform the smallholders of all the costs (quantity and quality losses) of their current storage practices and all the benefits they can achieve by adopting. Currently the smallholder seems to be aware of the quantity losses and has only marginal concerns about quality, since lower quality grain is fed to the animals or brewed for beer.

The project will not pay for itself in five years. However, the ultimate purpose of the project is to improve storage practices of smallholder families nationwide. For this reason, the project is evaluated over a fifteen year period. The total number of adopting smallholder families by the end of year fifteen has been estimated to be around 225,000 or about 15.0 percent of Kenya's total. After five years the total number of adopting families in the project area is 12% or about 72,000. DPRA and the Mission feel that these are conservative adoption assumptions.

The additional cost of expanding this project nationwide after year 5, when the AID contribution ceases, is an average \$549,600 per annum. Annex D, Exhibit 5 summarizes the additional GOK budgetary costs. Over 15 years the total undiscounted project cost is \$17.2 million. The only benefit included in the analysis was the value of the maize saved. Over the life of the project, total undiscounted benefits were \$61.4 million. The internal rate of return (IRR) over fifteen years is about 24.1 percent. Again, not included in the benefits were improved nutritional quality of the grain and the potential benefits from reduced rodent losses. The overall net present value and the benefit-cost ratio of the project were estimated at \$5.0 million and 1.6, respectively.

The sensitivity analysis considered variations in the number of adopting smallholdings, growth in maize production, and average loss reduction achieved by smallholdings (Annex D, Exhibit 5). In no case did the IRR drop below 8.3 percent.

Based upon the assumptions underlying the economic analysis, the project appears to be economically feasible.

The On-Farm Grain Storage Project will not add significantly to the external debt service burden of the GOK. The 7.8 million dollars of project loan financing represent an increase of approximately one-half of one percent of GOK loans and guarantees outstanding as of December 31, 1979. (See table B-1) At the end of 1979, service charges on such debt amounted to approximately \$104 million, implying a debt service ratio equivalent to 6.8 percent of Kenya's exports of goods and non-factor services.

Inclusion of the debt of parastatal corporations, and of the debt of the defunct East African Community, would raise Kenya's overall debt service ratio for 1979 to approximately 11.2 percent. Kenya's debt service ratio has risen rapidly in the past five years as Table B-1 clearly indicates. Further increases are expected in 1981 and beyond when repayment of the first \$99 million of the 1979 \$200 million Eurocurrency loan must begin, along with increased payments on other loans. Kenya's debt service ratio, however, will remain near the average for the group of 38 low income countries to which it belongs. A detailed year by year profile of debt service charges resulting from the On-Farm Grain Storage loan is presented in Table E-8 below in connection with the discussion of GOK recurrent costs. Project-related debt service charges are insignificant in relation to total debt service payments, actual and projected, as present in Table B-1.

TABLE B-1

KENYA-EXTERNAL PUBLIC DEBT (MILLIONS OF U.S. DOLLARS)

	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
DISBURSED	570.3	701.8	918.5	1086.6	1429.0
UNDISBURSED	117.4	133.2	170.2	214.4	267.1
DEBT SERVICE	36.2	49.4	57.3	108.2	104.3
PRINCIPAL	15.5	25.4	24.9	63.5	44.0
INTEREST	20.7	23.9	32.4	44.7	60.3
RATIO TO EXPORTS OF GOODS, NFS	3.7%	4.4%	3.7%	7.6%	6.8%
	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
DEBT SERVICE	159.5	207.7	241.6	241.1	251.2
PRINCIPAL	81.3	111.7	128.1	129.9	151.0
INTEREST	78.2	96.0	113.5	111.2	100.2

Service: IBRD, World Debt Tables. Projections exclude disbursements after December 31, 1979.

Exports of Goods and Non-Factor Services from GOK Economic Surveys 1978 - 80, converted to U.S. dollars at IMF average annual exchange rates.

C. SOCIAL SOUNDNESS ANALYSIS

1. Social Feasibility.

The project aims at reducing grain losses on smallscale farms in Western and Nyanza Provinces. The main thrust is to reach farm families who produce less than 22 bags of grain annually. These families tend to be among the poorest of the region and face constraints which inhibit them from adopting the optimal technologies to reduce grain losses. In addition, women are responsible for post-harvest tasks, with the exception of construction of facilities, and the current MOA methods and those recommended by DPRA for reaching farmers are biased toward progressive male farmers.

As discussed in the Detailed Project Description a study will be made prior to the initiation of other field activities under this project to better understand determinants of current practices and identify possible entry points and agents for change. In order that this project positively benefit the target group, it will be necessary for smallholders to play a participatory role in identifying and testing those technologies they deem feasible. Furthermore, both female farmers and their spouses as well as female heads of households need to be reached. The best method for accomplishing this will be to hold discussions, based on the facilitator approach, (Annex C, Exhibit 5) with members of existing groups, in their local community. A group approach will increase the extension agent/farmer contact ratio, facilitate public discussion and commitment, and provide for an equitable selection of households to receive materials on a grant basis for trials and demonstrations. If members of groups are involved in the decision-making process, it is expected that the technologies identified will take into account constraints faced by smallscale farmers, there will be individual as well as group commitment to follow the testing and demonstration phases, and the individuals selected for the testing and demonstrating phases will feel social accountability to use the materials provided for the intended purpose as well as to follow all the technologies recommended by the group for reducing grain losses.

To reduce the risk incurred by smallscale farmers in testing innovations to reduce postharvest grain losses, commodities will be provided on a grant basis. Grants will also be given to farmers for demonstrating successful technologies. However, these grants must be given in a manner so as not to raise expectations of other farmers that the GOK will provide everyone with the materials and so not to impede expansion of the program to other regions if grants are not available. The social-economist will investigate the need of smallscale farmers for financial assistance to adopt the postharvest technologies and the best delivery system. The ideal situation would be

the identification of economically feasible technologies which are socially acceptable to the target group which are within their financial ability to adopt.

## 2. Social Consequences and Benefit Incidence.

This project incorporates a participatory approach with farmers--males and females--who produce less than 22 bags of grain annually to identify and test technologies they deem feasible. Those technologies (practices, equipment, materials and structures) found successful will be introduced in similar areas. During this process, it is anticipated that 10,000 farm families will receive, on a grant basis, construction materials for drying platforms and storage cribs and production materials for testing and demonstration. At least 65 percent of these families are expected to be selected by members of their own community (see Annex C, Exhibit 5) and others will be selected according to criteria established by the FTDU with guidance from the Anthropologist.

Other direct beneficiaries will be those receiving training. Approximately 1,500 LEOs and HEs will be trained in the participatory approach and ways to reduce grain losses. About 7 district and 37 divisional agricultural officers and eight instructors from Bukura and Embu will receive short-term, non-degree training. Another 6 persons will be trained to the M.S. levels in an offshore university. It is also anticipated that about 800 CBS enumerators will learn about collection of grain samples and complementary survey questions.

Since Kenyan women play a vital role in postharvest practices, AID considers it essential to have female staff directly involved in the MOA effort to reduce postharvest grain losses. (See Social Analysis Annex C). The Home Economists as well as the LEOs will need to be involved at the field level. Moreover, in the selection of personnel to specialize in postharvest grain drying and storage at the local, divisional, district, provincial and national levels, female candidates should be considered equally with male candidates. Of the officers selected for positions in postharvest drying and storage, a target of a minimum of 15 percent females is judged to be an achievable goal based upon the percentage of women to men employed in these activities. This target will be included as a covenant of the Project Agreement.

During the life of this project, 12 percent of the smallholder households in Western and Nyanza Provinces are expected to benefit through adoption of improved technologies to reduce grain losses. They will benefit from an increased quantity and improved nutritional value of the grain stored. It is anticipated that over half of the grain saved through reduction of losses will be consumed by the producers' households with the balance moving into commercial channels.

Since women are responsible for post harvest tasks, with the exception of construction of storage facilities, this project aims primarily at female farmers and their spouses, and female heads of households. The LEOs and Home Economists will work primarily through already established groups, such as women's groups; husbands of the members of women's groups will be encouraged to participate in discussions and the resulting activities. The technologies identified by the groups may require more time and labor from women, but through the dialogue process they will have given their approval. At that time, those practices which demand time unavailable to women are expected to be rejected by them.

The status of women may be slightly enhanced through the reduction of grain losses. Women are responsible for meeting domestic food requirements and grain is the basic food. An increase in the quantity of homestead grown grain would allow women to serve the type of meals expected by their families.

The proposed project as outlined in the Detailed Project Description is socially sound in the Kenya context provided that effective use is made of the Anthropologist's study and the participatory method of communication to create and maintain a two-way information system to guide FTDU and Extension Service activities. Given this assumption the project will also satisfy the requirements of AID's Women in Development initiatives.

#### D. ADMINISTRATIVE FEASIBILITY

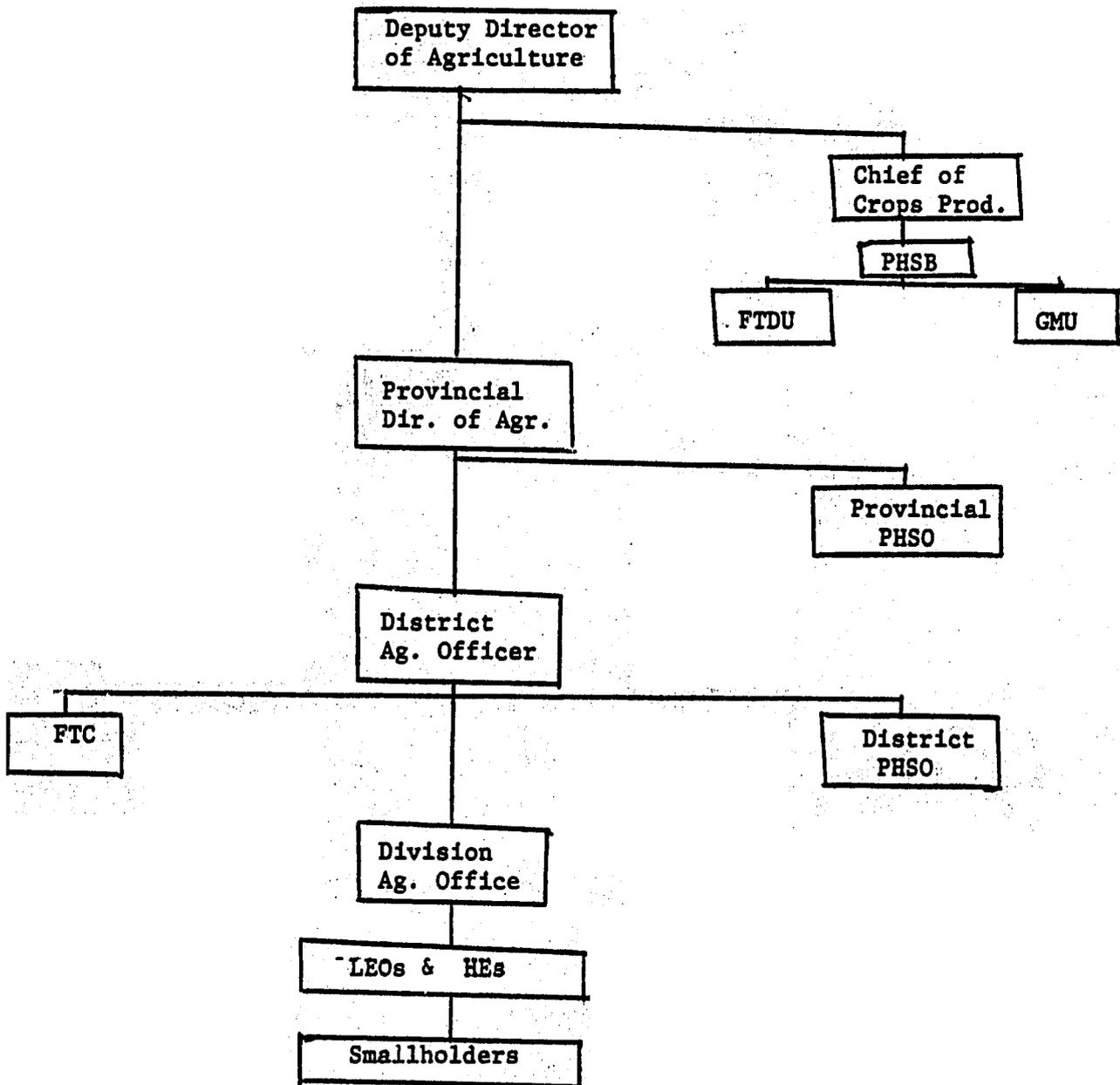
##### 1. Implementing Organization

The implementing organization for this project will be the Ministry of Agriculture's Crop Production Division's recently formed Postharvest and Storage Branch (PHSB). An MOA organization chart is in Annex A, Exhibit 3. The PHSB in conjunction with the Contractor's Project Coordination (CPC) will be responsible for the implementation and coordination of the total project. The Head of the PHSB will be responsible to the GOK's designated Project Coordinator who is the Chief of the Crop Production Division, reporting directly to the District Director of Agriculture.

Due to the urgent national priority to improve grain storage, the MOA has developed a Post Harvest and Storage capability via the vertical development of Post Harvest and Storage

Officers at the provincial (2 new positions), district (7 new positions), and the divisional (37 new positions) levels. In addition to these 46 Extension Service Positions, the MOA will also provide 4 professional positions for the FTDU, 3 for the PHSB and 10 laboratory technician positions for the GMU.

The following chart illustrates just this part of the organization:



sufficiently interested in postharvest storage losses to establish an organizational framework adequate for the administrative feasibility of the project. As in all organizations there will exist both formal and informal communication linkages. It is anticipated that the informal linkages between FTDU technicians (and their counterparts) with other individuals involved in postharvest storage activity will be extremely beneficial to the project.

Official communications between the FTDU and other project components will be through the PHSB office with copies sent to the Provincial Directors of Agriculture (PDA) for Nyanza and Western Provinces. Although all agriculture officers in a Provincial area are responsible directly to the PDA for administrative matters and day to day supervision, the Postharvest and Storage Officers are responsible to the PHSB for technical and professional matters and will, in fact, maintain informal communications. All official communications to and from Postharvest and Storage Officers assigned to provincial, district and divisional areas must, however, go through the PDA's office. Communications from other GOK units affected by the project will have to follow normal channels to the PHSB where they will be directed as required. Although this system of communications may be slow and cumbersome, established communication channels and regulations within the MOA will have to be followed and should not prevent the project from achieving its designed purpose.

## 2. Personnel

The project design team was advised by MOA that providing a total of 63 new postharvest storage positions (46 extension, 4 FTDU, 3 PHSB and 10 GMU) is not expected to be a problem as overstaffing does exist in other less important and less active endeavors. The MOA has agreed to fill all the newly created postharvest positions with experienced field personnel but, owing to the fact that all Postharvest and Storage Officers will be newly appointed, technical training will be required and is provided for in the project. See Annex A, Exhibit 4 for a complete summary of training under the project. The creation and staffing of all these positions, with terms of employment adequate to provide reasonable assurance to the CPC that those persons receiving training can be retained by the MOA in on-farm postharvest storage related positions, will be a condition precedent to obligation of funds for training. The MOA has also agreed and will covenant to create and staff new clerical and secretarial positions as required for the new postharvest storage activities.

## 3. Conclusion

The MOA will have the administrative capacity to effectively implement the proposed project as designed.

**E. FINANCIAL ANALYSIS AND PLAN.**

**1. Summary Cost Estimate**

The total estimated project cost is \$11.7 million of which AID would finance \$7.8 million and the GOK \$3.9 million in Kenyan Shillings. Of the AID share, \$6.0 million would be in foreign exchange and \$1.8 million in local currency. Table E-1 below indicates the estimated project costs, in summary form, by project input.

**Table E-1: Project Cost Summary by Project Output (\$000)**

Description	AID	GOK	Total
Field Testing and Demonstration Unit	\$2,760	\$ 615	\$3,375
Extension	2,641	1,718	4,359
Education Institutions	313	168	481
Grain Monitoring Unit	202	616	818
Project Evaluation	189	21	210
<b>Sub-Total</b>	<b>6,105</b>	<b>3,138</b>	<b>9,243</b>
<b>Escalation and Contingency</b>	<b>1,660</b>	<b>784</b>	<b>2,444</b>
<b>TOTAL</b>	<b>\$7,765</b>	<b>\$3,922</b>	<b>\$11,687</b>

**Table E-2: Project Cost Summary by Project Input (\$000)**

Description	AID	GOK	Total
Long-Term Consultants	\$1,745	\$ 56	\$ 1,801
Overhead and Fee	836	0	836
Short-Term Consultants	1,053	117	1,170
Training	846	314	1,160
Equipment and Vehicles	502	410	912
Structures	532	27	559
Maize Purchases	61	0	61
Cribs and Platforms	530	0	530
Research Grants	0	118	118
Kenyan Professional and Technical Support	0	2,096	2,096
<b>Sub-Total</b>	<b>6,105</b>	<b>3,138</b>	<b>9,243</b>
<b>Escalation and Contingency</b>	<b>1,660</b>	<b>784</b>	<b>2,444</b>
<b>Total</b>	<b>\$7,765</b>	<b>\$3,922</b>	<b>\$11,687</b>

## 2. Project Component Costs

### a. General

As discussed in the implementation section, this project will be implemented utilizing a host country contract between the GOK and a U. S. contractor. The financial costs have been estimated assuming the use of a host country contract, including estimates for overhead and fixed fee. It is envisioned that the contractor will supply the long- and short-term consultants, procure all commodities and vehicles for the project, arrange all long- and short-term participant training, and will also be responsible for the arrangement of financing for the test platforms and cribs.

Included in the project costs are a 15 percent inflation factor on U.S. dollar and Kenyan shilling costs, a 25 percent inflation factor on AID Kenyan shilling costs (construction) and a 10 percent contingency factor on all costs.

### b. Long-Term Consultants

The project as designed provides for a total of 216 person months of long-term technical assistance of which 144 is for the FTDU and 72 person months for the extension component. Table E-3 indicates the proposed level of effort for each of the individuals planned for the project.

Table E-3: Long-Term Technical Assistance Person Months

Position	FTDU	Extension	Total
Grain Storage/Team Leader	48	0	48
Entomologist/Mycologist	36	0	36
Extension Specialist	36	0	36
Social Economist	24	0	24
Provincial Specialist	0	36	36
Provincial Specialist	0	36	36
<b>Total Person Months</b>	<b>144</b>	<b>72</b>	<b>216</b>

The team leader salary was calculated at \$45,000 for the first year and escalated 7 percent for each of the remaining three years. The technicians salaries were calculated with a starting salary of \$32,000 per

annum and also escalated at 7 percent a year. Employee benefits of 30 percent were added, along with post differential of 10 percent and a cost of living allowance of 5 percent. The mandatory Workmans Compensation Insurance was calculated at 9 percent of direct hire salaries. The support costs for the long-term personnel were estimated assuming a family of four with a child in high school and a child in grade school.

c. Overhead and Fee

At the present time it is uncertain whether the contractor will be a university, other non-profit organization or a profit making company. Therefore, an allowance for overhead in the amount of 70 percent of salary costs (salaries plus benefits) was included in the cost estimates totaling \$662,850. The fixed fee was estimated at \$800 per direct person month, or \$172,800.

d. Short-term Consultants

A major cost of the project is the provision for short-term consultants totaling 78 person months of services. The allocation of person months are 32 for the FTDU, 24 person months for the Extension component, 8 person months for the Education component, and 14 person months for the Project evaluation. A cost of \$15,000 per person month was used in preparing the total estimate of \$1.17 million. Mission contracting experience with other short-term consultants indicates that this figure, \$15,000/month, is realistic.

Not included in this total are an additional 15 person months of short-term consultant services for the participant training component as discussed below.

e. Training

As discussed in the Education and Training Summary, Annex A, Exhibit 4, there are 60 training participants both long-term and short-term for which costs are summarized in Table E-4 below.

The costs estimated for the training were based on AID/W participant training notice No. TN 29 which provides \$1,850 per person month for academic long-term training and \$3,500 per person month for short-term technical training. The GOK will provide one-half of the round trip air fare in accordance with the similar practices for AID projects in Kenya.

TABLE E-4: TRAINING COST ESTIMATE

Type of Training	Number of Persons	Duration	Training Costs	Airfare	Salaries During Training
Long Term	6	2 years	\$266,400	\$9,000	\$125,580
Short-Term					
Offshore	17	6 months	357,000	15,300	88,952
Incountry	37	3 months	225,000*	incl.	56,763
			<u>\$848,400</u>	<u>\$24,300</u>	<u>\$271,295</u>

\*Represents 15 person months of short-term consultants/instructors from TPI-U.K. GOK will finance incountry per diem of \$22,500 which is included in total.

f. Equipment and Vehicles

The equipment lists and estimated costs for commodities shown in Annex B were prepared by DPRA. USAID reviewed each of the line items where necessary and modified the selection and quantity of equipment as necessary in the design of the project. However, line item costs as determined by DPRA were retained, unless information came to the attention of the project Design Team requiring modification.

Table E-5 below indicates the list of vehicles and the approximate CIF value for them:

TABLE E-5: VEHICLE COST ESTIMATE

Type	Number	Cost
Sedans	2	\$20,000
4 WD LandRovers	4	72,000
Pick-up Truck	1	12,000
Stake Bed Truck	1	35,000
4 WD Suzuki Jeeps	7	65,000
125 cc Motorcycles & Helmets	50	106,250
Bicycles	700	105,000
Operating Expenses		382,875
		<u>\$798,125</u>

The four wheel drive Land Rovers and bicycles are assembled in Kenya and will be a local currency cost. The remaining vehicles will all be purchased from the U.S. or Code 935 countries. Appropriate waivers are included in the paper. Operating expenses of the vehicles including spare parts, gasoline, oil and maintenance will be provided by the GOK. These costs are calculated based on vehicle usage of approximately 20,000 miles per year.

g. Structures

For this project, five technicians will live in Kisumu/Maseno and one in Kakamega. Recent experience, both with AID financed projects and other donor projects, indicate that suitable rental housing will be unavailable in the two towns; therefore, AID will finance the construction of the houses.

Standard Ministry of Works' design will be used. Each house will have three bedrooms, the total gross area being 109 square meters. According to the GOK's practice, each house will be provided with two room quarters for household staff, having a total gross area of 37 sq. meters. The houses will be constructed of concrete blocks, PVC flooring, asbestos roofing, sheeting on timber trusses and soft board ceiling. The houses will be connected to the town's potable water supply and electrical supply. Septic tanks to treat waste water will be constructed.

AID will also finance the construction of the GMU laboratory and office space at the FTC at Maseno, near Kisumu. For both the office and laboratory blocks, standard MOW's designs and specifications will be used. The total gross area will be 500 square meters.

The construction costs for the six houses are estimated at \$310,500 based on construction costs of similar houses AID is financing under the ASAL project. It is proposed that USAID will contract directly with a Kenyan engineering firm to perform the site survey, develop the plans, issue the construction IFB and provide supervision of construction services. The cost of these services is approximately 15 percent of the \$310,500 total cost, or \$40,500. For a full statement of the reasons for adopting direct contracting by USAID for construction of housing see Annex F, Exhibit 4.

The cost estimate for the laboratory office construction was prepared by DPRA; however, it has been increased by ten percent for inflation incurred since these estimates were prepared. As with the housing, 15 percent of the laboratory costs is attributed to engineering services provided by a Kenyan engineering firm. Thus, the AID-financed construction costs are estimated at \$140,500, and A&E services at \$19,500.

h. Maize Purchases

Both the FTDU and GMU components of the project will require the purchase and/or reimbursement of maize. Under the FTDU, approximately 350 tons of maize will be purchased for use in the testing of the cribs over a three year period. Under the GMU it will be necessary for the CBS enumerators (in collecting 10,000 1 Kg. samples annually) to either pay the farmer for the samples or to reimburse him in kind with another appropriate grain. The cost of the maize for this component was estimated at \$150 per ton.

i. Cribs, Platforms and Kits

The costs of the materials for the test cribs and platforms used in the FTDU component including poles, building materials, rat guards and other construction materials, were estimated at \$100 per unit (Annex B, Exhibit 1). It is envisioned that about 300 such units will be constructed over the life of the project resulting in a total cost of \$30,000.

In the extension component, the cost of each of the kits, which will be made available to approximately 10,000 smallholders, is estimated at \$50 per kit (Annex B, Exhibit 8). The materials for the platforms, cribs and the 10,000 kits will be procured locally from various retail outlets of the Kenya Farmers Association (KFA). (See Annex B, Exhibit 8 for possible list of outlets.) One of the duties of the contractor will be to devise an appropriate method to distribute the kits to the 10,000 smallholders, possibly using a chit system.

3. Financial Plan.

a. AID Contribution

AID proposes to make its contribution at \$7.8 million available to the project on a loan basis to Kenya. The lowest of AID's concessionary loan terms will be utilized, that is principal repayment in 40 years with a ten-year grace period, with interest at two percent per annum during the grace period and three percent during the repayment period.

b. GOK Contribution and Recurrent Cost Implications.

The GOK contribution to the project is estimated at \$3.9 million. As noted in Annex E, Exhibit 3 and summarized in Table E-6 below, the major GOK contribution to the project will be for salaries, which total \$2.37 million including salaries of participants during training.

Table E-6: GOK Contribution

Present Recurrent Cost	Additive Recurrent Cost	Non-Recurrent Project Cost	Total
\$2,266,173	\$1,193,469	\$ 462,038	\$3,921,680

The allocation of the total GOK contribution costs was made among three classifications:

- a) Those costs which are already in the GOK budget and expenditures which are already being incurred, such as present staff, and Ministry of Works services.
- b) Those costs which, as a result of this project, will become recurrent costs, such as operating expenses for new project financed vehicles and the GMU laboratory, and newly hired staff such as the GMU laboratory staff.
- c) Those costs which are a one time expenditure for the GOK as a result of this project.

The project will not have a significant impact on the MOA recurrent cost budget. Table E-7 below compares the project additive recurrent and non-recurrent project costs to the MOA budget projections as presented in the GOK five year plan.

TABLE E-7: RECURRENT COST IMPLICATIONS (KSH 000)

	80/81	81/82	82/83	83/84	84/85 and on
MOA Proposed Budget	48,056	48,439	51,117	49,224	49,224
Additive					
Project Cost	431	514	514	431	431
(U.S. \$000)	(1,193)	(1,424)	(1,424)	(1,193)	(1,193)
Percentage of					
Project Additive					
Cost of MOA Budget	0.90	1.06	1.01	0.88	0.88

During fiscal years 81/82 and 82/83, the project will have the greatest impact due to one-time additive costs such as construction procurement and construction expenses. Even so, the costs will amount to only one percent of the total MOA budget. For subsequent years, additive recurrent costs of \$1.2 million (K.Sh. 431,000) will be approximately nine tenths of one percent of the total MOA budget. The project will not, therefore, impose a recurrent cost burden of any significance on the MOA.

The total GOK contribution of \$3.9 million is approximately 33 percent of the overall project total of \$11.7 and therefore the requirements of section FAA 110 (a) deemed satisfied.

Additional GOK outlays required to cover interest and amortization costs resulting from the project loan of \$7.8 million dollars are summarized in table E-8. Calculations are based on the pattern of projected disbursements set forth in Table E-9. Debt service charges during the first five years total \$367 thousand. The largest single payment during that period amounts to \$141 thousand in FY 1985. Debt service payments continue to rise through 1990 stabilizing at a level of \$390 thousand annually in 1991 and thereafter. Total undiscounted payments would amount to approximately \$13.0 million. The 1981 net present value of the entire stream of such payments would amount to approximately \$1.1 million, assuming a discount rate of 15%.

An alternative method of measuring the recurrent cost impact of debt service charges to the GOK resulting from the project loan is to calculate the approximate cost of establishing a sinking fund to cover repayment of the principal once the ten year grace period has expired. At a 15 percent rate of return, such a fund would require ten equal payments of \$372 thousand annually between 1981 and 1990. Such sinking fund payments would be in addition to the annual debt service payments due during the first ten years as shown in Table E-8. The 1980 net present value of all such payments would amount to \$2.4 million. The relatively larger net present value of payments made under the sinking fund approach is indicative of the generally high levels of concessionality implicit in current terms for 40 year development loan funds. Given the disbursement pattern shown in table E-9, the concessionality of the current loan is somewhat greater than 78%.

#### 4. DISBURSEMENT PROCEDURES

All services provided under this project will be financed through a host country contract. The contract will permit the contractor to sub-contract for any required short-term consultants, participant training, and to the extent necessary, to act as the procurement agent for commodities and vehicles (except for some commodities to be ordered by USAID in advance of the contract signing.) Distinct disbursement procedures will be used for both the U.S. dollar and the Kenyan shilling payments under this contract. Separate invoices for dollar expenses and shilling expenses will be submitted monthly by the contractor to the appropriate GOK contracting officer for certification. They will then be forwarded to the USAID project manager for administrative approval (similar to that required under the AID direct Letter of Commitment procedure) and then forwarded to the USAID Controller for verification and payment. Actual payment will be made either by Kenyan Shilling check, or U.S. dollar check prepared by the Regional Finance Officer in Paris.

TABLE E-8

COMPUTATION OF INTEREST AND PRINCIPAL REPAYMENTS

	(IN U.S. \$000)										
	<u>F I S C A L Y E A R S</u>										
	1981	1982	1983	1984	1985	1986	1987	1988	1999	1990	1991-2020
Loan Fund (Disbursements)	<u>399</u>	<u>2421</u>	<u>2089</u>	<u>1524</u>	<u>1332</u>	-	-	-	-	-	-
Interest on 1st Year Loan @ 2%	4	8	8	8	8	8	8	8	8	8	-
Interest on 2nd Year Loan @ 2%	-	24	48	48	48	48	48	48	48	48	-
Interest on 3rd Year Loan @ 2%	-	-	21	42	42	42	42	42	42	42	-
Interest on 4th Year Loan @ 2%	-	-	-	15	30	30	30	30	30	30	-
Interest on 5th Year Loan @ 2%	-	-	-	-	13	27	27	27	27	27	-
TOTAL INTEREST	4	32	77	113	141	155	155	155	155	155	-
Principal repayment										<u>127</u>	<u>390</u>
TOTAL DEBT SERVICE	<u>4</u>	<u>32</u>	<u>77</u>	<u>113</u>	<u>141</u>	<u>155</u>	<u>155</u>	<u>155</u>	<u>155</u>	<u>282</u>	<u>390</u>

NOTES:

- (1) Assuming interest during grace period paid as it falls due; and loan disbursements made evenly through the year.
- (2) Loan term for 40 years at 2% interest per annum during grace period of 10 years; and at 3% thereafter.
- Interest to be paid semi-annually on outstanding principal during grace period. Repayment of principal to begin nine and one-half years after the first interest payment is due.

The direct disbursement procedure has several advantages over the Commercial Bank Letter of Commitment and the AID Direct Letter of Commitment: (a) There will be no banking charges normally associated with a Bank Letter of Commitment and related Letter of Credit, thereby providing a savings of approximately \$150,000 over the five year life of the project; (b) Although the direct payment procedure adds approximately two additional invoices and checks per month to the work load of the Mission Controller's Office, the record keeping requirements are no more than when the AID Direct Letter of Commitment procedure is used; (c) Current disbursement data will be available to the USAID Project Manager two to three months earlier than if the Direct Letter of Commitment procedure were used.

The estimated schedule of disbursements is shown below in Table E-9.

Table E-9 Estimated Disbursement Schedule

AID AND GOK CONTRIBUTIONS

(\$000)

	FY81	FY82	FY83	FY84	FY85	TOTAL
AID TOTAL	\$399	\$2421	\$2089	\$1524	\$1332	\$7765
U.S DOLLAR	93	1765	1811	1246	1044	5959
KENYAN SHS.	306	656	278	278	288	1806
GOK TOTAL	77	406	1314	1075	1049	3921
TOTAL DISBURSEMENTS	\$476	\$2827	\$3403	\$2599	\$2381	\$11,686

F. DEMOGRAPHIC IMPACT STATEMENT

It is anticipated that the proposed project activities, on balance, will be mildly supportive of GOK efforts to reduce the estimated 4% annual rate of population growth at least among primary target beneficiaries. The project is intended to assist rural smallholders to adopt innovative practices in on-farm crop storage in order to reduce postharvest crop losses, however, and not to reduce population growth. Agricultural innovation may influence smallholders to consider adoption of innovation in other aspects of their lives such as family planning. Increased income through reduction of crop losses, particularly for female smallholders, could result in consideration of alternative uses of family resources rather than fatalistic acceptance of increased number of children. This could enhance receptivity to the concept of planned births. Fertility determinants research suggests that increased income for rural smallholders, improved socio-economic status of women and adoption of innovation are associated with decreased fertility.

Improved nutritional status of women is also associated with reduction of fecundity impairment and resulting infertility. The anticipated nutritional gains arising from the reduction of postharvest losses probably will exacerbate Kenya's population problems by further reducing mortality. The reduction of mortality without offsetting reductions in fertility will result in an increased rate of population growth. Kenya already has the lowest infant mortality rate in sub-Saharan black Africa. Although Kenya has already experienced an unprecedented rapid reduction in infant mortality, evidence from the 1977-78 Kenya Fertility Survey suggests that there has been an increase in fertility. Conventional health theory proclaims that reduction of infant mortality is a precondition to reduction of fertility and that fertility will decline when parents realize that their children will survive. However, there may be a lengthy period between perception of reduced infant mortality and a conscious decision to have fewer children. In the meantime, the anticipated reductions in mortality will temporarily increase rather than diminish the population problem.

It is not anticipated that the crop storage activities proposed in this document will in themselves have more than a mild indirect effect on population growth. However, USAID/Kenya and the Ministry of Agriculture (MOA) have held discussions about the desirability and feasibility of integrating simple information, education and communication (IEC) materials on family planning into the content of crop storage training and extension activities.

The Government of Kenya has clearly established the policy of supporting and popularising family planning, and USAID/Kenya is preparing to assist the MOA to include motivational materials on the benefits of family planning as a component of this crop storage project. Both male and female members of rural families will be involved in project activities. The males will be expected to construct storage facilities on their farms, while the females will harvest, dry, heat, store and maintain grain. Family planning IEC modules could be integrated into the contents of the following training and extension activities:

- a) Farmer Training Center Courses
- b) Community-based, group-oriented extension activities, especially those involving women's groups, and
- c) Agricultural Information Service mass media.

The USAID/Kenya Population Officer has participated in discussions with the Head of the Post Harvest and Storage Branch and the Chief of the Home Economics and Rural Youth Branch of the MOA about the desirability of training MOA staff as dissemination agents of information about the benefits of family planning to poor smallholder families. There is a definite link between the project goal (to improve the welfare of small-scale grain farmers) and the improved family welfare which will result from child-spacing. MOA officials have indicated their interest in IEC activities and the Mission is considering initiating a separate activity which could link into this project. As a first step USAID would arrange the services of a short-term consultant to design IEC messages on benefits of family planning for the rural smallholder audience. The consultant would work with MOA staff in designing messages which are readily comprehensive and culturally acceptable to the target audience. The messages would be carefully pretested on rural smallholder groups to ensure that they are effective and inoffensive. IEC modules on benefits of family planning would then be integrated as appropriate into training and extension activities including those anticipated in this project.

#### G. ENVIRONMENTAL IMPACT

The Initial Environmental Evaluation (IEE) included in the PID was approved by AID/W with the provision that the PP provide for

risk/benefit analysis of each pesticide to be used during project implementation. The scope of work for the host country contract will include this requirement within the FTDU function. Prior to the use of any pesticides, the FTDU will complete any necessary risk/benefit analysis and submit its conclusions to AID for review and approval. At present, the only pesticide being considered for use in the project is malathion dust, which is on the Environment Protection Agency's approved pesticide list (EPA number 241-48). A risk/benefit analysis of this pesticide will be submitted by the FTDU Entomologist/Mycologist upon that person's assumption of duties.

With respect to construction activities, the PID proposed only a laboratory/office building to be built in Nairobi. Final project design requires construction of five residential houses in Kisumu, one residential house in Kakamega and a laboratory/office building in Maseno. Final sites selection criteria for these buildings will require that all services such as treated water, waste-water treatment and electric supply are available, and are environmentally satisfactory. Given the fact that total construction activities are minor and that changes between the PID and the PP are not significant from an environmental point of view, revision of IEE was not necessary.

#### IV. IMPLEMENTATION ARRANGEMENTS

##### A. GOK PROJECT ADMINISTRATION

The details of the Ministry of Agriculture's organizational structure designed to support postharvest storage activities is discussed in the Administrative Feasibility section of this project paper.

In order to enhance the MOA's capability to administer this project three specific steps have been taken. First, the project will provide short-term off-shore training for the Head of PHSB and his assistant. This training will include technical programs in grain drying and storage as well as instruction in extension methodologies and administrative skills improvement. Second, the MOA over-all Project Coordinator will be an experienced administrator, the Chief of the Crop Production Division who reports directly to the Deputy Chief of Agriculture. Third, the project is providing a technician who will function as the Contractor's Project Coordinator (CPC) for the life of Project. The CPC will assist the GOK overall Project Coordinator, and the Head of the PHSB in the management and administration

of this project and will provide on-the-job training to the Head of the PHSB.

It is anticipated that these three actions will sufficiently enhance the MOA's administrative capability to adequately administer the On-Farm Grain Storage Project. GOK administrative arrangements and capacities are adequate for the timely and satisfactory implementation of the project.

#### B. AID PROJECT ADMINISTRATION

USAID/Kenya has assigned an Agricultural Advisor to be the Project Manager for this project. The Project Manager has contributed significantly to the design of the project and has considerable experience in extension activities.

The Project Manager will be supported by the fully staffed USAID Mission to Kenya including a five-person staff in the Agriculture Division. REDSO/EA, also based in Nairobi, participated significantly in the design of this project and will be available on a continuing basis to support the Project Manager as required.

AID does have adequate resources and administrative arrangements to implement the project satisfactorily.

#### C. IMPLEMENTATION PLAN

##### 1. General

In general, overall project implementation will be carried out under a single host country contract between the GOK and an appropriate host country contractor to be selected. Given the complexity of this project, particularly with respect to the timing of the varied elements, it was necessary to prepare detailed "Implementation Tracks" or schedules to determine that a timely and logical sequence of events would occur. These illustrative tracks appear in Annex A, Exhibit 7. The Mission recognizes that actual implementation may not follow the detailed schedules, but they will serve to remind the Project Manager and the GOK that certain events must take place and that some events are dependent upon the occurrence of others. Implementation tracks will, of course, be modified from time to time to reflect the occurrence of actual events.

Eleven separate implementation tracks have been

identified which commence independently but are, in fact, interdependent.

- Overall Project
- Host Country Contract
- Anthropologist
- FTDU-GMU and House Construction
- Commodities Procurement
- MOA Personnel
- Long-Term Training
- Team Leader
- Short-Term In-country Training
- Training of LEO/HE and FTC

## 2. Timing of Implementation Tracks

The timely execution of initial events will be critical to the successful project start-up and possibly the entire project. The major constraint to early project implementation is the lack of suitable housing for contractor personnel stationed outside of Nairobi.

Therefore, AID will finance the costs of constructing five houses in Kisumu and one in Kakamega, as well as a combined laboratory/office building in Maseno. These facilities will not be completed until approximately 12 months after the contract has been signed and approved, however, so overall project timing must take this delay into account.

### a) Host Country Contract

This first draft of the proposed contractor's scope of work prepared by the Mission appears in Annex A, Exhibit 6 along with the Technical Assistance Plan and a description of each technician's responsibilities. The scope of work will undergo further refinement as a result of the AID/W approval process and continued review by the Mission and MOA.

Selection of the contractor will be carried out in accordance with procedures in AID Handbook 11, Chapter 1. It is expected that the Commerce Business Daily notice advertising the Request for Proposals will be published 3 months after the Loan Agreement is signed with proposals due in Nairobi 6½ months after the Loan Agreement is signed. Evaluation of proposals will consume about six weeks and will include interviews of candidates in the U.S. by the

USAID and MOA Project Coordinators. Contract negotiations are expected to take another 45 days with contract signing expected 9½ months after the Loan Agreement is signed. Ideally, the Contractor's Project Coordinator would arrive within 30 days of contract execution.

b) FTDU-GMU and House Construction

Under GOK regulations, all structure construction is the responsibility of the Ministry of Works (MOW). Usually, the MOW either contracts with local private companies or carries out the work with its own staff, after completing site surveys and preliminary and final design. It was originally intended and agreed to by AID, MOA and MOW that MOW would carry out the site surveys, prepare designs and tender for a local construction contractor. However, because of extremely heavy workload, construction of the houses was not expected until approximately 14 months after the Contract has been signed and approved. It is now proposed that AID contract directly with a local Kenyan engineering firm to carry out those functions which would have been performed by MOW. By doing so, a time savings of upto six months is possible. Annex F Exhibit 4 is the USAID/Kenya memorandum justifying the use of direct AID contracting for construction. The implementation tracks show, however, the "worst case" timing, i.e., first construction completed approximately 14 months after the Contract has been signed and approved.

The first, and most important step, will be the allocation of five residential lots in Kisumu and one in Kakamega for construction of housing. The MOA has already begun discussions with the respective District Commissioners for the two cities to identify potential lots with utility services. Once the lots have been identified, approval of the respective District Councils and the Office of Lands and Settlements in the Office of the President will be required. Only after all approvals have been obtained will the proposed AID-financed engineering firm be able to initiate the site survey. Based upon USAID experience with house construction for the AID-financed Arid and Semi-Arid Lands Project, we have estimated that actual construction will take about 40 weeks after the construction contract is signed.

The construction for the GMU laboratory and FTDU offices will follow approximately the same schedule. AID-MOW-MOA approved plans and a construction IFB from the ASAL project will be used for housing construction.

c) Contractor Arrival Track

The Contractor's Project Coordinator (CPC) is expected to arrive 1½ months after the signing and approval of the Contract to begin project start-up activities. The CPC and his family will reside for the first year in rental housing in Nairobi; most of the CPC's functions during the first year will be administrative in nature requiring close coordination with the new PHSB officials. The three remaining FTDU technicians will commence a three week language program in the United States during the first week in January 1982 and in mid-February will arrive in Kisumu for a three month TDY, without their families.

During this three month period, the technicians will complete their orientation, participate in community participation discussions and begin collecting data for the preparation of the baseline survey questionnaire. The three technicians may return to the U.S. to complete work on the questionnaire, and complete personal obligations such as packing and shipping. Technicians will then return with their families about July 1982. Should the housing in Kakamega and Kisumu be completed earlier, the schedule has enough flexibility to permit the consultants to return sooner.

d) Training

The first training program under the project will be the long-term training programs for the four FTDU counterpart personnel and the two Provincial Extension Specialists. Prior to the arrival of the CPC, the USAID and MOA Project Coordinators will begin initial negotiations directly with selected U.S. universities to determine curriculums and schedules. Upon arrival, the CPC will join in the MOA candidate selection process and will be responsible for finalizing arrangements with the respective schools. The U.S. Department of Agriculture, which normally carries out these functions, will not be used. The participants will depart for the winter semester 1982 and return two years later, January 1984. This will then provide a one-year overlap with the two remaining FTDU technicians and a year and one-half overlap with the Team Leader.

The two six-month out-of-country training program discussed in the Detailed Project Description will be arranged by the contractor to begin in June 1982 and in June 1983. The incountry, three-month divisional training program by TPI is scheduled to begin January 1983, between the two out-of-country short-term programs.

e) Procurement Plan

With the exception of two project vehicles which MOA/USAID will procure prior to the arrival of the CPC, all project commodities, equipment, vehicles, furniture and appliances will be purchased by the contractor. All procurement will be subject to the guidelines in Chapter 3 of Handbook 11 except as covered by appropriate waivers in Annex F. Depending upon the contractor, either the procurement will be done directly by the contractor, or a procurement service will be utilized, such as AAPC. One set of household furnishings will be required early for the CPC. This procurement will fall under the Small Value guidelines but furnishings for the remainder of the team, due in country ten months later, will be purchased using a more formal system since the total value will be in excess of \$100,000.

3. Project Dates

The following official dates will be incorporated into the Project Agreement:

a) Eligibility Date

The eligibility date for financing any bona-fide AID financed project costs will be March 1981, provided that the Loan Agreement has been signed by authorized representatives of the Republic of Kenya and the United States.

b) Terminal Date for Conditions Precedent

The Terminal Date for the general Conditions Precedent will be 90 days from the date of Loan Agreement signing. No terminal dates are established for specific purpose Conditions Precedent. Also, initial vehicle procurement for the Team Leader will commence April 1981, and the Purchase Order cannot be issued until CP's have been met. The host country contract will not require funding until approximately 10 months from Loan Agreement signing.

c) Project Assistance Completion Date

The Project Assistance Completion Date (PACD) will be 60 months from date the Project Agreement is signed. The Team Leader will have departed one month prior to the PACD.

d) Terminal Date for Disbursement Authorizations

The Terminal Date for Disbursement Authorizations (i.e., letters of commitment) will be 58 months from Loan Agreement signing to allow the financing of the short-term consultants who will carry out the final project evaluation.

e) Terminal Disbursement Date

The Terminal Disbursement Date for this project will be 64 months from Loan Agreement signing as by then, all residual billings will have been submitted by the contractor and paid by AID.

D. EVALUATION PLAN

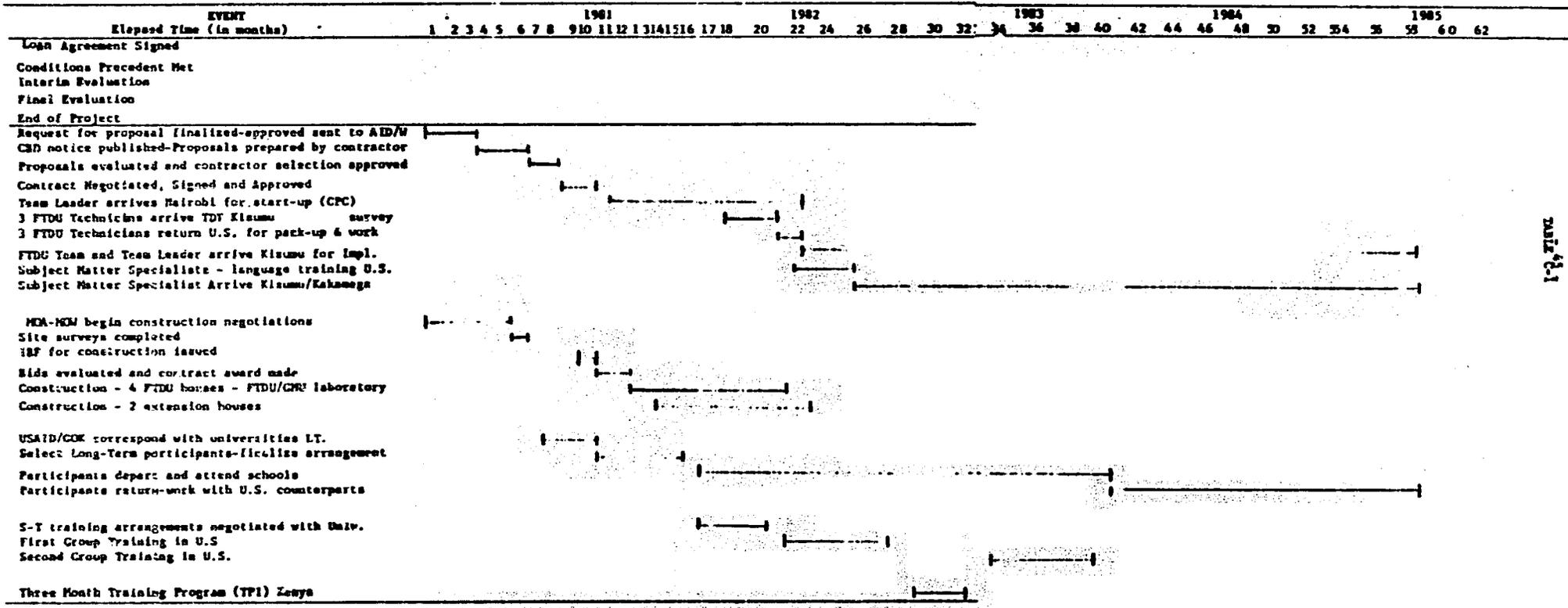
1. Baseline Data Requirements

More information about the poor smallholder is required to establish precise baseline requirements; collection of this data is provided for in the project design. The preliminary study by the Anthropologist, participatory meetings with representative poor smallholders and the baseline survey design effort by the FTDU team will provide the necessary baseline information early in the project. In general terms, baseline information will include:

- a) Comprehensive and reliable statistics regarding current on-farm grain drying and storage practices of smallholders in the targeted area.
- b) Identification of primary determinants of behavior, obstacles to change and potential entry points for effective promotion of innovations.

As the project proceeds from the initial information gathering (baseline establishment) phase into the adaptive testing phase, the FTDU staff will require and will develop its own procedures to obtain production and quality of grain statistics as well as economic data from poor smallholders who are included in test and control groups. Extension advisors at the provincial level of the MOA will also require and be responsible for obtaining baseline data against which the effectiveness (quality as well as quantity) of extension efforts may be measured. Each of the long-term technicians, then, will be responsible for initial collection of baseline data and the development of systems and procedures to capture

**TABLE C-1**  
**INITIAL IMPLEMENTATION TRACKS**  
**SUMMARY OF MAJOR EVENTS**



1-3-81

and evaluate that information essential to monitor and manage project activities. These data collection systems and procedures will be evaluated during the project's two evaluations and responsibility for their maintenance will be assumed by Kenyan counterparts to insure the continued availability management and monitoring information after AID's participation ceases.

## 2. Evaluations

Two evaluations are planned utilizing expert consultants in grain storage and extension/non-formal education who are completely independent of the project. The Government of Kenya will also be requested to provide at least one agriculture technician, at a responsible level, to serve on each evaluation team. The first evaluation will take place approximately three years after the Grant Agreement is signed, on or about the fourth quarter of 1983. Final evaluation will take place almost at the end of AID's participation but before the Contractor's Project Coordinator leaves Kenya, on or about December 1985. The exact composition of the evaluation teams will be determined jointly by the USAID Project Manager and the MOA Project Coordinator.

The evaluation during the fourth quarter of 1983 will focus on the extent to which planned inputs have been provided by AID and the GOK on a timely basis, the degree to which outputs in general and specifically planned activities, in particular of the FTDU and GMU, have been achieved and problems encountered in having smallholders accept new technology, and any resistance in the extension component specifying what changes of behavior have taken place; and the adequacy of planning project activities for the final three years. Such planning will include activities necessary to insure that adequate data will be available for final project evaluation. The extent and quality of actual field testing, the information system established and training accomplished will all be key points of interest to the evaluators. Sources of information will include, but not be limited to interviews (MOA, USAID and project staffs), field observations of training and/or participatory discussions, review of training materials and review of project records as required. At this time a determination will be made as to the need to extend the life of the project beyond 1986.

The final evaluation will determine the extent to which outputs were achieved, the degree to which logical framework linkages actually operated as presumed (and the reasons therefore), and the degree to which project purpose was achieved.

As part of the final evaluation of this project during year five, close consideration should be directed to the possibility of a follow-up project. This may be necessary for some of the following reasons:

1. Adoption rate of improved or suggested technologies may need to be increased or encouraged on a broader country-widescale through continued extension and training efforts.

2. Positive results of project activities may have significant impact and require accelerated expansion or refinement. For example the Grain Monitoring Unit could impact government policy and planning activities as to require accelerated development additional GMU Units in other areas of the country.

3. Positive results of adaptive or other research programs may be ready for testing or promulgation for improved reduction of postharvest losses.

4. New topics of research may have been identified during the 5 years of this project. These topics may deserve support and continuation of research grant funding.

5. Aspects of adaptive research believed to be beneficial may need economic interpretation or cost-benefit analysis to show positively or negatively whether the suggested innovation deserves further work and extension efforts.

6. The research and training program for Kenya Masters Degree candidates at the University may deserve evaluation for continued grant funding of new candidates.

7. Other project components may be identified during the course of this project such as small holder's access to credit, marketing channels, or improved storage containers which may require further definition or implementation to maximize the outputs of this project.

8. Methods to assess this project and duplicate the positive effects in other countries by AID/Washington may require modest follow-up project funds or use of some personnel employed or trained during this project.

For the reasons given above a complete and thorough project evaluation sensitive to the above aspects will be necessary during the fifth year of this project. Multiple copies of the project results including negative aspects and difficulties encountered

during the project need to be distributed widely so that other regional or country-wide or international programs can benefit from the efforts and funds expended during this project.

E. (Left Blank)

F. CONDITIONS, COVENANTS AND NEGOTIATING STATUS

Conditions Precedent to Disbursement

1. Prior to any disbursement or the issuance of any commitments under the Project Agreement, the GOK shall in substance satisfy the following conditions precedent:

(a) 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 Borrower, and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Borrower specified in Section 9.3, and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) Evidence that the GOK has made available for the project five acres of land with adequate services at the Maseno FTC for construction of an office and laboratory facility for use by the Field Testing and Demonstration Unit (FTDU) and the Grain Monitoring Unit (GMU)

(d) Evidence that the GOK has made available for the project six improved lots suitable for the construction therein of staff housing for six U.S. project technicians. One such lot shall be located proximate to Kakamega and five such lots proximate to Kisumu. Improvements to be provided at Cooperating Country expense shall include adequate provision of water, sewage, electricity, and year-round serviceable road access to each lot.

Covenants

1. The GOK and the MOA will in substance covenant:

a) Execution of the Project

(1) to finance host country contract activity, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.: An executed contract for the services of a U.S. consulting firm for the preparation of a master plan for Project implementation.

(2) to finance participant training, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D. evidence that qualified persons selected for training under the Project will be assigned to on-farm postharvest storage related positions and that their terms of employment after training will provide reasonable assurance that such individuals can be retained in such positions.

(3) to finance the purchase of bicycles and motorcycles for Government of Kenya employees, subject to the establishment of an employee purchase plan satisfactory to A.I.D.

b) Funds and Other Resources to be Provided

(i) To make available on a timely basis any Kenyan currency and other agreed upon GOK inputs for the punctual and effective carrying out of construction, maintenance, repair and operation of the project.

c) Operation and Maintenance

(i) To operate, maintain and repair project equipment in conformity with sound operational, financial and administrative practices and in such manner as to insure the continuing and successful achievement of the purposes of the project.

d) Management

(1) To provide qualified and experienced management for the project and to train such staff as may be appropriate for the maintenance and operation of the project.

e) Continuing Consultation

(i) To cooperate fully with AID to assure that the purpose of the loan will be accomplished. To this end, the GOK and AID shall from time to time, at the request of either party, exchange views through their designated Project Coordinators with regard to the progress of the project, the performance of the GOK and AID of their obligations under the Project Agreement, the performance of consultants, contractors and suppliers engaged on the project, and other matters relating to the project.

Negotiating Status

As of August 28, 1980 the MOA's designated Project Coordinator and the Head of the PHSB have expressed agreement with the project's purpose, general design and implementation plan as described in this Project Paper. The Project Paper has been revised to represent loan funding.

SUMMARY OF THE KENYA NATIONAL CROP STORAGE STUDY BY  
DEVELOPMENT PLANNING & RESEARCH ASSOCIATES, INC. (DPRA)

Description of Survey Methodology

The survey covered 14 districts of 5 provinces and a total of 188 smallholders were contacted. Some 320 grain (mostly maize, but including some bean, sorghum, and millet) samples were analyzed for insect, bird, and mold damage and loss. Another 151 samples were analyzed from non-smallholder sources. A grain quality laboratory was set up by the DPRA team to analyze the samples for mold and insect weight loss and included a presumptive aflatoxin test of those samples which fluoresced under a black light. The survey was conducted by a Central Bureau of statistics enumerator while a DPRA team member collected samples and made observations of on-farm grain storage facilities. The survey included a description of the types and maintenance of storage structures, drying and storage practices, rodent control, use and disposal of grain plus extension worker involvement, attitudes about credit, and radio usage.

Tabulation of results

Based on the survey and analysis of samples the DPRA team concluded the following important points:

1. The estimated post harvest losses of maize on smallholdings by birds, insects and mold in Kenya in 1979 expressed as a percentage of actual production at maturity is 16.86.
2. Bean losses are estimated at .2% from insects and 4% from mold.
3. Sorghum losses are estimated an average 6.3% from mold and an average 40% from insects.
4. Over 90% of smallholders dry their maize in the field rather than put it directly in cribs for storage.
5. Recently harvested maize shows average moisture exceeding 19%, a level which supports rapid mold and insect growth.
6. Beans are field dried just short of shattering then the entire plants are pulled and stacked in a crib until drying is complete enough for threshing.
7. Beans are usually threshed by being beaten with sticks on a cloth or floor then sun dried on a mat if additional drying is needed.
8. The majority of the farmers stored their maize in ear form, with the husks removed.

to build and 90 K.Shs. to roof it.

23. Pest control measures include: dusting with marathion, lindane, DDT, Aldrin, Chlorodane, and Actellic. Traditional methods include admixture with wood ashes, lining crib with wild marigold (*Tagetes minuta* L.), or smoking of maize ears with the husk on. Rodent control most frequently involves keeping cats, also Warfarin was said to be used as well as traps. Only 40% reported using chemical protection including ashes. Rat guards on supporting poles of cribs were not found.

24. Shelled maize is more often treated with protectants than ear maize, and insecticides were frequently applied haphazardly and at less than recommended dosages "to save money".

25. Over 80% of the households interviewed sorted their maize prior to grinding. About 85% used moldy or damaged grain for animal food, 10% threw it away, and 5% used it for beer making.

26. The shelling process is accomplished mostly by women with some help from the children.

27. Shelling is accomplished by hand beating of ear maize in a sack or by bare hands.

28. Maize is commonly ground into whole maize or posho by small custom mills, however, some traditional grinding by hand or stone grinders still exists.

29. Nearly half of the respondents in this survey were women (44%).

30. Only 40% of those interviewed sold maize and only 29% bought maize. Only 8% sold and then repurchased maize during the year. Of those who bought maize, 44% purchased from fellow farmers, 58% bought it from traders.

31. Out of 133 households included in the study 35% were suspected of having aflatoxin contamination, and 14% of the 133 contained a presumptive level of 40 ppb. (U.S.F.D.A. tolerance level allowed for feed in interstate commerce is 20 ppb).

32. Bird losses in maize before harvest was estimated at 1.26%.

33. A large majority of farmers indicated a desire for credit to build new storage facilities (86%) and to purchase insecticides (63%).

9. Beans are usually stored in ear form.
10. Grain sorghum is usually stored in the heads and threshed as needed.
11. Spike millet is usually threshed after drying and stored in small containers such as gourds, cans or woven baskets.
12. Finger millet is usually stored in the heads and threshed as needed.
13. Crib configuration percentages are 62% rectangular, 17% circular, 20% elevated wicker-basket, 1% conical.
14. Crib construction materials are; wood poles for structural support, sisal poles, round or split bamboo, sticks and plant stalks for floor and wall.
15. Mudded or mud and dung walls were used on 23% of the cribs.
16. The storage capacity of the average small farm holder exceeds the average maize production of 1,012 kg.
17. The average age of the cribs was found to be 5.3 years with an expected useful life of 9.7 years.
18. Of the cribs studied 80% had thatched roofs and 20% had metal roofs of either corrugated galvanized iron or flattened kerosene cans.
19. Of the farms surveyed, 64% built their own store with family labor, 26 percent hired someone to build their store, and 10% employed both family and hired labor to construct the storage.
20. The main responsibility for grain storage construction is the husband's.
21. Thatch roofs were reported to cost 4 K.Shs./m<sup>2</sup> if purchased or require about 1.5 hours/m<sup>2</sup> of labor to gather. Metal roofs cost about 20 K.Shs./m<sup>2</sup>. Wall and floor materials cost about 17 K.Shs./m<sup>3</sup> if purchased or 4.4 hours/m<sup>3</sup> of labor to gather materials.
22. Storage structures require about 5 hr/m<sup>3</sup> to build and 1 hr/m<sup>2</sup> to apply the roof. If labor is hired it costs about 150 K.Shs.

Confusion regarding the farmer's interpretation of a loan perhaps as a gift was possible. Only 21% were interested in credit to improve or repair stores (a minor cost item), and 36% expressed interest in drying facility credit.

34. The survey indicates that 40% own a radio and evening is the prime time for radio listening by farmers.

35. Twenty-eight percent of the survey respondents had been visited by an extension agent and 29 percent had visited an extension office. Farmers do respect the extension service and 91 percent expressed a desire for more help.

36. Only 36% had attended local meetings or barazas during the previous year and only 11% had visited an FTC.

37. Only 43% belong to any cooperative (including purchasing cooperatives for milk or export crops) and 11% had received loans from cooperatives or the government.

38. Nineteen percent had attended a demonstration on storage. However, 94% expressed a desire for more storage information.

39. Ninety two percent expressed an interest in improvement of stores.

40. Farmers estimate their own grain losses at 11%.

Conclusions and recommendations in post-maturity, prestorage procedures, storage facilities and practices, insect and rodent control.

1. Crops should be harvested as soon after physiological maturity as possible to reduce losses.

2. Harvesting soon after maturity will require new drying techniques; platform sun drying is used extensively on other crops and should be used on maize, beans, sorghum and millet.

3. Grain to be stored longer than 3 months should be shelled and properly treated with an effective insect protectant.

4. As new cribs are built they should be narrower (1.5 m maximum) to provide better ventilation and be equipped with rodent guards and adequate roof overhang.

5. Shelling and threshing losses can be reduced by techniques which will damage kernels less.

6. Increased rodent control measures around grain stores is needed.

7. Beans, sorghum, and millet should be treated in a similar fashion to reduce losses of these commodities.

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Life of Project:  
From FY 81 to FY 85  
Total U.S. Funding  
Date Prepared: AUGUST 13, 1980

Project Title & Number: On-Farm Grain Storage (615-0190)

FACE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: The broader objective to which this project contributes: (A-1)</p> <p>To improve the welfare of small-scale grain farmers (smallholders).</p>	<p>Measures of Goal Achievement: (A-2)</p> <ol style="list-style-type: none"> <li>1. Increased quantity and improved nutritional value of grain stored on smallholder farms.</li> <li>2. As a result of FTDU activities an improved grain drying and storage technology has been proven effective, economical and culturally acceptable in Western and Nyanza Provinces.</li> </ol>	<p>(A-3)</p> <ol style="list-style-type: none"> <li>1. Baseline vs end-of-project statistics.</li> <li>2. Same as (1)</li> </ol>	<p>Assumptions for achieving goal targets: (A-4)</p> <ol style="list-style-type: none"> <li>1. Reduced losses of grains to molds, insects and rodents will result in more nutritional and larger quantities of grain for consumption and/or sale.</li> </ol>

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project:  
From FY 81 to FY 85  
Total U.S. Funding  
Date Prepared: AUGUST 15, 1980

Project Title & Number: On-Farm Grain Storage (615-0190)

PAGE 2

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose: (B-1)</p> <p>To increase the use of more effective on-farm grain drying and storage practices in Kenya.</p>	<p>Conditions that will indicate purpose has been achieved: End-of-Project status. (B-2)</p> <p>1. A significant number smallholders in the project area adopt the improved technology.</p> <p>Beneficiaries will:</p> <p>a) harvest crop when it reaches physical maturity</p> <p>b) shell corn immediately after harvest and put kernels in drier until dried to 12-13% moisture content,</p> <p>c) dry all grain crops until they reach 12-13% moisture content,</p> <p>d) sack grain and apply insecticide to grain before storing,</p> <p>e) construct grain cribs and driers,</p> <p>f) make other behavioral changes as necessary to accommodate new technology developed and promoted under the project.</p>	<p>(B-3)</p> <p>1. Test Results from project records.</p> <p>2. Baseline vs end-of project statistics.</p>	<p>Assumptions for achieving purpose: (B-4)</p> <p>Technological packages exist which can be adapted and demonstrated which will prove effective, economical and culturally acceptable in Western Kenya.</p> <p>Delivery systems, including the MOA extension service, can be sufficiently and strengthened to effect widespread use of the technological packages.</p>

AO 100-20 (1-78)  
SUPPLEMENT 1

**PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK**

Life of Project: \_\_\_\_\_  
From FY \_\_\_\_\_ to FY \_\_\_\_\_  
Total U.S. Funding \_\_\_\_\_  
Date Prepared: \_\_\_\_\_

Project Title & Number: \_\_\_\_\_

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)

**PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK**

Life of Project:  
From FY \_\_\_\_\_ to FY \_\_\_\_\_  
Total U.S. Funding \_\_\_\_\_  
Date Prepared: \_\_\_\_\_

Project Title & Number: On-Farm Grain Storage(615-0180)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose:</p>	<p>Conditions that will indicate purpose has been achieved: End of project status.</p> <p>2. Losses of on-farm stored grain are reduced by fifty percent for those small-holders adopting the improved technology.</p> <p>3. As a result of project's Agriculture Education and MOA Extension Service Interventions, Local Extension Agents (LEOs) and Home Economists (HEs) in the Western and Nyanza Provinces are significantly more aware of and better trained in post-harvest storage problems.</p> <p>4. As a result of this project's intervention into the PHSB and Extension Service administrative levels (including creation of the Grain Monitoring Unit), MOA policy and planning with respect to postharvest storage problems is significantly improved.</p>	<p>3. Same as (2)</p> <p>4. Same as (2) plus evaluation of training and performance of LEOs and HEs.</p> <p>5. Independent evaluation of MOA policy formulation and planning in postharvest storage losses.</p>	<p>Assumptions for achieving purpose:</p>

PROJECT DESIGN SUMMARY  
 LOGICAL FRAMEWORK

Life of Project: From FY 81 to FY 85  
 Total U.S. Funding \_\_\_\_\_  
 Date Prepared: AUGUST 15, 1980

Project Title & Number: On-Farm Grain Storage (615-0190)

INDICATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Objective (C-1)</p> <p>1. MOA capacity established to stimulate participation of smallholders in identifying grain drying and storage problems; to conduct field trials necessary to adapt technology to local conditions; and to demonstrate the effectiveness of that technology to smallholders.</p> <p>2. Improved MOA capacity to facilitate adoption of appropriate on-farm grain drying and storage technological packages.</p>	<p>Magnitude of Outputs: (C-2)</p> <p>1. a) Fully staffed, functional and financially supported laboratory and office for Field Trials and Demonstration Unit (FTDU) in Kisumu. Four professionals trained to M.S. level, 2 clerical staff.</p> <p>b) Physical structures completed and equipped including 4 FTDU staff houses and one 10X30 meter laboratory/office building to be shared with the CMU.</p> <p>c) Adequate evidence that an effective information feedback system has been established between the FTDU and the targeted smallholder</p> <p>d) Satisfactory number of field trials and demonstrations are performed.</p> <p>2: a) Fully staffed, functional and financially supported Postharvest and Storage Branch of MOA: 1-Head, 2 PHS officers, 2 clerical staff.</p> <p>b) Two functioning provincial level officers trained to MS. level in Postharvest Drying and Storage Technology with clerical support. Two houses constructed and furnished for Expatriot Advisors.</p> <p>c) Seven District specialists with six months of non-degree training abroad. Necessary clerical support.</p> <p>d) Thirty-seven Divisional specialists having three months non-degree training incountry.</p>	<p>(c-3)</p> <p>1. Project and USAID records. Physical site inspection. Review of FTDU records and MOA financial planning documents.</p> <p>2. Project and USAID training records. Inspection of FTC sites and interviews with PHS and extension employees.</p>	<p>Assumptions for achieving outputs:</p> <p>Land for building construction will be provided by MOA in Kisumu area. GOX salary structure will not operate to discourage professionals from retaining their posts.</p> <p>Satisfactory candidates for training can be identified and will be supported by MOA.</p>

Annex A  
 Exhibit 2 (Cont'd.)  
 Page 3 of 7

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project  
From FY 81 to FY 85  
Total U. S. Funding  
Date Prepared: AUGUST 15, 1981

Project Title & Number: On-Farm Grain Storage (615-0190)

PAGE 3

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Outputs: (C-1)</p> <p>3. Increased capacity of agriculture educational institutions to provide general training in on-farm drying and storage technology.</p>	<p>Magnitude of Outputs: (C-2)</p> <p>(e) Approximately 1,500 LEO/HE in Western and Nyanza Province completed two, two-week basic courses in grain drying and storage.</p> <p>(f) Equipped and functional worksheds at all 6 FTCs in Nyanza and one mobile workshop unit.</p> <p>3. (a) University of Nairobi and Egerton College each supplied with necessary equipment, library materials and supplies to support PHS programs.</p> <p>(b) Embu and Bukura Agriculture Institutes supplied with necessary equipment, library materials and supplies to conduct in-service workshops and courses in PHS. Eight staff members receive six months overseas training in grain drying and storage and participatory methodology.</p>	<p>(C-3)</p> <p>3. Project and USAID financial and training records. Review of educational institutions class offerings and course descriptions.</p>	<p>Assumptions for achieving outputs: (C-4)</p>

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project 81 to FY 85  
From FY 81 to FY 85  
Total U.S. Funding August 15, 1980  
Date Prepared: August 15, 1980

ARD 1220-20 (1-78)  
SUPPLEMENT 1

Project Title & Number: On-Farm Grain Storage (615-0190)

PAGE 3

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Outputs: (C-1)</p> <p>4. To create the capacity of MOA and MOP/CBS to monitor and evaluate the losses of grain stored nationwide.</p> <p>5. A complete report and recommendations on the need for financial assistance to smallholders and a delivery system.</p> <p>6. Written report of Contract Project Team Leader including justification of his recommendations regarding how best to expand this initial effort on a nationwide basis.</p>	<p>Magnitude of Outputs: (C-2)</p> <p>4. Fully operational and financially supported grain testing and analysis laboratory staffed with ten certificate level technicians. Eight hundred enumerators (nationwide) trained in CBS to undertake grain storage surveys. Lab building constructed to share with FTDU.</p> <p>5. Document in form and content satisfactory to USAID Project Manager.</p> <p>6. Same as no. 5</p>	<p>(C-3)</p> <p>4. USAID and project records. Operating reports and financial plan of laboratory.</p> <p>5. Review of document.</p> <p>6. Review of document.</p>	<p>Assumptions for achieving outputs: (C-4)</p>

ANNEX A  
Exhibit 2 (cont.)  
Page 5 of 7

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PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project: 81 to FY 85  
From FY 81 to FY 85  
Total U.S. Funding  
Date Prepared: August 15, 1980

Project Title & Number: On-Farm Grain Storage (615-0190)

PAGE 4

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS		MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)		(D-3)	Assumptions for providing inputs: (D-4)
1. <u>Field Testing and Demonstration Unit (FTDU)</u>	USAID	GOK	1. USAID and Project Financial and Training records.	1. International and internal transportation links to and in Kenya are not severely taxed by the relief efforts in the East Africa area so that inputs are timely. Qualified experts available in U.S. to do short-term consultation at times required.
Technical Assistance S-T consultants Participant Training (Degree) Local Hire Salaries Vehicles, 2LR, 1PU, 1 Trk. Lab and Test Equipment Maize for Testing Test Cribs & Platforms Kit Grants Housing	12 PY 32 PM 8 PY 0 4 List 635 tons 300 10,000 4	Logist, Loc. Hire Logistical Salaries, 1/2Trans. 65 PY Oper. Exp. & Maint. Oper. Exp. & Maint.  Land site prep.	2. USAID and PHSB field trips.	2. Same as (1)
2. <u>Capacity to Transfer Technology.</u>	6 PY 24PM 4 PY 54 PM 111 PM 10 50 700 List 7 7 - -	Logistics Logistical Salaries, 1/2Trans Salaries, 1/2Trans Salaries, Trans. Oper. Exp. & Repaire Oper. Exp. & Repaire Main. Per Diem Main. Supplies Land 27 PY 1525 PM		

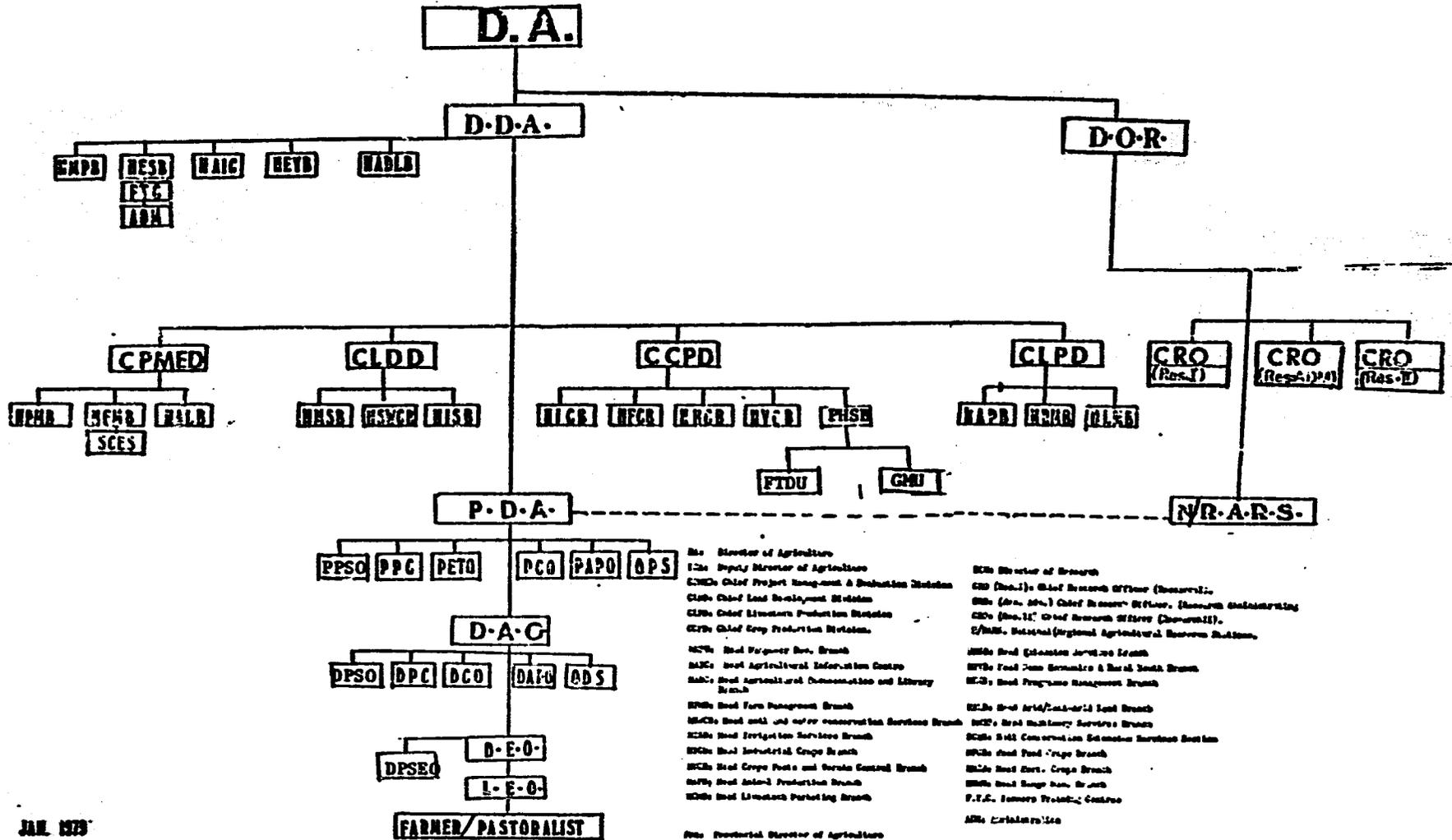
PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project: 81 to FY 85  
From FY \_\_\_\_\_ to FY \_\_\_\_\_  
Total U.S. Funding \_\_\_\_\_  
Date Prepared: August 15, 1980  
PAGE 4

Project Title & Number: ON-Farm Grain Storage (615-0190)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS												
Project Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)												
<p>3. <u>Educational Institutions</u> S-T consultants S-T offshore (non-degree) Teaching aids, AV &amp; Lab. Research Grants Equip.</p>	<table border="0"> <tr> <td>USAID</td> <td>GOK</td> </tr> <tr> <td>8 PM</td> <td>Logistical</td> </tr> <tr> <td>48 PM</td> <td>Salaries, 1/2</td> </tr> <tr> <td>4 Inst.</td> <td>Trans. &amp; Other</td> </tr> <tr> <td>20 PY</td> <td>Admin. tuition, Res.</td> </tr> </table>	USAID	GOK	8 PM	Logistical	48 PM	Salaries, 1/2	4 Inst.	Trans. & Other	20 PY	Admin. tuition, Res.	<p>3. Reports required of FTDU, NAC and other food drying and storage specialists</p>	<p>3. Same as (1).</p>		
USAID	GOK														
8 PM	Logistical														
48 PM	Salaries, 1/2														
4 Inst.	Trans. & Other														
20 PY	Admin. tuition, Res.														
<p>4. <u>Monitoring and Evaluation.</u> Lab/Office Building/10X30M Furniture &amp; Equipment Grain Samples  CBS Enumerators Lab. Technicians Lab. Tech. Training</p>	<table border="0"> <tr> <td>1</td> <td>Land</td> </tr> <tr> <td>List</td> <td>Maint.</td> </tr> <tr> <td>-</td> <td>10,000 of 1 kg. each year.</td> </tr> <tr> <td>-</td> <td>800 part time</td> </tr> <tr> <td>-</td> <td>30 PY</td> </tr> <tr> <td>5 PM</td> <td>Salaries</td> </tr> </table>	1	Land	List	Maint.	-	10,000 of 1 kg. each year.	-	800 part time	-	30 PY	5 PM	Salaries		<p>4. Same as (1)</p>
1	Land														
List	Maint.														
-	10,000 of 1 kg. each year.														
-	800 part time														
-	30 PY														
5 PM	Salaries														
<p>5. <u>Need for Financial Assistance.</u></p>	<p>Included in No. 1 above.</p>		<p>5. Same as (1)</p>												
<p>6. <u>Recommendations for Project Expansion.</u></p>	<p>Included in No. 1 above.</p>		<p>6. Same as (1)</p>												
<p>7. <u>Project Evaluation</u> S-T Consultants</p>	<p>14 PM Support &amp; 14PM</p>		<p>7. Same as (1)</p>												

# ORGANIZATION OF THE DEPARTMENT OF AGRICULTURE



- DA:** Director of Agriculture
- D.D.A.:** Deputy Director of Agriculture
- EMPD:** Chief Project Management & Evaluation Division
- RESB:** Chief Land Development Division
- NAIG:** Chief Livestock Production Division
- REYB:** Chief Crop Production Division
- NADLB:** Chief Forest Management Branch
- EYB:** Chief Extension Services Branch
- ARB:** Chief Agricultural Information Centre
- CPMED:** Chief Livestock Production Division
- WPHB:** Chief Livestock Production Branch
- MCHB:** Chief Livestock Production Branch
- HALB:** Chief Livestock Production Branch
- SCES:** Chief Livestock Production Branch
- CLDD:** Chief Livestock Production Division
- NRSR:** Chief Livestock Production Branch
- NRYCR:** Chief Livestock Production Branch
- NISR:** Chief Livestock Production Branch
- CCPD:** Chief Crop Production Division
- NIGR:** Chief Crop Production Branch
- NRCR:** Chief Crop Production Branch
- NRCR2:** Chief Crop Production Branch
- NYCR:** Chief Crop Production Branch
- PHSB:** Chief Crop Production Branch
- FTDU:** Field Trials & Demonstration Unit
- GMU:** Grain Monitoring Unit
- CLPD:** Chief Livestock Production Division
- NADP:** Chief Livestock Production Branch
- NMBR:** Chief Livestock Production Branch
- NLRB:** Chief Livestock Production Branch
- D.O.R.:** Director of Research
- CRO (Res.):** Chief Research Officer (Research)
- CRO (Res.):** Chief Research Officer (Research)
- CRO (Res.):** Chief Research Officer (Research)
- N/R.A.R.S.:** National/Regional Agricultural Research Station
- P.D.A.:** Provincial Director of Agriculture
- PPSO:** Provincial Program Co-ordinator
- PPG:** Provincial Program Co-ordinator
- PETO:** Provincial Extension Officer
- PCO:** Provincial Crop Officer
- PAPO:** Provincial Agricultural Officer
- OPS:** Other Provincial Specialists
- D.A.G.:** District Agricultural Officer
- DPSO:** District Post-Harvest & Storage Officer
- DPC:** District Crop Officer
- DCO:** District Livestock Officer
- DAFU:** District Agricultural Information Centre
- ODS:** District Livestock Production Officer
- D.E.O.:** District Extension Officer
- L.E.O.:** Livestock Extension Officer
- FARMER/PASTORALIST:** Farmer/Pastoralist

JAN. 1979

ANNEX A  
Public

Education and Training Summary

Education and training are an essential element in this project's attempt to increase the use of more effective on-farm grain drying and storage in Kenya. Under this project some persons will obtain the knowledge and skills necessary to assume newly created positions relative to post-harvest storage losses; some will receive general training about postharvest storage losses and communication methodology so they can, in turn, teach others; and some will receive the information and instruction necessary to actually implement improved grain storage technology.

The following tables summarize training proposed under the project:

Long Term - Overseas Training in U.S.A.

Organization/Level trainee returns to	Number of trainees	Level and type of training	Duration
EFTDU	1	M.S., Ag. Eng	2 years
FTDU	1	M.S., Ag. Econ	2 "
FTDU	1	M.S., Stored Grain Prod.	2 "
FTDU	1	M.S., Extension	2 "
Provincial Extension	1	M.S., Extension	2 "
Provincial Extension	1	M.S., Extension	2 "
	<u>6</u>		<u>12 PY</u>

Short term - Overseas Training in U.S.A. Food and Feed  
Grain Institutes or England (Tropical Products Institute) (1)

<u>Organization/level training returns to</u>	<u>Number of trainees</u>	<u>Level and type of training</u>	<u>Duration</u>
District Extension	7	non-degree grain storage practices	6 mo. ea.
PHSB	2	non-degree grain storage practices	6 mo. ea.
Embu Institute	4	non-degree grain storage practices	6 mo. ea.
Bukura Institute	4	non-degree, grain storage practices	6 mo. ea.

Short term - In Country Training

<u>Organization/level training returns to</u>	<u>Number of trainees</u>	<u>Level and type of training</u>	<u>Duration</u>
GMU	10	non-degree, lab skills and OJT by FTDU	OJT 2 yrs each
Divisional Extension	37	non-degree, post- harvest storage by TPI in Kenya <u>1/</u>	3 months each
Local Extension	1,500	non-degree, post- harvest storage,	total of 1 month each
FTCs	25	non-degree, post- harvest storage	total of 1 month each
	<u>1,572</u>		<u>1,641 PM (2)</u>

1/ It is planned to utilize TPIs training services for incountry training of the MOA's field extension staff. For detailed information on TPIs incountry training program refer to Annex A, Exhibit 4, Page 7.

Farmer Training (3)

<u>Number of smallholder Units</u>	<u>Type of Training</u>	<u>Duration</u>
12,824	field courses with partial grant	2-4 days each
2,175	FTC courses with partial grant	2-4 days each
8,049	FTC courses without partial grant	2-4 days each
<u>23,048</u>		<u>NA</u>

In addition to the above described project funded training, there are also grain storage related training slots available under another USAID project, Agricultural Systems Support. The USAID/Kenya Agriculture Division will work with MOA to determine whether or not the slots can be effectively utilized to support the On-Farm Grain Storage Project.

- Note: (1) See pages 5-8 of this Exhibit for description of TPI training capabilities
- (2) Excluding OJT
- (3) Refer to Annex D, Exhibit 5 for assumed adoption rates.

TROPICAL PRODUCTS INSTITUTE (TPI)  
STORAGE DEPARTMENT  
(TROPICAL STORED PRODUCTS CENTRE)  
London Road  
Slough, Berks SL3 7HL  
Telephone: Slough 34626

The TROPICAL PRODUCTS INSTITUTE is a scientific unit of the UK Overseas Development Administration and is financed from British aid funds. Its function is to cooperate with developing countries in deriving greater benefit from their plant and animal resources, principally by dealing with the scientific, technical and economic problems that arise after harvest. It has a staff of 380 of whom almost half are qualified scientists, engineers and economists.

The TROPICAL STORED PRODUCTS CENTRE (TSPC) is the Storage Department of TPI. It deals with the post-harvest problems of durable agricultural produce - for example the effects of pest infestation and of different methods of harvesting, threshing, drying, storage, packaging and transportation on produce quality. It is situated 22 miles west of London, on the same site as the Slough Laboratory, Agricultural Science Service, Ministry of Agriculture, Fisheries and Food (formerly the Pest Infestation Control Laboratory).

TSPC's staff are deployed in two ways. One group is mainly employed in developing countries on long-term assignments for up to several years' duration. The other group, based in Britain, carries out advisory, training or investigatory work, though these officers also go overseas on shorter assignments.

The PEST BIOLOGY AND INSPECTION SECTION aims to improve the efficiency of pest control practices through the application of knowledge of the biology of insects and mites in the storage environment. This is achieved through the development of appropriate infestation detection and assessment techniques, and evolving biological components of integrated pest control programmes. One major aspect of the current research programme is the cooperation with international plant breeding institutes on studies of the susceptibility of different varieties of certain cereals and grain legumes to pest attack in order to develop varieties with pest resistance. The Section is also concerned with broader aspects of inspection: including sampling techniques, quality determination in good grains, the monitoring of grain handling and storage practices, phytosanitation, certification and reporting procedures. Routine services offered by the Section to enquirers from developing countries include: the accurate identification of insects and mites found in association with stored produce; the assessment of post-harvest susceptibility of varieties of certain food grains to insect infestation; and advising on inspection methodology.

The CHEMICAL CONTROL SECTION is concerned with all aspects of the use and effectiveness of insecticides and fumigants for pest control in storage, and provides advisory and training services at home and overseas. Research and development work includes screening trials of insecticides and fumigants against a wide range of pests of cereals, grain legumes, groundnuts, dried fish and other commodities; the techniques of insecticide and fumigant application; persistence of insecticides on wall and bag surfaces; analysis of fumigants and insecticides in field trials: resistance to pesticides and alternatives to pesticides, including traditional methods. The Section plays a leading international role in the study of post-harvest losses and the development of methods for loss assessment, and assists countries to initiate and develop loss assessment programmes.

The STORAGE ENGINEERING SECTION is concerned with the hardware used in the storage of produce and with physical factors such as moisture and temperature and their relation to the storage of durable commodities. Advisory and research work covers the structures and handling methods appropriate to all levels of operation, from the subsistence farmer to the large central storage agency. The design of warehouses for the storage of bagged produce is considered in relation to the need to create a physical environment which maintains product quality and minimises pest development while facilitating efficient management. Silos and other bulk storage systems are similarly considered where appropriate. With both classes of structure advice on associated commercial drying and handling plant is given and system design is undertaken. In physical factors' work particular attention is paid to the evaluation of commercial moisture meters for measurement of produce moisture content and to the determination of moisture sorption isotherms of commodities from which the optimum storage conditions can be determined. The monitoring of conditions inside large masses of bulk or bagged grain is also being undertaken, in order to increase understanding of the changes occurring during long-term storage. Most overseas work is short-term and includes many consultancy visits on the design and operation of storage installations. In conjunction with the Marketing & Industrial Economics Department of the Institute, advice is given on planning requirements for major storage facilities.

The PACKAGING sub-section is concerned with the use of packaging both for durable produce and, in collaboration with other Departments of TPI, for perishable produce and processed foods. Advice is given on packaging materials and machinery; material testing and the assessment of package performance, in the laboratory or the field, can be undertaken.

The STORAGE TRAINING AND INFORMATION SECTION is responsible for the collation and dissemination of information on the storage and handling of durable agricultural produce. Its technical index provides the basis for the Centre's advisory service. The Section produces two regular publications, Tropical Stored Products Information twice a year, and Tropical Storage Abstracts, bi-monthly. These are both provided free of charge to official bodies in developing countries.

The other major responsibility of the Section is the planning and, with the assistance of other Sections, implementation of the Centre's training programme. The primary element of this programme is the 3-month 'Course in the Storage of Durable Agricultural Products in the Tropics' which is given twice each year at Slough for officers nominated by overseas governments. The Centre also collaborates with the National College of Agricultural Engineering and other colleges and universities in providing inputs to relevant MSc courses and arrange courses in overseas countries under Technical Cooperation arrangements. The Centre is the consultant body to the World Food Programme on storage and provides technical advice and training to the Programme's Advisers and Project Officers as required.

#### OVERSEAS OFFICERS SECTION

The duties undertaken by staff working overseas are varied. Commonly they include a programme of estimating storage losses and the development of appropriate methods of reducing them, the carrying out of research to develop and assess the suitability of improved techniques for maintaining the quality of produce in store and to introduce improved methods and systems of storage and pest control. These duties involve advisory and extension work and the formal and informal training of local personnel and counterparts. During the period 1970-80 the Section has undertaken 24 long-term assignments (most of 2 years or longer) for the governments of Bangladesh, Ethiopia, Gambia, Ghana, Indonesia, Jamaica, Kenya, Lesotho, Malawi, Mali, Nepal, Nicaragua, Swaziland, Uganda and Zambia.

**OVERSEAS COURSES IN THE STORAGE OF GRAIN AND OTHER DURABLE  
AGRICULTURAL PRODUCTS IN THE TROPICS.**

**Duration:** 3 - 6 weeks

**Closing date for receipt of nomination :** 3 months before course starting date.

**Location:** At an agricultural training centre or similar site in the recipient country.

**Entrance qualifications:** The qualifications of participants will depend on the needs of the country concerned. Courses may be held for participants ranging in qualifications from agricultural certificate holders to post-graduates in agriculture, entomology, chemistry, biology or engineering, who are or will be concerned with the investigation, implementation or extension of storage and allied techniques.

**Programme:** During the 3 - 6 week period one or more courses may be held for different groups of personnel according to demand. Courses may be of a general introductory nature, or deal with specific topics at a deeper level. Sometimes it will be appropriate to hold a short seminar for senior staff followed by a more detailed practical course for operators.

Topics which can be covered, and from which each programme will be made up, include the following :-

- Storage losses, factors affecting storage.
- The importance of relative humidity, moisture content and temperature (and their measurement).
- Climate and storage.
- Drying.
- Stored products entomology/insect identification.
- Rodent biology and control.
- Microorganisms/mycotoxins.
- Inspection and sampling techniques.
- Infestation control (non-chemical; chemical; insecticides; fumigants)
- Warehouse design and bag storage.
- Bulk storage.
- Good storage practice.
- Legislation and grading, quality standards.
- Packaging.
- Storage extension.

**Course fees:** As the courses are held in the recipient country the only charges would be for the return passages, freight of equipment and subsistence of two officers from the Tropical Stored Products Centre, Slough, England. Such costs would normally be paid from UK Technical Assistance funds following a successful request to the ODM. All other transport and accommodation costs for trainees would be borne by the local government. If non-government or quasi-government students were included on a course it would be for the local government to raise appropriate charges with those organisations where appropriate.

**Number of trainees:** Not more than 25.

**Accommodation:** Trainee accommodation is entirely dependent on the local government.

**General  
information:**

These courses represent an expansion of those already offered by the TSPC and endeavour to provide largely for cadres which would not normally be sent abroad for training. A main feature is that each course can be tailor-made to suit the exact requirements of the country concerned. For this reason it is essential that at least one fully experienced training officer be provided for the duration of the course(s) by the local government; and preferably for necessary follow-up work too. Courses will be essentially of a practical nature, involve maximum student participation, and include visits, discussions and if necessary teaching practice. A test may be held and a certificate awarded where appropriate.

It is essential to allow for a short visit to a requesting country by an officer from the TSPC approximately 10 - 12 weeks before the course is due to start, to assist with preparation and local organisational matters.

## RESEARCH GRANTS PROGRAM

### Research Grants for Postharvest Grain Loss Reduction

The research program suggested is of the applied type, aimed at solving practical problems important in Kenya. The focus of the research effort is to investigate practical means of reducing grain losses. Research grants are to be awarded for short-term research suitable for Master of Science candidates at the University of Nairobi. One requirement of all research grants will be mandatory publication of all research results. Also, copies of published results will be forwarded to AID/W, DS/AGR/AP so that results can be included in a Postharvest Documentation Service established and monitored by DS/AGR.

It will be necessary for the Contractor's Project Coordinator (Team Leader), with the assistance of the Kenyan institutions involved and the Postharvest Storage Branch (PHSB) interested in and willing to research the topics presented below and to approve grant programs. The topics presented below as an illustrative list are practical and deserve immediate attention. During the progress of research other topics may be identified for future or follow-up projects, however, the topics presented warrant prompt research activity and could make important contributions to the overall project. As the results of research findings become available, the Project Coordinator will arrange possible field trials with the Head of the PHSB. Positive results shown to be economical and practical for smallholders will become part of the extension and training efforts.

#### Proposed Research Topics Short-Term Research Areas

1. The use of Neem seeds (*Azadirachta indica*), (family Meliaceae) will be investigated as a deterrent for stored grain insect pests in Kenya. The tree now grows abundantly in the Mombasa area and is being promoted by the Forestry Division, MOA for planting as a fuel or firewood tree in other areas of Kenya. The tree is also planted for ornamental purposes, the leaves are reported good for use when smoking fish (possible correlation to project listed below which examines research on smoking grain), and the bark and leaves are reported to be a local cure for diarrhea. Research will focus on effectiveness of seeds or ground seeds upon stored grain insects and their feeding behaviour. It will also investigate dosage levels necessary to achieve protection for maize, the cost of such protection, and appropriate application procedures. Investigation may involve extraction of the active ingredient or oil from the seeds, as well as combination with other natural products under investigation as listed below.

2. The use of diatomite and pumice (blue) as insecticides for protection of stored grains will be investigated: (a) in combinations of different grades; (b) in combinations with other natural potential grain protectants such as pyrethrum or neem seeds; (c) at various dosage levels to achieve protection of maize; and (d) with various application procedures which give the best results. Investigations may involve removal procedures prior to grain consumption and reuse of compounds for cost reduction.

3. Research will be conducted on the effectiveness of ashes when used as insecticides for stored grain and beans. Different wood species, bean stalks, and rice hulls will be investigated for their effectiveness. Neem bark and leaf ash may also be included. Application rates and procedures (sometimes done by hand coating moistened bean seeds) for grain and beans will be investigated for recommended procedures

4. Research on attractants for the various species of stored product pests and the use of attractants (baits) combined with chemosterilants will be investigated. Coordination with ICIPE may be necessary to locate and procure compounds for investigation. Although this project is designed for research at the Zoology-entomology department at the University of Nairobi the Project Coordinator in collaboration with the Head of the Postharvest Storage Section, MOA and faculty of the University of Nairobi may consider ICIPE as an alternative site for this work as a result of the facilities and special expertise available at ICIPE.

5. The entomological aspects of small volume air-tight (hermetic) storage and/or underground storage of grain and beans suitable for storage of farm-size lots will be investigated. The development of molds, insects, toxins, and other grain pathogens; moisture translocation; container effects such as closures and possible internal coatings; and the effects of these variables upon weight and quality losses of stored grains and beans will be studied. Possible storage containers will include concrete, mud, and pottery jars, metal drums, sealed treated gourds, and underground pits. This work will have close association with No. 6 described below.

6. The agricultural engineering aspects of small volume air-tight (hermetic) storage of grain and beans as described in No. 5 above will be investigated. This project will focus on measurement of O<sub>2</sub> and CO<sub>2</sub> levels during storage, suitability of vessels and cost, ease of hermetic closure, preparation and sealing of containers, and other design features which will lead to appropriate air-tight storage containers suitable for use in Kenya by small holders.

7. Research will be conducted on direct-fired grain dryers in comparison to results of traditional methods and the sun drying platform method described earlier in this project. Design, cost, efficiency, operating procedures, fuel use, and potential application (small farmer versus village level operation) will be a part of the investigation. Research workers will want to coordinate efforts with No. 8 listed below and possibly with some of the natural products listed for investigation in No. 1, 2, and 3 above.

8. Research will be conducted on the effect of smoking, i.e., husked on ear and shelled, and unhusked and on grain during the drying process. Aspects relating to the effect of smoking on insect protection in stored grain, agricultural engineering aspects of smoking procedures, and milling quality of treated grain will be investigated. Effect of smoking on mold inhibition will be an equally important aspect of the research on smoking grain. The use of neem leaves, and various tree species for smoke production will be part of the variables investigated. This area will require close cooperation between the zoology - entomology and mycology aspects of the research and the minor aspects of agricultural engineering required to investigate construction of adequate smoking procedures or devices. The smoke delivery system or method may result from project No. 7 described above or the research worker may decide to build a simple smoker or devise an appropriate smoking procedure. The emphasis of this project is the (1) effect of smoke on insects common in stored grain and (2) growth of mold particularly Aspergillus flavus which produces aflatoxin.

9. This project will coordinate with No. 8 above and will focus on the palatability and nutritional and toxicological aspects of smoked grain. Variables may include the variety of smoke sources such as neem bark, leaves, or various tree species and densities of smoke. Taste tests will evaluate palatability, while animal feeding trials will compare untreated grain to smoked grain for nutritional and/or toxicological tests. More sophisticated toxicological examinations may be included if suggested by the faculty advisor.

10. Research on the cooking and nutritional/toxicological aspects of synthetic insecticide treated grains and beans will be conducted. Commonly used insecticides such as Malathion or actellic will be investigated in relation to their palatability and acceptance. Variables may include time from treatment with the insecticide at recommended dosage levels, and methods to reduce negative acceptance of the treated

products.

Summary: Short-Term Grants to Master of Science Candidates

Research leading to the award of 10 Masters degrees is to be grant-funded at the University of Nairobi. Such grants will be given for topics that can be adequately researched and written up in two years time. It is proposed to grant-fund the entire cost of the 10 students for a 2-year period, including tuition, books, subsistence, and research materials. The research is to be done by Kenyan citizens resident in Kenya and to be supervised by permanent Kenyan faculty members. The topics, University departments involved, and number of students are as follows:

<u>Thesis Topic</u>	<u>Department</u>	<u>Number of Students/thesis</u>
1) Use of neem seeds as insecticides in stored grain	Zoology-entomology	1
2) Use of diatomite and blue pumice as insecticides.	Zoology-entomology	1
3) Effectiveness of ashes as insecticides	Zoology-entomology	1
4) Attractants and chemosterilants for stored product pests.	Zoology-entomology	1
5) Small volume air-tight storage: entomological aspects	Zoology-entomology	1
6) Small volume air-tight storage: agricultural engineering aspects.	Agricultural Engineering	1
7) Direct-fired grain dryers, (Student will want to liaise with personnel doing related work at Embu/Bukura Institutes).	Agricultural Engineering	1
8) Effect of smoking grain: agricultural engineering aspects.	Zoology Agricultural Engineering	1
9) Effect of smoking grain: nutritional aspects	Food Technology	1
10) Cooking, palatability, and nutritional quality of treated grain, including smoking, natural and synthetic anti-insect products.	Food technology	1

TECHNICAL ASSISTANCE PLAN

Long-Term

The long-term Technical Assistance (TA) input into this project is designed to provide the specialized expertise necessary to initiate project activities and to provide the on-the-job training for returning participants which will enable MOA personnel to continue those activities. Language training and cultural orientation will be provided for each technician. The MOA does not now have the capability that will be provided by long-term TA. In summary the project will provide:

<u>Title</u>	<u>Length of Contract</u>
<u>FTDU</u>	
Grain Storage & Drying Specialist/Contractor's Project Coordinator (CPC)	4 years
Mycologist/Entomologist	3 years
Extensionist/Non-formal Educationist	3 years
Social Economist	2 years
<u>Provincial Agricultural Officers</u>	
Extension Specialist	3 years
Extension Specialist	3 years
	<hr/> <u>18 PY</u> <hr/>

The general activities of each individual technician and the approximate implementation sequence of their activities are discussed in the Detailed Project Description and the Implementation Plan. Briefly, the CPC will arrive in Kenya about August 1981. Initial responsibilities will be to assist the Postharvest Storage Branch (PHSB) in facilitating and coordinating requirements for technical assistance, construction procurement and participant training. The CPC will initially act as advisor to the PHSB and will also help initiate and suggest ways to maintain communication linkages required for project success.

The remainder of the FTDU team ( Extensionist, Entomologist, and Social-Economist) will begin their language lessons in the U.S. about

January 1982. Due to housing and laboratory construction constraints, it will be necessary for the technicians to arrive alone and then be joined by their families approximately three months later. It may be possible, however, for the technicians to return to the U.S. to travel to Kenya with their families once physical facilities are completed. The Social Economist on the FTDU team will complete his/her tour of assignment on or about January 1984 and, with the exception of the Project Coordinator, the remaining members of the FTDU team will complete their tour of assignment on or about January 1985. The Project Coordinator will depart approximately July 1985.

The two Extension Specialists will begin language training in July 1982 and will arrive (with families) in country late October 1982. After the completion of incountry cultural training and orientation they will help analyze baseline survey results and assume their job responsibilities.

Suggested Job Qualifications and Job Descriptions for each technician are as follows:

Grain Drying and Storage/Contractor's Project Coordinator.

A. Tour of Assignment.

4 years

B. Job Qualifications.

1. Have extensive administrative experience in grain drying and storage and/or grain storage extension programs or other equivalent experience.
2. Have experience working and living in a LDC preferable assigned to a project working with smallscale farmers dealing with cereal grain storage or extension enhancement.
3. Have a minimum of a Masters degree majoring in Postharvest Grain Storage or Extension Systems.
4. Experience in Grain handling systems, grain inspection or seed testing, phytosanitation, recommended grain storage practices, and grain storage extension.
5. Experience in stored products entomology, rodent biology, mycotoxin inspection methods, infestation control (non-chemical, insecticides and fumigants).

6. Experience in designing and construction of solar and/or natural air grain drying systems.

C. Job Description

1. Serves as Contractor's Project Coordinator (CPC) representing the contractor in all administrative matters including the establishment and maintenance of close liaison with the USAID/Kenya and Government of Kenya Project Managers and supervision of all long-term and short-term consultants.

2. Serves as initial facilitator and coordinator for all project activities including technical assistance, procurement, construction and selection of participant trainees.

3. Serves as advisor to the Head of Postharvest Storage Branch (PHSB) of the Ministry of Agriculture and assists him in the organization, initiation and enhancement of PHSB activities.

4. Throughout his tour ensures that the collaboration and coordination required among all elements of the project are initiated and maintained by expatriot technicians and their counterparts. Also investigates possible linkages with required and national research activities in Kenya.

5. Serves as leader for the FTDU component and participates in the overall evaluation and approval of technological packages to be recommended by the FTDU for demonstration.

6. Participates in the selection of Postharvest Officers that are to receive offshore training and determines that their terms of employment are sufficient as required by the project.

7. Participates in the selection of training programs, universities and study tours for all project participants funded under the project.

8. Has administrative and custodial responsibility for all U.S. Dollar expenditures and ensures that appropriate records are maintained.

9. Participates in coordinating and conducting courses in Grain Drying and Storage.

10. In cooperation with the PHSB approves all University of Nairobi Student Research Grants.

11. Provides on-the-job training to Kenyan national who will eventually replace him.

12. Submits an annual report which details the successes of the project, including results of the FTDU and GMU, problems encountered in project implementation, potential solutions to problems and a general "Plan of Work" for the project during the upcoming year. These reports will be submitted to the MOA, AID Mission and:

- a. D.S. Agriculture Postharvest Loss Specialist, AID/W
- b. Service Coordinator postharvest documentation service Food and Feed Grain Institute, Kansas State University.
- c. GASGA-Secretariat, Tropical Products Institute, Slough, England
- d. Document and Information Unit, AID/W.

13. Coordinates and participates in developing a potential program with Peace Corps utilizing volunteers in training targeted farmers.

14. Prepare a final written report, in format and content acceptable to the USAID/Kenya Project Manager, regarding the worth of the project and its potential for nationwide expansion. Includes recommendations regarding the organization, location and operation of the Field Trials and Demonstration Unit and the Grain Monitoring Unit.

Mycologist/Entomologist (Postharvest Pest Mgmt. Specialist).

A. Tour of Assignment

3 years

B. Job Qualifications.

1. Must have competency in laboratory analysis, survey design, and statistical analysis.
2. Experience in mycology and mold identification highly desirable.
3. Must have experience in some area of laboratory and chemical analysis of food commodities plus supervisory experience over laboratory technicians.
4. Limited exposure to entomological taxonomy or insect identification would be helpful.
5. Background in training laboratory personnel in routine analyses and laboratory administration is preferable.
6. Former experience in working in a LDC is required.
7. A minimum of a Masters degree is required.

C. Job Description

1. Reports to the Contractor's Project Coordinator (CPC) and designs a program to monitor test units.
2. Directs the organization, design and operation of the Grain Monitoring Unit (GMU) for on-farm grain storage. Estimation of grain losses will be based upon the Harris and Lindblad manual accepted by AID, FAO, TIP, and GASGA.
3. Review and approve all grain laboratory equipment being purchased by the project.
4. Design and implement an inservice training program for GMU grain laboratory technicians.
5. Participate in the design and performance of adaptive research on various chemical and non-chemical controls of insects in stored grain. Prepares risk/benefit analyses for each pesticide to be used in the project in accordance with AID regulations and obtains required AID/W approvals.
6. Assist as requested in the Research Grant Program and other project related activities as directed by the CPC.
7. Provide effective on-the-job training to Kenyan counterpart who will replace him upon termination of the contract.

Extension/Non-Formal Education.

A. Tour of Assignment

3 years

B. Job Qualifications.

1. Must have a minimum of two years experience in adopting extension programs to local conditions in a developing country. Extensive field experience in grain storage extension and programs as well as knowledge of Swahili is preferred.
2. Experience in non-formal education utilizing the participatory (facilitator) discussion approach would be desirable.
3. Must possess a minimum of a Masters degree in Extension or non-formal Education.

C. Job Description.

1. Responsible to the Contractor's Project Coordinator (CPC) and participates in the overall FTDU adaptive activities and demonstrations to develop and pre-test modules for transferring packages of grain drying and storage technology to the small grain farmer.

2. Participates in the designing, field testing and evaluation of various extension delivery methodologies to determine which are most effective for reaching the targeted small grain farmer in Kenya.

3. Participate in the final selection of technological packages and extension methodologies to be expanded and the preparation of full documentation for such packages.

4. Supervise preparation of audio-visual and mass communication aids and materials in coordination with short-term consultants.

5. Design and initiate training courses for extension personnel at various levels in the participatory dialogue and other appropriate extension communication methodologies.

6. Provide effective on-the-job training of a Kenyan counterpart.

7. Perform such other project related activities as required by the CPC.

Social Economist.

A. Tour of Assignment

2 years

B. Job Qualifications

1. Minimum of two years experience conducting rural household studies in Africa. Minimum of two years working with rural technical systems in Africa.

2. Demonstrated abilities in designing and implementing questionnaires and qualitative studies. Substantial experience with sampling procedures, report writing, supervision, and in working with governmental bodies and rural populations.

3. Ph.D. in agricultural economics, economic anthropology, a clearly related field.

C. Job Description

1. Reports directly to the Contractor's Project Coordinator (CPC) and is responsible for establishing an information system; overseeing collection and analysis of data; selection of methodologies and training of field assistants. The information system will include

a baseline survey and monitoring of participatory sessions, trials and demonstrations. The recommendations of the anthropologist will be used as a guide to key issues and topics to be addressed by the information system.

2. Evaluates in sociological and economical terms all proposed grain drying and storage units as well as proposed procedures in technological packages developed by the FTDU. Taking into consideration recommendations of the anthropologist, established procedure for selection of farmers to receive Kit Grants.

3. Participate in the final selection of proven technological packages developed at the FTDU and in the preparation of full documentation for such packages.

4. Assist the CPC in developing a plan to fund 700 bicycles and 50 motorcycles to enhance the mobility of the extension service as defined in the project paper.

5. Participates in the mid-project evaluation which is tentatively scheduled for the second quarter of calendar year 1983.

6. Prepare final report, in format and content acceptable to USAID/Kenya Project Manager, and which addresses the need for financial assistance in postharvest storage activities and possible delivery systems. (A copy of all data collected must be left with the FTDU.)

Provincial Extension Specialist.

A. Tour of Assignment.

3 years

B. Job Qualifications

1. Must have extensive experience in evaluating developing and implementing large scale extension programs, including in-service training components.

2. Must possess extensive knowledge in extension methodology.

3. Must have capabilities to develop, administer and instruct inservice training programs for MOA Postharvest Officers.

4. A minimum of a Master's Degree in the field of Extension is required.

5. Must have experience working with extension programs in a LDC in an administrative capacity.

C. Job Description.

1. Assigned as the Provincial Postharvest Officer working in either the Western or the Nyanza Provincial areas reporting directly to the Provincial Director of Agriculture (PDA) for the Government of Kenya but subject to professional guidance from the Contractor's Project Coordinator (CPC).
2. Participates in the review of existing methods and techniques utilized by the MOA to extend new technology to farmers.
3. Participates in the development and implementation of a workable concept for inservice training of MOA field extension personnel to enhance the transfer of locally adapted technology to the project's targeted smallscale grain farmer through both traditional and experimental participatory means.
4. Participates in the planning and conducting of short inservice training programs and workshops for postharvest Officers involved in the transfer of technology and the development of required extension communication skills.
5. Functions as the key Provincial liaison position for and actively promotes communications with Postharvest Storage Branch (PHSB), CPC, Field Trial and Demonstrations Unit (FTDU) and the various agriculture educational institutions concerned with the project.
6. Directs the planning, management and operation of the District, Divisional and local level Postharvest Officers' activities within the targeted Provincial areas.
7. Participates in developing methodology for evaluating the effectiveness of alternative extension programs aimed at the small-scale grain farmer.
8. Performs such other project related activities as required by the CPC and authorized by the PDA.

Short-Term.

Long-term consultants will be assisted in the implementation of this project by the timely input of short-term consultants and one medium-term anthropologist contracted to perform specialized tasks or provided needed expertise. Actual requirements, of course, will be determined by the CPC and PHSB as the project unfolds and specific needs are identified. At this time it is expected that short-term consultancy requirements may be as follows:

Person Months by Project Year

	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
<b>1. <u>FTDU and GMU</u></b>						
a. Baseline survey specialist	2	-	-	-	-	2
b. Computer Programmer	3	-	-	-	-	3
c. Participatory discussion specialist	1	2	-	-	-	3
d. Extension communications specialist	2	3	1	-	-	6
e. Aflatoxin specialist	3	-	1	-	-	4
f. Grain Storage Specialists		2	2	-	-	4
g. Social-Economist	-	-	-	-	1	1
h. Entomologist Insecticide specialist	-	2	2	-	-	4
i. Extension Program Specialist	3	1	1	-	-	5
<b>Total</b>	<b>14</b>	<b>10</b>	<b>7</b>	<b>0</b>	<b>1</b>	<b>32</b>

**2. Extension**

a. Teaching aids specialists	-	2	2	1	-	5
b. Mass Communication specialists	-	2	2	-	-	4
c. Inservice Training Specialist	1	5	2	-	-	8
d. Graphic arts specialist	1	2	2	-	-	5
e. Social-Economist	-	-	-	-	2	2
<b>Total</b>	<b>2</b>	<b>11</b>	<b>8</b>	<b>1</b>	<b>2</b>	<b>24</b>

Person Months by Project Year

	1st Year	2nd Year	3rd Year	4th Year	5th Year	Total
<b>3. <u>Agriculture Education Institute Enhancement.</u></b>						
a. Curriculum Development Specialists	-	2	-	-	-	2
b. Extension Methodology Specialists	-	2	1	-	-	3
c. Agriculture Engineer	-	2	-	-	-	2
d. Grain Storage Specialist	-	1	-	-	-	1
<b>Total</b>	<b>0</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>8</b>
<b>4. <u>Project Evaluation</u></b>						
a. Evaluators			6		8	14
<b>Total</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>8</b>	<b>14</b>

It is planned that some of the above funds reserved for the FTDU and GMU (32 PM @ \$15,000/mo.) will be utilized to finance an anthropologist to conduct a study as discussed in the following job description. Although the contract term for this individual would be approximately 15 months the total cost would reduce the total short-term consulting person months by about 5 PM. Because it may not be possible to find the type of individual required the illustration chart under No. 1. above has not been altered but, utilization of such an individual would greatly enhance the FTDU's opportunity for success. The job description for the anthropologist is as follows:

Anthropologist.

A. Contract Period.

15 months

B. Job Qualifications.

1. Must have completed all course work for a Ph.D. in anthropology or a closely related discipline.
2. Must have two years prior research field experience in rural Africa.
3. Must be fluent in Swahili.
4. Must be willing to live in a rural area of Western Kenya.
5. Will be selected from competitive job application which shall include a curriculum vita, references, a copy of any published materials relevant to the proposed study and a research proposal for the required study. The proposal must cover the proposed overall research framework, the specific methodology, proposal for data collection, analysis, and site selection; and a clear statement of the preliminary hypotheses.

C. Job Description.

1. Conduct a study to identify the options, constraints and decision making process of postharvest grain practices among families living in at least three different ecological and cultural areas of Western and Nyanza Provinces of Kenya. Focus of study will be on families producing less than 22 bags of grain annually.
2. Identify entry points where promotion of changes in current practices may be the most feasible and effective.
3. Assist in development of a project based information system including the identification of issues and variables to be addressed in a baseline and follow-on studies, and recommend most appropriate methodologies and specific sites.
4. Recommend criteria and procedures for households to be prime participants in project activities, e.g., those to receive "Kit Grants".
5. Recommend appropriate extension strategies.

6. Submit mid-term and final reports on findings and recommendations to the MOA Postharvest Storage Branch and USAID/Kenya in form and content satisfactory to USAID. Present a seminar at the end of the contract period to MOA and project personnel.

7. Leave copies of all data collected with the FTDU before final payment will be made under the contract.

CONTRACTOR'S SCOPE OF WORK (SOW)

Detailed Contractor's SOW is being prepared by the Agriculture Division of USAID/Kenya in consultation with the Regional Contracts Advisor of REDSU/EA. By the time the Loan Agreement is signed the SOW will have been finalized and approved by GOK and USAID/Kenya

## Exhibit 7

## OVERALL PROJECT IMPLEMENTATION TRACK

<u>Task</u>	<u>Elapsed Time</u> (in months)	<u>Responsibility</u>
1. grant agreement signed	1	USAID/K, USAID/W, GOK
2. general CP's met	4	USAID/K, MOA
3. project evaluation by three persons for two months	38	USAID/K, MOA, AID/W, HCC
4. final project eva- luation by four persons for two months	58	USAID/K, MOA, AID/W, HCC

EXHIBIT 7 (cont.)

HOST COUNTRY CONTRACT TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. scope of work approved by AID	1	USAID/K
2. scope of work approved by MOA	2	MOA
3. request for proposal (REP) sent to AID/W	3	USAID/K
4. CBD notice published	4	AID/W
5. proposals received	7	USAID/K, prospective HCC's
6. proposals evaluated, selection and approval by USAID and MOA completed	8	USAID/K, MOA
7. contract negotiations begin	9	MOA/HCC
8. contract approved and signed	10	MOA, HCC, USAID/K
9. team leader arrives incountry (see separate implementation track for team leader)	12	HCC
10. FTDU team begins language training in U.S.	17	HCC
11. FTDU team arrives in Kenya without families for orientation by PRSB	18	HCC, MOA
12. FTDU team starts community participation phase	19	HCC
13. FTDU team return to U.S. with families and prepare first draft of baseline survey design	21	HCC
14. FTDU team returns to Kenya to complete baseline survey design	24	HCC

Exhibit 7 (cont.)

HOST COUNTRY CONTRACT TRACK (cont.)

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
15. provincial extension agents start language training in U.S.	23	HCC
16. baseline survey administered by FTDU team	24	HCC, MOA, CBS
17. baseline survey data analyzed	25	HCC, MOA, CBS
18. provincial extension agents leave U.S. with families	26	HCC
19. adoptive research trials, need for financial assistance, examination of delivery systems, and the beginning of the grain monitoring unit starts and also GMU national grain loss surveys	28	HCC, MOA
20. FTDU/extension farmer training session begin	41	HCC, MOA
21. FTDU social economist submits final need for financial assistance report and leaves	41	HCC
22. rest of FTDU team leaves	41	
23. provincial extension agents leave	58	
24. team leader submits final summary report and departs	58	HCC

Exhibit 7 (cont.)  
Anthropologist Track

<u>Task</u>	<u>Elapsed time</u> (in months)	<u>Responsibility</u>
1. Request for proposals released	3	ISAID/K
2. Persons selected	5	"
3. Person arrives	7	"
4. Person departs	22	"

Exhibit 7 (Cont.)

FTDU, GMU, AND HOUSING CONSTRUCTION TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. MOA and MOW begin construction negotiation	2	MOA, MOW, USAID/K
2. all construction plans approved	2	MOA, MOW, USAID/K
3. all construction site surveys completed	7	MOW
4. invitation for bids (IFB) issued	10	MOW, USAID/K
5. construction bids received and evaluated	11	MOW, USAID/K
6. contractor approved and construction begins	12	MOW
7. construction for FTDU, GMU, four houses in Kisumu are completed	22	MOW
8. one house in Kisumu and one house in Kakamega completed	26	MOW

Exhibit 7 (cont.)

COMMODITIES PROCUREMENT TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. PIO/C for five FTDU vehicles and eleven extension vehicles prepared	4	USAID/K, MOA
2. purchase order for vehicles issued	5	USAID/K, MOA
3. first deliver of vehicles: sedan for team leader and small 4WD for anthropologist	10	USAID/K, MOA
4. housing furniture and appliance listing prepared	14	USAID/K, MOA
5. PIO/C for furniture and appliances issued	16	HHC
6. second delivery of vehicles: two land rovers	17	HCC, MOA
7. team leader and FTDU team finalize FTDU and GMU equipment lists	18	HCC, MOA
8. PIO/C for FTDU and GMU equipment issued to purchasing service	19	HCC
9. PIO/C for FTDU and GMU equipment issued to purchasing service	19	HCC
10. delivery of housing furniture and appliances	21	HCC
11. delivery of FTDU and GMU equipment	24	HCC
12. delivery of remaining vehicles: 1 PU, 1 trk, 2 LR, 1 sedan, & 6 small 4WD	27	HCC

Exhibit 7 (cont.)

MOA PERSONNEL IMPLEMENTATION TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. create positions at PHSB, provincial, district and divisional levels, FTDU, and GMU	4	MOA
2. secretary/receptionist with equipment starts work at PHSB, also 2 PHSB staffers	5	MOA
3. secretary with equipment starts work at PHSB for team leader	12	MOA
4. long term trainees depart (MS degrees)	17	MOA, HCC
5. first group of district trainees and four Embu/Bukura trainees and 1 PHSB leave	22	MOA, HCC
6. one secretary, one secretary/receptionist with equipment, and one laboratory technician start at FTDU	22	MOA, HCC
7. remaining district and all divisional extension personnel assume their positions	23	MOA, HCC
8. two GMU laboratory personnel assume positions	24	MOA, HCC
9. secretaries with equipment assume positions at two provincial offices	27	MOA, HCC
10. remaining 8 lab. technicians assume job at GMU	27	MOA, HCC
11. district level secretaries (7) assume positions	29	MOA, HCC

## Exhibit 7 (cont.)

## LONG TERM TRAINING IMPLEMENTATION TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. selection and notification of trainee arrival schedules at selected U.S. universities	7	AID/W, USAID/K, MOA
2. start selection process for four FTDU trainees, two provincial extension trainees	12	MOA, HCC, USAID/K
3. trainees all depart	17	MOA, HCC
4. trainees all return to assume positions identified	41	MOA, HCC

EXHIBIT 7 (cont)

TEAM LEADER IMPLEMENTATION TRACK

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. arrive in country		HCC
2. assume USAID/K role of: *overseas training selection process * procuring house furniture and appliances * receiving vehicles for project and liaison with GOK <sup>1]</sup> and other <sup>2]</sup> organizations	12	HCC, USAID/K
3. prepare orientation and language supplement packages for TDY arrival of FTDU team	12	HCC, MOA
4. communicate with FTDU team and determine assistance required by ST consultants during TDY	12	HCC, MOA
5. start communications with TPI to establish training schedule and implement plan	13	HCC, MOA
6. finished preparations for FTDU team TDY	18	HCC, MOA
7. finalized FTDU and GMU, analyzed institut equipment lists	18	HCC, MOA
8. PIO/C for FTDU And GMU equipment issued to purchasing service	19	HCC, USAID/K
PIO/C for motorcycles and bicycles issued	19	HCC, USAID/K

Exhibit 7 (cont.)

TEAM LEADER IMPLEMENTATION TRACK (cont.)

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
9. submit project progress report to USAID/K	20	HCC
10. assist project evaluation team	63	HCC, USAID/K
11. assist in final project evaluation	58	HCC, USAID/K
12. submit final team leader report to USAID/K and depart	59	HCC

- 1] includes MOA, MOW, CBS, MOE, KFA, etc.
- 2] includes other multi and bi-lateral donors and private concerns.

Exhibit 7 (cont.)

SHORT TERM OVERSEAS TRAINING IMPLEMENTATION TRACK.

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. institutions selected and notified of trainees arrivals.	16	MOA, HCC
2. first group of three district, 1 PHSB and 4 Embu/Bukura personnel leave	22	MOA, HCC
3. second group of 4 district, 1 PHSB, and 4 Embu/Bukura personnel leave	34	MOA, HCC

Exhibit 7 (cont.)

SHORT TERM INCOUNTRY TRAINING (AID FUNDED) IMPLEMENTATION TRACK.

<u>Task</u>	<u>Elapsed time</u> (in months)	<u>Responsibility</u>
1. training institute (TI) selection process and contract negotiations completed	22	MOA, HCC, USAID/K
2. S-T consultants arrive and train lab technicians (GNU/UNBI)	37	HCC
3. TI arrives to undertake one month course design	30	HCC
4. TI teaches final 3 month session	34	HCC
5. TI teaches second 3 month session	46	HCC

Exhibit 7 (cont.)

TRAINING OF LEO/HE and FTC

<u>Task</u>	<u>Elapsed time (in months)</u>	<u>Responsibility</u>
1. training courses commence and continue for LOP.	37	MOA, HCC

GLOSSARY OF TERM AND ACRONYMS

Agriculture and agricultural - these words refer to both crop and livestock production. They exclude forestry and fisheries.

Change agent or field extension agent - these terms refer to the various significant aspects of the role played by the person or organization to effect a particular change on the targeted population.

Change target or clientele - used interchangeably for a population or group of individuals whose behavioral characteristics an extension program was targeted to influence.

Entomology - a branch of zoology that deals with insects.

Extension or delivery system - these terms refer to the total organization that is required to support an extension service within which educational extension or new technology and high adoption by farmers is the ultimate goal.

Field Trail and Demonstration Unit - this project component is the unit which will complete the locally adapted research.

GDS Kit - the Grain Drying and Storage Kit is a grant of materials provided by the project to reduce the "risk" for cooperating farmers who elect to utilize demonstration Dryers and Storage Units.

Maize or Corn - these terms are used synonymously in this paper to mean white field corn that is to be processed into a meal for human consumption.

Mycology - a branch of botany that deals with fungi.

- 2 -

National Cereals and Produce Board - a GOK Parastatal body for the marketing of produce and cereal grains.

Non-formal Education - a non-formal education extension project differs from the normal concept of an education institution in that: it has no fixed curriculum or course of study; it confers no degrees and gives no diplomas; it operates informally off campus and uses farms, homes churches and places of business as classrooms; the Extension agent/teacher has a large field of subject matter; subject matter as used by the Extension agent/teacher is more practical than theoretical and is intended for immediate application in the solutions of problems; application of the subject matter requires a change of both mental and physical behavior; and participation is purely voluntary.

Physiological Maturity - this term is used to indicate the point of time when grain (principally corn) has reached a point where there will no longer be any growth or development of the grain while still on the stock.

Smallholder - in this paper the term smallholder is used synonymously with small scale grain farmer.

Technological packages - refers to a method or system that usually employs more than one technical practice for accomplishing a specific task.

AID - Agency for International Development  
ASSP - Agriculture Systems Support Project  
CBS - Central Bureau of Statistics  
CDSS - Country Development Strategy Statement  
CPB - Cereals and Produce Board  
CPC - Contractor's Project Coordinator  
DAO - District Agricultural Officer  
DEO - Division Extension Officer  
DPHSO - District Postharvest and Storage Officer  
DPRA - Development Planning and Research Associates  
ES - Extension Specialist  
FAO - Food and Agriculture Organization (U.N.)  
FTC - Farmer Training Center  
FTDU - Field Trail and Demonstration Unit  
GDSE - Grain Drying and Storage Engineer  
GOK - Government of Kenya  
GMU - Grain Monitoring Unit  
HE - Home Economics (Field Technician)  
IRR - Internal Rate of Return  
LDC - Lessor Developed Country  
LEO - Local Extension Officer (Field Extension Personnel)  
MOA - Ministry of Agriculture  
MOEP - Ministry of Economic Planning  
MOP - Ministry of Planning  
PAO - Provincial Agriculture Officer  
PDA - Provincial Director of Agriculture

- 4 -

- PHSO - Postharvest and Storage Officer
- PHSB - Postharvest and Storage Branch
- REDSO/EA - Regional Economic and Development Service Office  
East Africa
- SE - Storage Engineer
- SMS - Subject Matter Specialist
- TA - Technical Assistant
- TPI - Tropical Products Institute
- UNICEF - United Nations International Children Emergency Fund
- USDA - United States Department of Agriculture

- 1 -

EXHIBIT 1Bill of Material for a  
Maize Drying Platform

<u>Item No.</u>	<u>Material</u>	<u>No. of Units</u>
1.	Post - 8 cm dia. x 1.3 m	6
2.	Floor Support - 8 cm dia. x 1.6 m	3
3.	Floor Joist - 8 cm dia. x 3.2 m	3
4.	Wall - 5 cm dia. x 3.2 m	4
5.	Wall - 5 cm Dia. x 1.58 m	4
6.	Floor - 5 cm wide bamboo slats x 1.5 m	60
7.	Roof Support - 5 cm dia. x 1.73 m	5
8.	Roof Frame - 6 cm dia. x 3.2 m	2
9.	Top Rail - 5 cm dia. x 3.35 m	3
10.	Nails (for floor) - 2½" (6.5 cm)	50
11.	Rail Stand Cross Support - 8 cm dia. x 1.6 m	3
12.	Nails (for floor support) - 5½" (14 cm)	8
13.	Rail Stand Post - 9 cm dia. x 1.5 m	6
14.	Nails (for floor joist) - 5½" (14 cm)	12
15.	10' x 2' Gal Steel Corr. Roofing	3
16.	Nails (for wall) - 3½" (9 cm)	48
17.	Gutter - 1.5 m long	1
18.	Nails (for bamboo floor) 2½" (6.5 cm)	275
19.	Roof Nails - 2½" (6.5 cm)	60

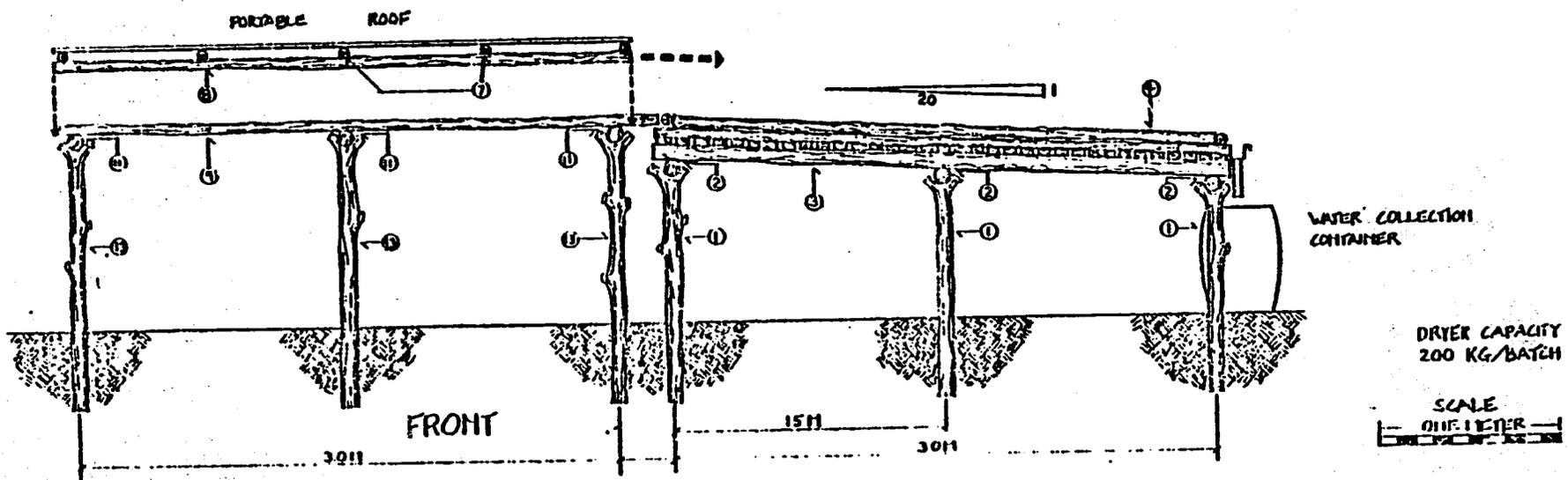
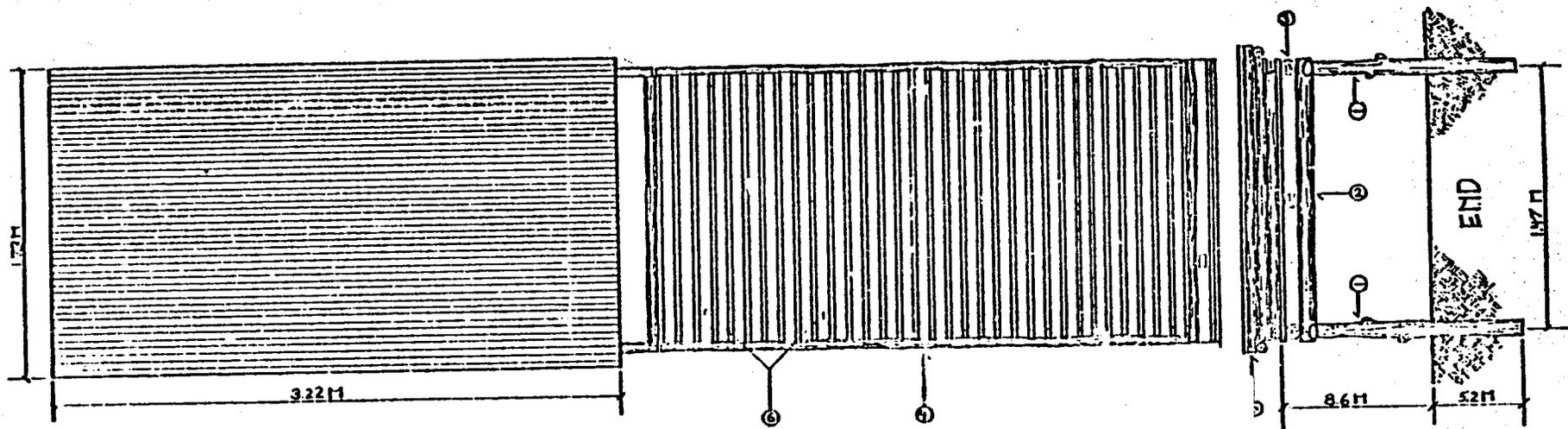


Figure B. Platform dryer

EXHIBIT 1 (cont'd)

Bill of Materials for a Maize Crib  
(1 m x 1.4 x 3 m)

<i>ITEM</i> <i>No.</i>	Material	No. of Units
1.	Front Posts - 10 cm dia. x 3.45 m	4
2.	Rear Posts - 10 cm dia. x 3.2 m	4
3.	Floor Joists - 10 cm dia. x 3.4 m	2
4.	Horizontal Studs - 7 cm dia x 3.4 m	6
5.	Horizontal Studs - 7 cm dia. x 1.5 m	6
6.	Rafters - 7 cm dia x 2.4 m	4
7.	Purlins - 6 cm dia. x 4.2 m	5
8.	Roof Support - 7 cm dia. x 3.26 m	2
9.	Floor - 6 cm dia. x 1.2 m	47
10.	Inner Wall - 5 cm dia. x 1.8 m	98
11.	Outer Wall - 5 cm wide x 1.85 m Split Bamboo or Sisal Poles	94
12.	Horizontal Outer Wall - 5 cm wide x 3.4 m	8
13.	Corrugated Metal Roof - Gauge 30 x 2.5 m (Or 8' long, gauge 30)	7
14.	Bolts - 5/8" dia. x 10" with 12 washers (or 1.5 cm dia. x 25 cm long)	6
15.	Plain Galvanized Sheet - gauge 30  3 feet x 6 feet (90 cm x 200 cm) (For Rail Guard and Gutter)	2
16.	Nails (for studs) - 5 1/2" long (14 cm)	44
17.	Nails (for purlins) - 5" long (12.5 cm)	35
18.	Nails (for rafters) - 5" long (12.5 cm)	14
19.	Nails (for inner wall) - 4" long (10 cm)	390
20.	Nails (for outer wall) - 3" long (7.5 cm)	422
21.	Nails (for floor) - 4 1/2" long (11.5 cm)	94
22.	Roof Nails (for roof) - 2 1/2" G.I. Nail (6.5 cm)	180

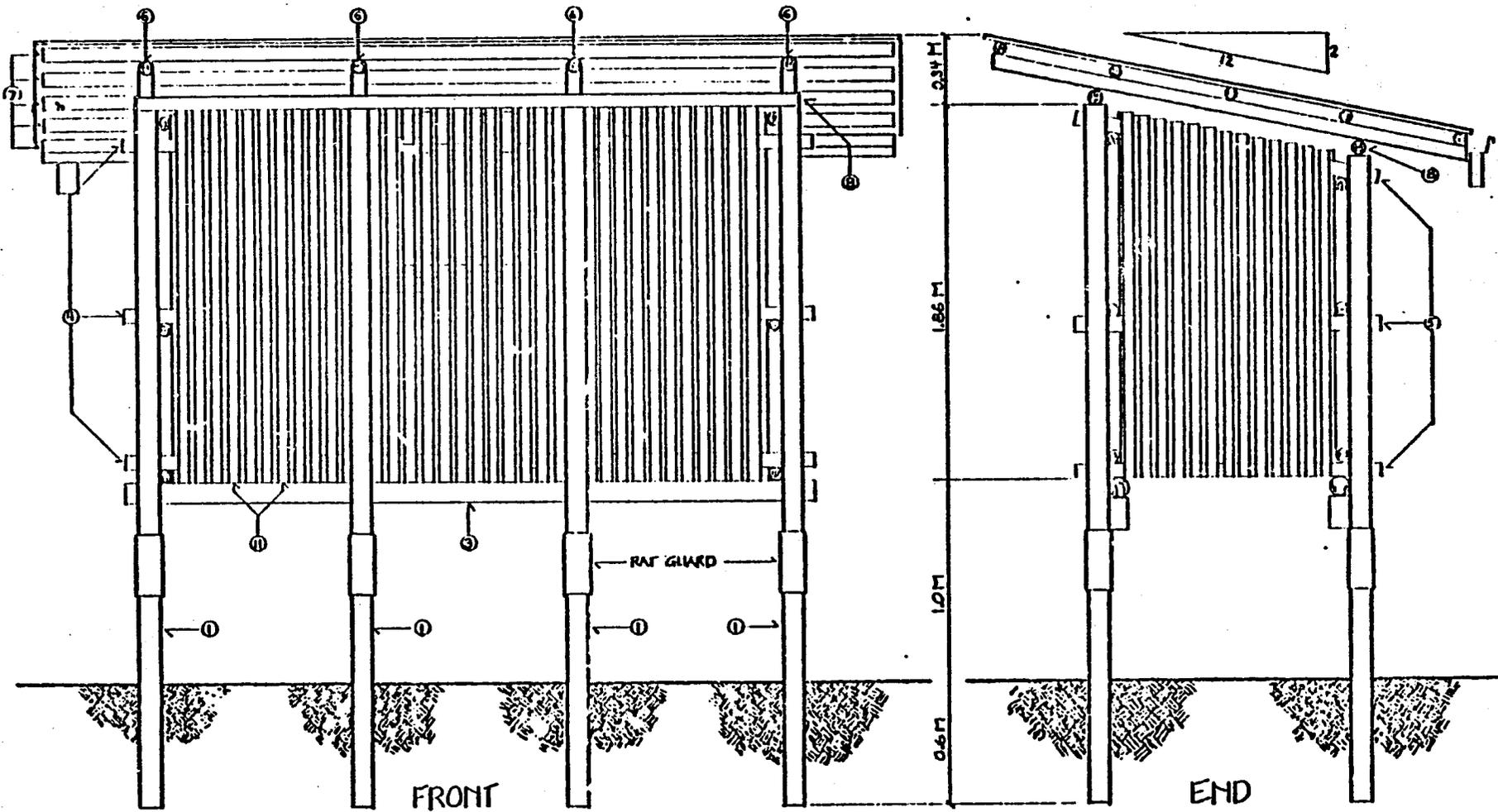
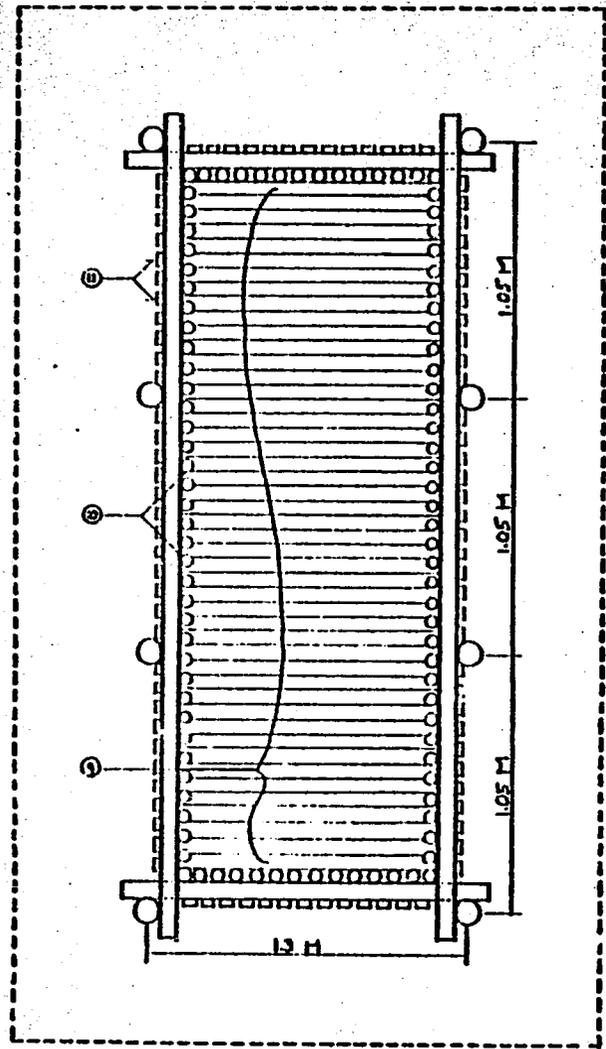


Figure A-1. Combination maize crib storage/dryer



FLOOR PLAN  
SCALE  
ONE METER

SECTION BB

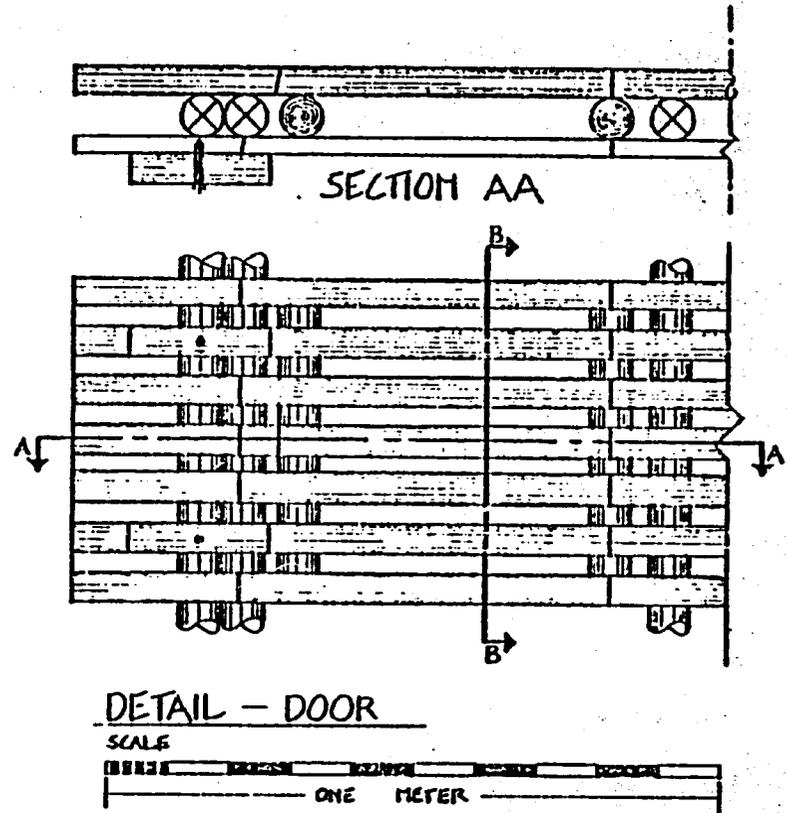
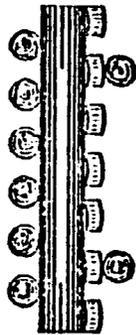


Figure A-3. Combination maize crib storage/dryer

EXHIBIT 2Equipment and other Training Expenses for District Offices  
and FTCs

<u>Item No.</u>	<u>Equipment Description</u>	<u>Units/District/FTC</u>	<u>No. of Units<sup>1/</sup></u>
1.	Slide Projector	1	13
2.	Overhead Projector	1	13
3.	Tape Recorder, Portable	1	13
4.	Mimeograph machine	1	13
5.	Electric Generator, Portable	1	13
6.	Portable Screen	1	13
	<u>Supplies</u>		
1.	Slide and Film Strip (Sets)	1	13
2.	Spare bulbs for each slide projector and overhead projectors (Doz.)	2	26
3.	Transparency Material (Ream)	5	65
4.	Markers for Overhead Projectors (Doz.)	3	39
5.	Blank Audio tapes (Doz)	2	26
6.	Batteries for recorder (Doz.)	3	39
7.	Mimeograph machine supplies (case)	50	650
8.	Ink (Case) electric wire 100 yds and assorted connections (set)	1	13
9.	Gas can, 5 gallon (set of 2)	1	13
	<u>Training Cost</u>		
10.	Board and room charges by FTC of 10,000 of K.Shs.15/ person/week for farmers women trainees. Sessions (Total project cost, to GOK K.Shs.1,102,655)	-	-

<sup>1/</sup> There are seven (7) PHSDO offices and six (6) FTCs in the project's target area.

EXHIBIT 3Suggested List of Equipment for The Grain Monitoring Unit's Laboratory

<u>Item No.</u>	<u>Equipment Description</u>	<u>No. of Units</u>
1.	microscopes, binocular wide field 20 to 40 variable	2
2.	microscopes, compound monocular	2
3.	balance mechanical, 2,000 gram capacity (similar to OHAUS 1,620)	3
4.	sets Dockage sieves 2 $\frac{1}{2}$ / $\frac{1}{64}$ " round, 8/ $\frac{1}{64}$ triangular 12/ $\frac{1}{64}$ " round, 1/ $\frac{1}{12}$ " round, bottom pan	4
5.	test tube racks 7/8" openings, 12 capacity	10
6.	moisture meter (similar to Burrows Mod-400)	1
7.	sample splitter, Riffle type	1
8.	small bundle thresher	1
9.	hand tallies, 4 digit	10
10.	portable UV lamps (such as ML-4a Black-Ray)	2
11.	hand corn shellers	5
12.	inspection viewers (such as Seedburo 226)	3
13.	UV tubes (replacement for lamps above)	4
14.	forceps, fine point, 4 $\frac{1}{2}$ -5'	20
15.	sample bags, poly 8 $\frac{1}{2}$ " x 18"	10,000
16.	ties, bag, twist	10,000
17.	grain samples boxes, 2 $\frac{1}{2}$ -3" dia., plastic	10
18.	shell vials, 2 dram, straight side (gross)	10
19.	corks, quality, for 2 dram vials (gross)	10
20.	shell vials, 4 dram, straight side (gross)	10
21.	corks, quality, for 4 dram vials (gross)	10
22.	Chemicals to control insect & make aflatoxin tests	-
23.	Mini-columns for aflatoxin (cost \$1,000)	-
24.	desiccating chambers for mini-columns	10
25.	Supplies and materials (Cost \$1,200)	-
26.	Equipment Maintenance (Cost \$1,500)	-
27.	Miscellaneous (Cost \$12,000)	-
28.	Aflatoxin analysis, equip. & materials (Cost \$15,000)	-

## EXHIBIT 4

Equipment list for Agricultural Engineering Department,  
University of Nairobi

Item No.	Equipment Description	No. of units
----------	-----------------------	--------------

MOISTURE DETERMINATION EQUIPMENT

- |    |  |   |
|----|--|---|
| 1. | Capacitance type for most cereals<br>220 VAC                                     | 2 |
| 2. | Vaccum Oven  |   |
| 3. | Air oven with three shelves 220 VAC<br>1000 watts, 0° -3000° C<br>ventlator type | 1 |

SCALES AND BALANCES

- |    |   |   |
|----|---|---|
| 4. | Balance scales, dial type 2600 gm<br>capacity, 0.1 gm sensitivity | 2 |
| 5. | Grain scale w/weight sets of 2 kg.<br>1 kg, 500 grams             | 1 |
| 6. | Platform scales, metric/English<br>combination 1-500 kg capacity  | 1 |
| 7. | Electronic single ban scale                                       | 1 |

GRAIN QUALITY TESTING

- |     |   |   |
|-----|---|---|
| 8.  | Grain probe for ear maize   | 2 |
| 9.  | Bag Triers, nickle plated, 1" outside<br>diameter at large end  | 4 |
| 10. | Bin, bag, feed, cereal probe 1 3/8"<br>outside diameter with 5 openings<br>brass, no partition                        | 2 |
| 11. | Dockage sieves for wheat, corn, rice<br>and sorghum with bottom pans (sets)   | 2 |
| 12. | Sample pans, triangular   | 6 |
| 13. | Boerner sample divider w/two pans   | 1 |
| 14. | Sample pans, aluminum with spouts   | 6 |
| 15. | Tyler sieves, 8" diameter, 1 1/8"<br>height Nos. 4,6,8,10,14,20,28,35<br>48,65,100,150,200, pan, brass material (set) | 1 |
| 16. | Same as item 15 but with sieve height<br>as 2 7/8" (set)  | 1 |

EXHIBIT 4

Item No.	Equipment Description	No. of Units
17.	Sieve shaker, 220 VAC 50 cycle 1450 rpm with timer	1
18.	Magnifying glasses with base	4
<u>AIR PROPERTY MEASURING EQUIPMENT</u>		
19.	Sling psychrometers	6
	replacement thermometers	6
	slide rule chart	6
20.	Hygrothermographs and accessories, pens, charts, inks, etc.	2
21.	Portable aspirating-type psychrometer, battery operated	1
<u>MISCELLANEOUS EQUIPMENT</u>		
22.	Hand grinder	2
23.	Mechanical maize sheller	2
24.	Inclined manometer, 0.1 inch sensitivity with case	1
25.	U-tube manometers, 18" long	2
26.	Bag trucks, two wheel	2
27.	Electric Hand Grinder - lab size (cost \$250)	-
28.	Wind Direction & Valocity plus recorder	1
<u>TEMPERATURE MEASURING EQUIPMENT</u>		
29.	Dial thermometers, 0-100° C 1 3/4" dial, 8" stem	10
30.	Digital potentiometer, T.C. Wire	2
31.	Selector switches, 36 points for T. C. wire	2
32.	Temperature recorder, 12 points 0° -150° C temperature range, T.C. wires	2
33.	Hot wire anemometer	1

Item No.	Equipment-Description	No. of Units
<u>AUDIOVISUAL EQUIPMENT</u>		
34.	Film Projector plus 1 doz. spare bulbs	1
35.	Slide Projector plus 1 doz. spare bulbs	1
36.	Overhead projector plus 1 doz. spare bulbs	1
37.	Screens	3
38.	Films/slides/material (cost \$2,000)	-
<u>MISCELLANEOUS SUPPLIES</u>		
39.	Supplies, Materials and Misc. (cost \$2,000)	-
<u>MAINTENANCE</u>		
40.	Equipment Maintenance, life of Project (cost \$5,000)	-

## EXHIBIT 5

Suggested Equipment list and Cost for Agricultural Engineering  
Department, Egerton College

<u>Item No.</u>	<u>Equipment Description</u>	<u>Cost U.S.\$</u>
1	Moisture determination equipment: Moisture meters, oven, and accessories	3,703
2	Scales and balances: Platform scales and laboratory balances	1,767
3	Grain quality testing equipment: sieves, probes, black light, lenses, pans with dividers	1,278
4	Air property measuring equipment: Psychrometers, thermometers, hygrothermograph and accessories	1,205
5	Temperature measuring equipment: automatic electronic recorders	1,100
6	Miscellaneous equipment: grinders, shellers, etc.	447
7	Maintenance, repair and operating cost for life of the project	527
	Total cost	<u>10,027</u>

Suggested Equipment needs for each of the Provincial Agricultural  
Education Institutions of Embu and Bukura.

Item No.	Equipment Description	No. Units Per Institution	No. of Units
<u>Moisture Testing Equipment</u>			
1.	Moisture meter, portable capacitance type, 220 VAC/Bat	2	4
<u>Grain Testing Equipment</u>			
2.	Dockage sieves for wheat, corn, rice, and sorghum with bottom pans (set)	2	4
3.	Balance scales, dial type, 2600 gm capacity, 0.1 gram sensitivity	2	4
4.	Magnifying glass with base	6	12
5.	U.V.Light w/batteries	1	2
6.	Sample divider, riffle type	1	2
7.	Hand Grinder, cast iron	1	2
8.	<u>Miscellaneous Equipment</u>		
8.	Sling psychrometer with spare thermometers and slide rule for psychrometer	2	4
9.	Dial thermometers, 32-100°C 1 3/4" dial, 8" stem	5	10
10.	Bag probes, 7/8" outside diameter i.e., openings w/partitions brass, chrome plated	1	2
11.	Bag triers, 1" outside diameter at large end, 12" long	3	6
12.	Air oven, 220 volts, 1000 watts 0-300°C	1	2
13.	Forceps	12	24
14.	Aluminum dishes 2-1/2 diameter flat bottom, 3/4" depth w/cover (Doz.)	3	6
15.	Equipment Maintenance Life of Project (cost/Institution \$4,000-project total \$8,000)		-

## EXHIBIT 6

Item No.	Equipment Description	No. Units per Institution	No. of Unit
<u>Classroom Equipment</u>			
16.	Overhead projector, w/spare bulbs	2	4
17.	Slide projector, 220 VAC	1	2
18.	Movie projector, 220 VAC, 16 mm.	1	2
19.	Movie screens/portable	3	6
<u>Duplicating Equipment</u>			
20.	Memograph machine	1	2
21.	Ink (cases)	20	40
22.	Paper (ream)	500	1000
<u>Miscellaneous Supplies</u>			
23.	Films, Slides, etc. (cost/Institution \$3,000-Total project cost \$6,000)	-	-
24.	Consumables/miscellaneous (cost/institution \$1,500-Total project cost \$3,000)	-	-
<u>Library Enhancement</u>			
25.	Text books, reference books, periodical, shelves. (cost/institution \$5,000-Total project cost \$10,000).	-	-

Extension Component Transportation Equipment List

<u>Item No.</u>	<u>Equipment Description</u>	<u>No. of Units</u>
1	Suzuki 4-wheel drive vehicle	7
2	Yamaha 125cc motorcycles <sup>1/</sup>	50
3	Motorcycle helmets <sup>1/</sup>	50
4	Bicycles <sup>1/</sup>	700
5	Land Rover	2
6	Sedan	1

Other vehicles to be provided to FTDU include:

1	Land Rover	2
2	Pickup trucks	1
3	Stake bed truck	1

<sup>1/</sup> Items number 2, 3 and 4 will be provided by AID funds augmenting the GOK's private vehicle purchasing program.

## KIT GRANTS

The specific contents of GDS-Kits\* will be developed by the FTDU, but it is anticipated that some of the following items would be included: metal rat guards, gunney sacks, insecticide, polyethylene (plastic sheet), set of support posts and assorted nails and a maize sheller. GDS-Kits would probably be distributed through the Kenya Farmers Association (KFA), FTCs, and MOA field offices. The KFA would charge approximately 15 percent handling and overhead charges based upon the retail value of the kits. The exact percentage would have to be negotiated by the PHSB and the Project Coordinator at the time required. The proposed distribution system would have the greatest possible number of outlets and would minimize the distance a smallholder would have to go for a kit. There are 18 KFAs which could be utilized (not all are within project's targeted area but do service part of targeted area), two provincial agriculture offices, seven district agriculture offices, 37 divisional agriculture offices, and six FTCs giving a total of 70 outlets for the kits. In addition to these outlets, the KFAs also have stockists or merchants who purchase at wholesale prices from KFA stores and service local markets in the target area. A list of all possible distribution outlets is as follows:

List of Outlets for GDS KitsKFA Outlets

- |                     |                         |
|---------------------|-------------------------|
| 1. Molo Branch      | 10. Siaya Depot         |
| 2. Kericho Branch   | 11. Eldoret Branch      |
| 3. Kipkelion Branch | 12. Bungoma Branch      |
| 4. Sotik Branch     | 13. Kapsabet Depot      |
| 5. Kisii Branch     | 14. Webuye Branch       |
| 6. Kakamega Branch  | 15. Turbo Depot         |
| 7. Kisumu Branch    | 16. Kimilili Depot      |
| 8. Chemelil Depot   | 17. Kitale Branch       |
| 9. Migori Depot     | 18. Moi's Bridge Branch |

Provincial Agriculture Offices

- |             |           |
|-------------|-----------|
| 1. Kakamega | 2. Kisumu |
|-------------|-----------|

\* Kits would also be expected to vary from one farming area or group to another.

EXHIBIT 8 (Cont'd.)

District Agriculture Offices

- |             |             |
|-------------|-------------|
| 1. Kakamega | 5. Homa Bay |
| 2. Bungoma  | 6. Siaya    |
| 3. Busia    | 7. Kisii    |
| 4. Kisumu   |             |

Divisional Agriculture Offices

- |              |              |
|--------------|--------------|
| 1. Mumias    | 19. Irianyi  |
| 2. Butere    | 20. Nyamira  |
| 3. Hamisi    | 21. Elgon    |
| 4. Vihiga    | 22. Bosongo  |
| 5. Ikolomani | 23. Tongaren |
| 6. Kabras    | 24. Manga    |
| 7. Lurambi   | 25. Nambale  |
| 8. Lugari    | 26. Ugembo   |
| 9. Kimilili  | 27. Amagoro  |
| 10. Sirisia  | 28. Ukwala   |
| 11. Migori   | 29. Hakati   |
| 12. Macalda  | 30. Boro     |
| 13. Central  | 31. Winamu   |
| 14. Eastern  | 32. Bondo    |
| 15. Mbita    | 33. Muhoromi |
| 16. Kihancha | 34. Yala     |
| 17. Dhiwa    | 35. Nyando   |
| 18. Kedu Bay | 36. Maseno   |
|              | 37. Ahero    |

Farmer Training Centers (FTC)

- |            |             |
|------------|-------------|
| 1. Busia   | 4. Homa Bay |
| 2. Bungoma | 5. Maseno   |
| 3. Kisii   | 6. Siaya    |

## SOCIAL SOUNDNESS ANALYSIS

### SOCIAL ORGANIZATION

In developing a strategy for reaching the intended beneficiaries one must focus on who should be reached within the small-scale farm household and their existing organizational affiliations. The latter assists in the identification of viable channels for reaching the household members. As discussed below, in Exhibit 3, women are primarily responsible for carrying out postharvest activities, such as harvesting, shelling, treating, storing and sorting grain. They may be assisted in these tasks by children of both sexes and, sometimes, adult males. In principle, construction is considered a male task; the husband may actually do the construction himself, obtain hired laborers and children to assist him, or pay for the entire operation. Expenditures for laborers and materials are expected to be met by the husband. While this is the societal ideal, it is not always followed and some women assume the responsibility.

Approximately 24 percent of all rural households in Kenya are headed by women. In parts of Kakamega and Siaya Districts about 40 percent of the rural households are headed by women. About half the women who head households are married but their husbands are living elsewhere, while others are separated, divorced or widowed. While some of the married women receive financial support from their spouses, others have been abandoned.

Women have considerably less access to income than men do and the cash which they do obtain is on a smaller scale than that of men. Women are primarily limited to obtaining money from trading, selling produce, brewing beer, wages of family members, and membership in work groups. In comparison, in Western and Nyanza Provinces the men mainly earn money from off-farm employment and sale of produce, particularly cash crops. In Kakamega, Siaya and Kisumu Districts almost all men have worked for wage employment at one time in their lives.

Little information is available on decision making within a household, a topic difficult to research. A study carried out by Kathleen Staudt in one administrative location of Kakamega District, an area with a high male absentee rate, revealed that women frequently make many of the decisions connected with husbandry practices, crops grown, time of planting and storage practices. She found that most of these agricultural activities were within the realm of women, even on those farms with a man present. When asking about the initial decision making connected with adoption of hybrid maize, Staudt dis-

covered that in 34 percent of the cases women made the decision; in 31 percent, men; in 28 percent both spouses; and in 7 percent a son made the decision. As K. Staudt points out, it is difficult to distinguish who or even whether one person is solely responsible for a decision. As an agricultural practice spreads through an area, decision making becomes less of an individual affair and more of a customary practice to be followed.

There are various formal and informal organizations with an agricultural base to which men and women in Western and Nyanza Provinces belong. Traditionally, women in these areas were usually members of reciprocal agricultural work parties. The groups consisted of neighboring women, including relatives, who assisted each other on a strict rotational basis with agricultural tasks. This form of work party is still commonly found in Busia, Kisii and Kakamega Districts. They occur less frequently in South Nyanza, Kisumu and Siaya Districts. (Similar groups are found outside the project area.)

A study of three women's agricultural work groups, reflecting different purposes and functions, in Kisii District has been carried out by the PP team sociologist. The first, organized on the basis of kinship and residency, consists of all adult women in a homestead, i.e., mother, and daughters-in-law. The group follows a strict rotational basis for assisting one another with planting, weeding and harvesting, particularly grain crops. The second group consists of twelve neighbors with cross-cutting ties of kinship or church affiliation. They assist each other, usually with weeding and harvesting grain crops, for a nominal fee on a rotational basis. The group offices are formalized and the treasurer, responsible for keeping the money, divides the earnings at the end of the year according to a member's participation. Whereas both the first and second types of groups refer to themselves as egesangio, the traditional name, the third calls itself ekeombe which refers to a self-help group. The third consists of about 15 members, who work only for money and do not follow a rotational basis. This group also has a set of officers. In looking at membership in the groups, over a six year period, there is a high degree of stability in the first and second, and less in the third. In all the groups the women report that it makes work more enjoyable and tasks are accomplished more quickly. In the first group members also stress that it provides a means of exchanging views on social problems and members in the second and third groups mention learning better farming methods and having a means of earning money.

K. Staudt found that about two-thirds of the women in her study belonged to a communal labor group, bahasio, for agricultural

activities. They were organized and functioned similarly to the second group studied in Kisii District. Women are also members of church groups. A study conducted by the PP sociologist in Kisumu District showed this as the most common type of organization to which women belong.

Women also belong to groups formally registered with the GOK, which fall under the purview of the community development department of the Ministry of Culture and Social Services. To varying degrees, the groups are also provided assistance by agricultural extension agents, home economists and other field workers. Only a proportion of the registered groups are active, and among these not all are engaged in agricultural activities. There are about 200 active women's groups with a total of 6,859 members in South Nyanza district; about three fourths of these groups are engaged in agricultural endeavors. In Kakamega District there are approximately 100 active groups which are mostly engaged in farming, beekeeping and poultry. Out of about 40 active registered groups in Kisii District more than half are active in agricultural activities. In Busia District 98 groups with a total of 3,730 members are engaged in farming activities. The active registered groups have elected leaders and usually meet on a regular basis. These groups are usually community based.

In comparison to women, men in Western and Nyanza Provinces are more likely to participate in casual work parties and be members of formal cooperative societies. The traditional casual work party was based on locality and men as well as women would donate labor and be rewarded with food and drink. This type of work group which would be called for agricultural tasks and construction has largely been displaced by the practice of hiring laborers. Some men do join together in groups of two to six for plowing, with each person owning part of the equipment. Men are more often found as members of cooperative societies. The purpose of belonging to a cooperative society is to have an outlet for a particular commodity and accessibility to loans and some agricultural inputs. Societies are geographically based and vary in size from 100-2,000 members. There is little feeling of cohesiveness and identity among members. Research conducted by the PP team sociologist in 1977 among a sample of 224 members of cooperative societies in Kisumu District which are affiliated with the Sugar Belt Cooperative Union revealed that during the past year only 29 percent had attended a society meeting or seminar. Respondents were asked to name the persons on their cooperative society managing committee. Since the committees varied in size from five to nine members, the number of members correctly named out of the total number on the committee was computed on a percentage basis. On the average the members could name only 28 percent of those on their society managing committees. This shows a low level of awareness about elected representatives and indicates the impersonal nature of membership in a cooperative society.

Thus, in principle women are responsible for all postharvest practices, with the exception of construction of facilities. In actuality some women assume the responsibility for construction and in other cases males assist with some of the tasks. Therefore, this project aims at reaching both males and females of the same male headed household, as well as female heads of households. To do this the project will use existing groups whose members have strong cross-cutting ties of affiliation and loyalty such as women's formal and informal groups, as the basis for reaching smallscale farmers. A group approach will increase community awareness and acceptance of improved postharvest practices as well as provide an equitable system for selection of households which will receive grants and help ensure that the materials received on a grant basis are used for the intended purpose.

## SOCIAL SOUNDNESS ANALYSIS

### NUTRITIONAL ASPECTS POTENTIAL ADDITIONS BENEFIT

This project indirectly addresses the nutritional status of household members in Western and Nyanza Provinces by focusing on reduction of insect and mold damage to grain kernels which will result in improving the nutritional quality of the grain available and on practices which will increase the quantity of grain available for consumption

A national survey of the nutritional status of young children aged six to 60 months carried out in late 1978 and early 1979 covered all districts in Nyanza and Western Provinces. The results, given in Table C-1 below, show the effects and extent of malnutrition. Height is an indicator of the long term nutritional status of a child because a child who has received an inadequate diet for much of its life will fail to grow properly. Children with low heights for their age are referred to as nutritionally stunted. In comparison to height, a child's weight reflects its immediate nutritional history, and the child with a low weight in reference to its age is referred to as wasted. Low weight for height and height for age is referred to as wasted and stunted. Table C-1 shows that 56 percent of the children in Nyanza Province and 63 percent in Western Province have a normal weight for height and height for age. Nyanza ranked second in all the areas as having the lowest percent of children in the normal category.

Maize is the main ingredient of porridge given to young children in the agricultural areas of Kenya. In the rural areas of Nyanza Province, 70 percent of the children's porridge is made mainly from maize, 8 percent from millet, 9 percent from maize and millet, and 12 percent from cassava or cassava and maize or millet. In the rural areas of Western Province 85 percent of the children's porridge is made primarily from maize, 4 percent from millet or maize and millet, and only 2 percent from cassava.<sup>1</sup> An analysis of children in Nyanza fed on cassava based porridge revealed that they are nearly ten times more likely to be nutritionally wasted than children fed other types of porridge, and more than eight times more cassava eating children suffered from combined wasting and stunting compared to children eating any other type of porridge.

An analysis of the nutritional status of children in reference to type of porridge shows that those who consume porridge of maize and millet are more likely to have a normal status than those taking other types of porridge. (Table C-2.)

1] In Western Province nine percent were either other or no response and in Nyanza one percent were in this category.

**Table C-1: Simplified cross-classification of weight for height and height for age by province**

(Percentage of Children)

	Central Rural	Coast Rural	Eastern Rural	Nyanza Rural	Rift Valley Rural	Western Rural	Other Urban	Coast Urban	Nairobi Urban
Normal	65.4	46.7	57.8	56.1	61.1	62.8	67.6	64.8	74.3
Stunted Only	32.6	43.9	36.0	38.2	33.0	34.2	26.6	25.8	20.4
Wasted Only	2.0	7.0	4.7	3.6	4.2	1.8	3.2	6.4	5.0
Wasted and Stunted	0.0	2.4	1.5	2.1	1.7	1.1	2.6	3.0	0.3

Source: GOK, Report of the Child Nutrition Survey 1978/79.

It is anticipated that over half of the increased quantity of maize, which will become available through households adopting improved postharvest technologies, will be consumed by the producer's households. Not only should there be more to eat, the maize available will be more nutritious. Thus, increasing the supply of maize in poor rural households will probably positively impact on the health and nutritional status of children in the project area.

Table C-2: Nutritional Status by Composition of Porridge.  
(percentage of children)

Nutritional Status	Maize Only	Millet Only	Maize & Millet	Cassava Plus Other	Bananas	Other
Normal	59.0	58.0	64.2	43.0	48.2	64.7
Stunted Only	36.3	36.2	32.7	34.5	44.6	32.7
Wasted Only	3.3	4.0	2.6	14.5	7.2	2.1
Wasted and Stunted	1.4	1.8	0.5	8.0	0.0	0.5
Percent of Total	65.5	8.4	12.9	3.2	1.2	8.8

GOK, Report of the Child Nutrition Survey. 1978/79.

SOCIAL SOUNDNESS ANALYSIS

CURRENT PRACTICES

While the focus of this section is on Western and Nyanza Provinces, some information is given on current practices in other provinces to illustrate regional variations. These variations indicate that expansion of the postharvest program to areas outside those of project concentration will need to be accompanied by adaptation to local conditions.

Maize is the predominate food crop grown in Western and Nyanza Provinces, although there are geographic pockets where millet and sorghum are the primary grain crops. The Kenya National Crop Storage Study data (Table C-3) indicate that contrary to popular belief most smallholder households in the project area do not sell maize immediately after harvest to meet cash needs and then purchase maize later. The data indicate that:

- a) some households sell maize but consume the major part of their harvest,
- b) at least half the households in Kisii and Kakamega Districts do not buy or sell maize,
- c) some households, especially in South Nyanza, District are unable to meet their domestic demand for maize.

Table C-3: Households Buying and Selling Maize (percent)

	Some Maize Sold	Some Maize Purchased	Some Maize Sold and Purchased	No Selling or buying of Maize
S. Nyanza	18	37	18	27
Kisii	31	-	-	69
Bungoma	29	21	29	21
Kakamega	36	14	-	50
Average	29	18	12	42

DPRA, Kenya National Crop Storage Study code sheets.

The goal of most smallscale farmers is to produce enough grain to meet their domestic requirements. Even in places like the highlands of Kisii District where relatively high price cash crops are grown, most households attempt to produce enough grain to meet their domestic needs. Experience has shown farmers that grain is not readily available for purchase nor at a reasonable price, if they rely mainly on the marketing system.

The following analysis provides a description of current post-harvest practices within and between districts to illustrate the extent to which behavioral changes will be required and by whom if the recommended practices are to be adopted. Almost all households dry their maize on the stalk in the fields. Farmers perceive that maize is mature only when it is sufficiently dry enough to store. The dried maize is primarily harvested by women, although some are assisted by young children and husbands. Women are primarily responsible for husking the maize and households usually place it in a crib. Most farmers report a small amount of maize lost or spoiled prior to storing the crop. In Bungoma District farmers claim the rats, birds, and molds, (in descending order) cause the damage, while in Kakamega mold is considered the primary cause of damage. In comparison, in South Nyanza and Kisii Districts, farmers report that the maize is primarily lost due to birds. Loss also occurs while the maize is stored. As shown in Table C-4 most households do not apply protective measures against insect damage and even fewer protect their stored crop against other forms of spoilage, such as that by rodents.

Table C-4: Protection of Stored Grain Against Insects.  
(Percentage)

	Not Protec- ted	Dusted	Sprayed	Ashes
Western Province	71	25	4	-
(Bungoma)	(64)	(36)	-	-
(Kakamega)	(79)	(14)	( 7)	-
Nyanza Province	68	20	4	8
(South Nyanza)	(55)	(27)	-	(18)
(Kisii)	(79)	(14)	( 7)	-
Rift Valley Province	69	28	3	-
Central Province	36	45	19	-
Eastern Province	19	61	8	12

DPRA Kenya National Crop Storage Study, Code sheets.

**Table C-5: Source of Crib Materials (Percent)**

	Bungoma	Kakamega	South Nyanza	Kisii
<b>Roof (thatched)</b>				
Purchased	45	63	5	43
Gathered	45	27	78	43
Both	10	10	17	14
<b>Rest of Crib</b>				
Purchased	15	50	5	21
Gathered	8	7	61	65
Both	77	43	34	14

DPRA, Kenya National Crop Storage Study, Code sheets

**Table C-6: Type of Labor Used in Construction Crib (Percent)**

	Family Mem- ber(s) Only	Hired Only	Combined	Farms where labor contributed by			
				Husband	Wife	Children	Other
Western Province	37	44	19	48	-	19	-
(Bungoma)	(54)	(31)	(15)	(54)	-	23	-
(Kakamega)	(21)	(58)	(21)	(43)	-	14	-
Nyanza Province	88	6	6	82	-	73	-
(S. Nyanza)	(94)	(6)	-	(86)	-	94	-
(Kisii)	(72)	(7)	(21)	(76)	-	21	-
Rift Valley Province	80	11	8	89	13	20	24
Central Province	59	35	6	55	18	18	18
Eastern Province	50	47	3	75	12	19	31

DPRA, Kenya National Crop Storage Study.

As mentioned previously, most farmers store their grain in cribs. However, in East Bunyore location of Kakamega District where the homesteads tend to be less than one acre, the households store shelled maize in bags which are kept in the rafters of their house. Generally in Western and Nyanza Provinces, the storage cribs on most smallscale farms have thatched roofs and wooden floors. Walls are usually made of woven sticks or plant stalks, although in Bungoma some are made of sisal poles and in some parts of Kakamega the cribs are primarily made of wooden walls.

There are some variations in the source of materials for the cribs and labor used in the construction. Information in Table C-5 indicates the extent to which people are used to making a cash outlay for crib materials, and reflects in some cases the scarcity of materials, such as thatching grass, in some localities. Cribs are often constructed by male household members, and hired laborers. In some areas, such as Kakamega District, there are specialists who weave the storage baskets. Table C-4 shows the districts where cribs are primarily constructed by family members and which members carry out the work.

Women regularly remove a small amount of maize from the store to prepare it for household consumption. Often before shelling it, the maize is further dried outdoors on a mat. Then the maize is shelled. Shelling is primarily the responsibility of women, although in some households children and, to a lesser extent, husbands assist. The latter occurs primarily when maize is shelled by beating the cobs. The technique of shelling maize varies as shown in Table C-7. Shelling by hand is the most common technique in Western and Nyanza Provinces. After shelling most women sort the maize: spoiled grain is usually used as animal feed.

Table C-7: Technique of Shelling Maize (Percentage)

	By Hand	Beating with Stock on Threshing Floor/Mat	Beating in Sack	Other
Western Province	45	17	38	-
(Bungoma)	(64)	(29)	( 7)	-
(Kakamega)	(27)	( 6)	(67)	-
Nyanza Province	68	-	28	4
(S. Nyanza)	(64)	-	(36)	-
(Kisii)	(73)	-	(18)	( 9)
Rift Valley Province	29	2	67	2
Central Province	45	-	55	-
Eastern Province	25	-	73	2

## SOCIAL SOUNDNESS ANALYSIS

### RECOMMENDED PRACTICES

The postharvest technologies identified by DPRA to reduce grain losses require a significant change in current practices. The differences between current and the DPRA proposed practices for maize are given below:

#### Current Common Practices

1. Harvest maize after dried on stalk (1-2 months after physiologically mature.)
2. Husk maize and place maize on ear in store.
3. Periodically remove maize from store, dry it on mats and shell it.

#### Proposed Practices

1. Harvest maize when physiologically mature.
2. Husk maize and dry on platform.
3. Shell half of maize and treat shelled half.
4. Place all maize in store.

The proposed practices are likely to encounter labor, financial, and cultural constraints among most smallscale farmers. A labor constraint might prevent farmers from early harvesting of maize. Farmers follow a calendar of activities which includes times for major social obligations such as community ceremonies and self-help work during low periods in the agricultural schedule. The early harvesting of maize might conflict to some extent with the harvesting and shelling of beans. (See Table C-8.) Beans are a high value crop, grown for sale and consumption, although only a small portion of a smallholder's land is devoted to the crop. Currently beans are dried on the vines in the fields or vines are uprooted after the beans are physiologically mature and then the beans are dried in their pod. Beans must be shelled when they are dry; otherwise, the pod will split and scatter the beans. Harvesting and shelling are done primarily by women, who store the beans in a covered container.

While the early harvesting of maize may overlap with bean harvesting and shelling, the availability of labor and the volume of beans and maize produced are anticipated to be key factors in determining whether or not this overlap will be a constraint. If they are, the FTDU ought to focus on the possibility of early harvesting of

Table C-8: Maize and Beans Harvesting Calendar

PROVINCE	DISTRICT	ZONE	MONTH													
			Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb		
<b>WESTERN PROVINCE</b>																
	Busia	-				B	B	LH	LH	B		B	LH	LH		
	Bungoma	Upper						B	B	LH		B	B			LH
		Lower				B		B	B	B LH			B			LH
	Kakamega	Upper				B	B	LH		B		B	LH	LH		
		Lower					B	B	LH	B		B	LH	LH		
										LH						
<b>NYANZA PROVINCE</b>																
	Siaya	-					B	B	LH			B	LH			
								LH				LH				
	Kisumu	-					B	B	LH			B	B	LH		
													LH			
	S. Nyanza	-				B		B			B	B	LH	LH		
						LH		LH								
	Kisii	Upper		B	B			LH	LH	LH				B	B	
		Lower						B	B	LH				LH	LH	
								LH	LH					LH	LH	

L= Local Maize Harvest  
H= Hybrid Maize Harvest  
B = Beans Harvest

G. Schmidt, "Interim Report on the Effectiveness of the Maize and Bean Marketing System in Kenya,"  
Institute for Development Studies, University of Nairobi, July 1978.

beans and drying them on a drying platform as part of an overall postharvest package of technologies.

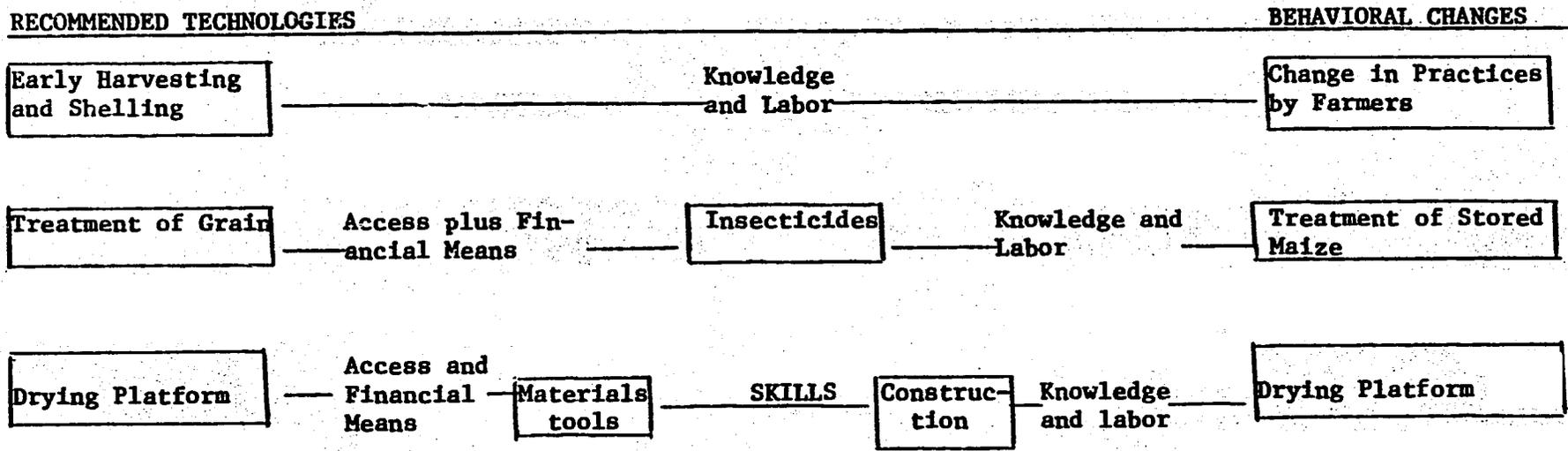
The constraint to adoption of chemical treatment of maize, and a drying platform is likely to be financial. The proposed practices may also encounter cultural constraints. Maize is generally considered mature only after it has dried in the field. Also, chemical treatment of maize leaves a residue of powder; when stored on the cob, farmers beat the cobs together to release and eliminate the powder which otherwise causes a change in the flavor of the cooked maize. The recommended treatment must be such that the flavor of the food is not changed.

When discussing the recommended practices with women in Nyanza and Western Provinces, most of them perceived the recommendations to be risky. They thought that early harvesting, and storing of shelled maize would increase mold and insect damage to the grain. Some also mentioned labor constraints. The women claimed that if the practices were shown to produce successful results then they might be convinced to try them.

Most farmers are aware of advantages which are supposed to accrue due to chemical treatment of stored maize and to improved storage models, yet they have not adopted them, implying that the reasons for non-adoption are more fundamental than just a lack of information. Figure C-9 below shows that for farmers to adopt the recommended practices, it requires more than knowledge and a willingness to do so.

While it can be hypothesized that one factor or another may act as a constraint to the adoption of improved practices, field testing is still required in order to draw valid conclusions. Information is available on what the current practices are but little, if any, information exists on the reasons behind them or for variations among groups. Therefore, prior to the arrival of the FTDU technical assistance team, an in-depth study will be carried out by an anthropologist in three different human ecological areas. The purposes will be to identify primary determinants of current practices, important constraints to change and the most suitable means to encourage adoption of improved postharvest grain practices among smallholders who produce annually less than 22 bags of maize. The study will be the first step of the information system. The anthropologist will provide recommendations on issues to be covered in the baseline study; criteria and procedures for selection of households to receive grants during the testing and demonstration phases; and extension strategies.

Figure C-9: Requirements for Adoption of Recommended Technologies



SOCIAL SOUNDNESS ANALYSIS  
COMMUNICATIONS, METHODOLOGIES

The previous exhibits describe the changes that would be necessary to adopt the recommended practices, and possible constraints to their adoption. This exhibit assesses channels for the identification, testing, and demonstration processes in light of the nature and extent of their relationship with smallscale farm household members. It also analyses methods for encouraging adoption of innovations.

Currently the MOA uses the following methods to reach farmers:

- a) individual homestead visits by LEOs and Home Economists,
- b) demonstration plots,
- c) informational announcements at meetings known as barazas,
- d) training of farmers at Farmer Training Centers (FTCs) and,
- e) a weekly radio program in Swahili.

Studies conducted in various areas of Kenya, including Kisii and Kakamega Districts (for example, studies carried out by David Leonard and John Gerhardt) have shown that progressive farmers are the ones who primarily receive visits from extension agents, are selected to have demonstration plots, and attend FTC courses. Moreover, often there is not a spread effect to poorer households, because the latter have a different resource base. And, the agricultural extension service has tended to focus on males rather than females. Currently, in some districts in Western and Nyanza Provinces, the District Agricultural Officers are encouraging LEOs to work with groups, particularly women's groups, to increase the rate of contact between agents and farmers, and some are attempting to get agents to focus on middle level farmers.

Under traditional mores, a male stranger, such as a LEO should not visit a woman unless a male family member is present. This combined with other factors has resulted in a low level of extension advise to women farmers since less than ten percent of the LEOs are female. However, the constraint can be overcome by an LEO working with a group of women. Also, women's attendance at barazas is usually low as a result of their lack of free time to attend often lengthy

meetings. While some women have attended courses in agriculture and home economics at FTCs, household and farming responsibilities, including child care and meal preparation, prevent most women from being able to leave their homestead for a short course. The information in Table C-10 on FTC attendance should be interpreted cautiously because of the small sample size. FTC attendance records show more males than females participate in agricultural courses. Also, women with little experience in the modern sector do not like the idea of staying overnight in an FTC dorm with strangers.

Under the Home Economics and Rural Youth Section of the Crop Division, MOA, there are a total of 326 home economists in teaching, management and contact positions. The 1977 ratio of farm households to agricultural contact agents was approximately 126:1, whereas the ratio of farm households to home economics contact agents was 6,000:1. The number of home economics contact staff, their tier of operation and level of training are listed below (based on 1977 figures):

- 81 TOs (Technical Officers), divisional level, diploma
- 96 TAs (Technical Assistants), divisional or locational level, certificate
- 149 JTAs (Junior Technical Assistants), locational level and sometimes sub-locational level, primary education

The radio is a good channel for creating awareness of innovations, but studies in Africa have documented that adoption is influenced by inter-personal communication. Table C-10 shows that households are

more likely to have media exposure than contact with extension workers or formal agricultural training centers although the data do not indicate the type of program heard. While the information given does not cover contact with home economists, it can be assumed that it is even lower than contact with agricultural or livestock extension agents.

Community development agents are also a channel for reaching farm families. They are responsible for group activities such as self-help projects and registered women's groups. At the locational and sub-locational levels, the community development assistants (CDAs) are employed by their respective county council, although they are responsible to the Ministry of Cultural and Social Services. Since the field staff is dependent on their county councils, their numbers, training, etc. often reflect the poverty of their district. Nevertheless, the existence of this group of field workers provides a viable channel for reaching farmers, especially women.

Outside of government structure there are various groups which operate in the rural areas. Most prominent in Western Kenya is the Maseno South Diocese, with their rural development outreach program. There are also some special centers such as rural craft training centers under the National Christian Council of Kenya and a girls center in Bungoma under the Salvation Army.

Given that the existing MOA strategy for reaching farmers is biased towards progressive, male farmers, the approach detailed hereafter seeks to support district level initiatives to redress the situation. It is deemed the most feasible to encouraging adoption of economically feasible postharvest practices which are socially acceptable by households which produce annually less than twenty-two bags of maize, and diffusion of these practices.

The target group is composed of males and females from small-scale farming households which produce annually less than twenty-two bags of maize. Since women are responsible for almost all postharvest tasks, and men are usually responsible for construction, e.g., storage cribs, this project will attempt to reach male and female members of the same households, as well as female heads of households. The best approach for accomplishing this will be to use existing community based groups which have a high degree of cross-cutting ties and in which a system of cooperation is already established. The sub-section on social organization shows that the most common communal groups meeting this criteria are women's groups. The project will use both women's informal and formal groups which are engaged in agricultural

TABLE C-10

Smallscale Farming Households Extension, Training  
and Media Exposure (Percent)

	Western Province	Nyanza Province	Rift Valley Province	Central Province	Eastern Province
Agriculture/livestock extension visits to farm during past year	4	29	36	32	47
Household Members going to seek advise from exten- sion worker	4	22	10	47	19
Household Members attended local meeting on farming during past year	14	77	38	47	25
Male members having attended a FTC course (ever)	-	7	12	12	18
Female members hav- ing attended a FTC course (ever)	-	13	8	9	28
A household member listening regularly to the radio	85	50	71	85	72

DPRA, National Crop Storage Study, code sheets.

activities as the focal point for community contact. Husbands of the members will be asked to participate in discussions and the ensuing activities. Male participation is not expected to present any difficulties since the men will have already shown their approval of the group by allowing their wives to be active in it. Furthermore, in some areas men have already actively assisted in the activities of the registered women's groups.

In order to better understand smallscale farmers' rationale for following current practices and the extent to which they are both willing and able to change these, this project will include a dialogue approach with groups of male and female farmers. Initially the participatory discussions will be held by a team of specialists. During this phase, the dialogue, stimulated by a facilitator, will cover farmers perceptions of the grain loss problems, reasons for the current postharvest practices, and materials and knowledge locally available to reduce grain losses. Also the local agricultural extension agent or home economist will be encouraged to articulate his/her perception of the reasons for the current losses, measures to overcome these and availability outside the immediate environment of materials for reducing losses. Information will be given on recommended practices, including structures, and the farmers asked to assess these recommendations in light of their own situation. At the end of the dialogue process the farmers will identify practices which they would be willing and able to adopt. Then the group will select individuals to test the practices: these individuals will receive commodities requiring financial resources on a grant basis. The farmers may identify improvements in their normal storage cribs which will require minimum access to materials not locally available but they may also be interested in trying cribs and drying platforms which require purchased materials not locally available. The discussion group will set up a system for the community to monitor the degree to which the improved technologies reduce grain losses.

The participatory approach called for under this project is taught at various training courses in Kenya, although it has not been institutionalized in the training of LEOs and HEs. Persons at the Institute of Adult Studies and the Rural Services Coordination and Training Unit (MEP) as well as individuals scattered throughout various organizations are experienced trainers in the method. However, too often the training in the facilitator approach is not combined with the teaching of cognitive skills and management. Also, in most cases the teachers have been unable to be involved in a follow-up program of their trainees.

The Field Trials and Demonstration Unit in consultation with local officials will select communities based on different production types and ecological factors. A team consisting of a facilitator fluent in Swahili, a grain drying and storage specialist, and an artist will be involved in the dialogue process with members of these communities. (Representatives including husbands from several locally based women's groups may make up the discussion group.) The role of the artist will be to give formal expression to the ideas generated as well as to summarize key points. The dialogue which is expected to continue over several days and takes into account time constraints on male and female farmers and allows for individual reflection, will also be taped and photographed by team members. The local agricultural extension agent or home economist will be expected to attend and participate in the discussions.

After the team of experts have covered some communities, they will have a better understanding of the constraints to adoption of the recommended practices by smallscale farming households and the types of practices farmers are willing and able to change. The acceptable structures will have been constructed and trials in progress. The FTDU will carefully monitor (including through photographs) the use and results of the trials to assess the extent to which grain losses are reduced. Once the practices are judged to be economically feasible in reducing losses, representatives of groups outside the selected communities will be financed by the project to make field visits to talk with the farmers who have tested the improved practices and see them in operation.

The FTDU Non-formal Education Specialist will devise modules for field agents to use in dialogues with groups and oversee the development of supportive materials such as slides, tapes and posters. The aim of the materials will be to encourage discussions. The modules and supportive materials will be used in training extension agents in the facilitator approach to the introduction of improved postharvest technologies. The FTDU team may choose to experiment with who should be the facilitator: the LEOs, HEs and/or community development assistants. It is anticipated that the Institute of Adult Studies will be involved in training the extension agents as well as other postharvest specialists, e.g., divisional officers, in the facilitator approach to reduction of grain losses.

The modules and supportive audio-visual materials designed for extension agents to use with groups will be made available to voluntary and private organizations. These organizations can use the materials

in training persons to work with farmers on postharvest practices as well as in direct discussions with farmers. The FTDU will be responsible for liaising with potential user organizations and make these materials available to them. Furthermore, the modules and audio-visual materials can be used throughout Kenya since they will refer to a process rather than giving definitive answers to problems associated with grain losses.

Training of extension agents and creating an awareness of this approach amongst their superiors is expected to positively impact on their other responsibilities. To date, most extension agents are engaged in a one-way communication process, that is giving farmers advice, rather than understanding the reasons for the farmers actions and their constraints to adoption of recommended innovations.

Reports through the mass media, such as the radio and newspapers, on the project will also stimulate interest in the methodology as well as the results.

The technologies identified by the FTDU as having an optimal pay-off in reducing grain losses but which require a greater input of labor and financial resources are expected to be adopted by the more progressive smallscale farmers and those with more land under grain crops. If the recommended technologies are economically sound, this group of farmers will adopt them with a minimum extension effort. These farmers will learn about the recommendations, and details of inputs, costs and savings through the radio, pamphlets, newspaper articles and the Kenya Farmer Association Journal. (These will be developed by short-term consultants.) Furthermore, they can observe demonstration models at the FTCs and local agricultural shows.

## SOCIAL SOUNDNESS ANALYSIS

### SPREAD EFFECTS

The dialogue approach to be used by the FTDU in the identification of improved postharvest technologies which are acceptable to smallscale farmers will positively influence the spread of improved practices. First, it is anticipated that some groups will identify structures, such as improved storage cribs, and techniques, such as tin cans used as rat guards, which are within their skill level to construct and for which materials are readily accessible. The techniques and practices thus identified are anticipated to initially spread through observation by visiting farmers. The adoption of improved practices by smallscale farmers outside the immediate impact area will be influenced to a great extent by information spreading by word of mouth. Relatives and friends visiting the immediate project sites will observe and learn of the results of the new practices and will carry information back to their neighborhoods. Also those from the project sites are anticipated to transmit information while on visits to relatives, friends and markets. Since in many parts of Western and Nyanza Province, there is a relatively high degree of physical mobility facilitated by access to transportation, the word should spread rapidly. And, if the materials are readily available and within the financial means of the farmers, the practices should diffuse.

SOCIAL SOUNDNESS ANALYSIS

ROLE OF WOMEN

The preceding exhibits in this Annex and the social consequences and benefit incidence part of the project description incorporate information on the role of women, their anticipated participation in the project and the way in which women will benefit from the project. For the project field component to be successful, women must be reached. Both the home economic extension agents and LEOs will be involved in the field process. In the selection of persons to be postharvest specialists at the divisional, district, provincial and national levels, the Project Agreement will require that the GOK meet a target goal of staffing at least fifteen percent of the specialist positions with qualified females.

The long-term technical assistance team will include at least one qualified woman. And, the project contractor will attempt to meet a target goal of obtaining the services of qualified women to fill approximately fifteen percent of the short-term consultancy positions. The males recruited for long- and short-term technical assistance ought to be sensitive to the key role that women play in postharvest responsibilities and constraints they face in improving their practices and from benefiting from current MOA extension and training approaches.

EXHIBIT I

CURRENT LOSSES

A. Definition.

For this project, postharvest losses are those grain weight (quality) losses attributable to birds, insects, rodents, and molds. Postharvest losses are tabulated from the time when grain is ready for harvesting, which is when the crops are physiologically mature. At maturity is when the maximum quantity of grain is available for consumption. In Kenya, postharvest losses can be more accurately referred to as postmaturity losses since most smallholders do not harvest their crops at physiological maturity, but one to two months afterward during which considerable losses occur. However, in this paper the losses will still be referred to as postharvest losses.

B. Methodology.

Considerable controversy remains concerning the accuracy of grain loss estimates. A 1978 National Academy of Science Study states, "the low accuracy of loss survey techniques on the one hand, and the limitations of extrapolating from even a specific, well characterized loss situation on the other, makes reliable economic loss estimates very difficult to obtain," (8,p. 1-2). The loss estimates used by this project were determined by DPRA. Briefly, the DPRA loss estimation methodology was to sample 188 slightly above average smallholders nationwide and various off-farm locations, such as rural markets, during October-December, 1979. A total of 320 smallholder and 151 off-farm grain samples were collected. Due to the importance of maize as the country's primary staple, it received more emphasis in the study. Most of the grain samples were maize, while 60 bean and 18 sorghum samples were collected. The grain was analyzed for weight loss due to birds, insects, and molds. Due to the sampling methodology used, rodent losses were not examined. DPRA extrapolated from this sample to obtain estimates for nationwide losses of maize, bean, and sorghum losses. (See Annex A, Exhibit 1 for a detailed review of the DPRA study).

EXHIBIT 1 (Cont'd.)

ANNEX D

C. Conclusions.

The DPRA loss survey technique estimated Kenya's 1979 postharvest maize losses on smallholdings by birds, insects, and molds, expressed as a percentage of actual production at physiological maturity, was almost 16 percent (see Table D-1). About six percent occurs between physiological maturity and harvest, while the rest is lost after harvest. Birds accounted for 1.0 percent of maize lost, while mold and insects accounted for 11.0 and 4.0 percent, respectively.

On a national scale, these losses are equivalent to approximately 227,000 metric tons of maize (see Table D-2). Using the world market price of maize and including the cost of shipping into Kenya provides a monetary equivalent of the estimated quantity of maize lost. At the time of writing in early 1980, the world price of maize was approximately \$115 per metric ton at the Gulf Ports, U.S.A. According to officials at the National Cereals and Produce Board, cost of transportation and insurance to Mombasa is \$50 a ton and the cost of rail transport to Nairobi is K.Sh. 20 a bag. At 90 Kg. to a bag and a shadow price of 0.67, the latter works out to approximately \$20 metric ton. Therefore, for the purposes of this project, maize that is lost was valued at \$185 a ton or K.Sh. 1,332 a ton. With this as a benchmark, the estimated value of maize lost in about U.S. \$42.0 million (K.Sh. 304.7 million).

The DPRA estimated losses for beans and sorghum are subject to greater error since the samples upon which the estimates were based were much smaller than for maize. Table D-3 summarize these losses. The quantity of beans and sorghum lost were estimated to be about 3,168 MT and 78,000 MT, respectively. The estimated value of these losses is approximately U.S. \$27.0 million. Thus, the total value of the three grains surveyed is upwards of U.S. \$69.0 million. The estimated maize losses alone are equivalent to about fifty percent of metric tonnage of all basic foods imports planned for 1980. Furthermore, an examination of the DPRA study shows the grain losses may be underestimated due to the biases inherent in the methodology uses (see Annex A, Exhibit 1).

The estimates of total losses nationwide provide a perspective of the impact of these losses on the national

EXHIBIT 1 (Cont'd.,

TABLE D-1:  
Kenya: Estimated post harvest losses of maize on smallholdings by birds, insects,  
and molds, 1979

	apparent consumption and/or loss during period ( <sup>'</sup> 000 bags)	stored at end of period ( <sup>'</sup> 000 bags)	Type of Loss							
			Bird Loss		Insect Loss		Mold Loss		Total Loss	
			(%)	( <sup>'</sup> 000 bags)	(%)	( <sup>'</sup> 000 bags)	(%)	( <sup>'</sup> 000 Bags)	(%)	( <sup>'</sup> 000 Bags)
Potential production at maturity		15,991								
	191		1.19	191.1					1.19	191.1
Actual Production at maturity		15,800								
	920.0				.59	93.1	5.23	826.5	5.82	919.6
Actual Production at Harvest time		14,880								
	2,370				.117	16.0	4.11	562.9	4.23	578.9
One month after Harvest		12,510								
	2,606				.303	34.0	2.07	232.0	2.57	266.0
Two Months		9,904								
	1,826				.602	54.2	0.80	71.9	1.40	126.1
Three Months		8,076								
	2,159				.849	59.4			.85	59.4
Four Months		5,917								
	2,291				1.198	57.1			1.20	57.1
Five Months		3,626								
	1,416				1.689	49.3			1.69	49.3
Six Months		2,210								
	.431				2.321	47.5			2.38	47.5
Seven Months		1,779								
	260				3.357	55.4			3.36	55.4
Eight Months		1,519								
	434				4.733	61.6			4.73	61.6
Nine Months		1,084								
	463				6.674	59.9			6.67	56.9
Ten Months		621								
	511				9.411	48.1			9.41	48.1
Eleven Months		110								
	110				13.269	7.3			13.27	7.3
Twelve Months		0								
TOTAL LOSS				191.1		639.9		1,693.3		2,524.3
Percentage of Actual Production at Maturity			1.21		4.05		10.72		15.98	

Source: (3, p. V-15)

EXHIBIT 1 (Cont'd.)

level. In addition to examining the losses in terms of the cost of importing that quantity of maize to help satisfy national demand, there are other impacts. Purchasing large quantities of food in the world market uses Kenya's scarce foreign exchange resources. The reduction of grain losses would ease the competition for foreign exchange allowing the country to maintain a more favorable consumption -- investment balance. Lower losses would also increase the supply of grain in the rural areas where GOK food distribution costs are highest.

On the individual smallholder level, a reduction in grain losses is also advantageous, but for different reasons. By reducing losses, the smallholder will have more for consumption or sale. In either use, the smallholder's general welfare would be improved. For those smallholders sampled by DPRA, whose mean quantity stored was about 1,440 Kg. of maize per season, the loss is approximately 230 Kg. or 2.5 bags (See Table D-4). Almost one bag is lost before harvest and the other 1 1/2 bags are lost after harvest.

The quantity of maize lost after it has been placed in storage is equivalent to about 10.5% of the total quantity of grain stored. This estimate is in line with what smallholders perceived their losses to be (10%). The preharvest loss would most likely not be known to most smallholders since they usually do not harvest at physiological maturity, thus having no basis to compare with.

Based on Kenya's integrated Rural survey's (6) estimates of household cash income, the value of maize lost is equivalent to about 6.5 percent of cash income. In the project area, the cost of maize purchased by smallholders is the third largest food expense item amounting to 15 percent of total expenditures on food items. These findings both suggest that reductions in maize losses would be improving the smallholders welfare by reducing outlays on a major household item.

For both the national government and individual smallholders, the DPRA estimated losses are significant.

Nutritional Aspects.

Although this project is primarily concerned with reducing absolute grain losses, there are also losses in quality under current smallholder practices. The losses estimated by DPRA were absolute losses attributable to birds, insects, and molds. However, there is damaged grain remaining after the birds, insects, or molds have taken their share. The damaged remainder is less nutritionally valuable than undamaged kernels because insects and molds have a tendency to attack the more nutritious parts (i.e., protein core) of the kernel.

DPRA also found the presence of aflatoxin, a highly toxic substance strongly suspected of contributing to liver cancer in humans. Out of 133 households sampled, about 35 percent were suspected of having aflatoxin contamination, and 14 percent of the samples contained a presumptive level of 40 parts per billion (the USFDA tolerance level allowed for animal feed is 20 ppb).

As is the case with health and nutritional issues, it remains difficult to place a quantifiable value, monetary or otherwise, on improved health and nutritional status. By reducing grain losses, the available supply of food increases, thereby positively impacting on health and nutrition. Along with reducing grain losses, the proportion of damaged kernels is also reduced, again contributing positively to better health.

The reduced grain losses not only helps by directly reducing the need for basic food grain imports and increasing available food supplies for the rural smallholders, it also contributes positively toward improving the general health of a country.

EXHIBIT 1 (Cont'd.)

Table D-2: Estimated Monetary Value of Maize Lost, 1979.

1.	a)	Estimated bags lost during 1979 by DPRA (1 bag = 90 Kg)	2,524,300 bags
	b)	Metric Ton (MT) equivalent	227,187 MT
2.	a)	Cost of shipping maize from gulf ports (USA) to Nairobi, Kenya	185
	b)	Dollar value of maize lost	42.0 million US\$
	c)	Kenya Shilling Equivalent**	304.7 million K.Sh.

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* Cost estimated in early 1980 world price of maize	\$115/MT
Cost of transport and insurance to Mombasa	50/MT
Cost of transport and insurance to Nairobi at a shadow price of 0.67	<u>20/MT</u>
Total Cost	\$185/MT

\*\* 1 US \$ = 7.25 Kenyan Shillings

Table D-3: Estimated Bean and Sorghum Losses, 1979.

Crop	Quantity Lost	K. Sh.	US \$	Loss as Percent of Actual Pro- duction at maturity
Beans	3,168/MT	9.6 mil.	1.3 mil.	2%
Sorghum	78,000/MT	185.0 mil*	25.7 mil.	46%*

\* DPRA notes the estimate seems high

Source (3, p.V-25)

EXHIBIT 1 (Cont'd.)

Table D-4: DRPA Estimates of Average Smallholder Losses of Maize  
1979

Production of Maturity:	1519 Kg or 16.9 bags
Loss till stored:	79 Kg or 0.9 bags
Stored:	1440 Kg or 16.0 bags
Loss during storage:	151 Kg or 1.6 bags
Available for consumption:	1289 Kg or 14.4 bags
Total Loss due to birds, insects, and molds	230 Kg or 2.5 bags

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Source: (3, p. V-24).

EXHIBIT 2

POSSIBLE INTERVENTIONS

A very large number of possible interventions (or models) could be conceived and evaluated. Those examined were determined by DPRA to be the "most logical" (1,p. V-21). Table D-5 presents the postharvest losses by birds, insects, and molds over a 12 month period.

With the data available, DPRA examined five different interventions to determine their effects on maize losses. The interventions (models) evaluated were:

- (1) Shell grain after traditional crib drying, treat with an insecticide (which is 75 percent effective), and store in bulk containers, Table D-6.
- (2) Harvest uniformly during the first month after physiological maturity, sun dry on a platform, and then store in a traditional crib. Here the assumption was made that one seventh of the crop would be harvested, husked and sun dried on a platform on the ear (cob) for three days. It would then be shelled and sun dried for one more day to reduce the moisture to the 14 percent range. The harvest and drying would be complete in one month after maturity compared to the present system which leaves the crop in the field for six to eight weeks after maturity. All loss reduction accrues in the field and through mold reduction while drying normally in the crib. It was assumed that field losses would be reduced 75 percent since most insect and mold loss occurs after the grain is approaching a fairly dry condition, Table D-7.
- (3) Begin harvest at maturity, sun dry, shell, treat all grain with an insecticide which is 75 percent effective, and store in traditional crib. Loss reductions accrue in the field and throughout the storage period; Table D-8.

EXHIBIT 2 (Cont'd.)

Table D-5:

Kenya: Estimated post harvest losses of maize on smallholdings by birds, insects, and molds, 1979

	apparent consumption and/or loss during period ( <sup>'000</sup> bags)	stored at end of period ( <sup>'000</sup> bags)	Type of Loss				Total Loss	
			Bird Loss		Insect Loss		Mold Loss	
			(%)	( <sup>'000</sup> bags)	(%)	( <sup>'000</sup> bags)	(%)	( <sup>'000</sup> Bags)
Potential production at maturity		15,991						
	191		1.19	191.1			1.19	191.1
Actual Production at maturity		15,800						
	920.0				.59	93.1	5.23	826.5
Actual Production at Harvest time		14,880						
	2,370				.117	16.0	4.11	562.9
One month after Harvest		12,510						
	2,606				.303	34.0	2.07	232.0
Two Months		9,904						
	1,826				.602	54.2	0.80	71.9
Three Months		8,076						
	2,159				.849	59.4		.85
Four Months		5,917						
	2,291				1.198	57.1		1.20
Five Months		3,626						
	1,416				1.689	49.3		1.69
Six Months		2,210						
	431				2.381	47.5		2.38
Seven Months		1,779						
	260				3.357	55.4		3.36
Eight Months		1,519						
	434				4.733	61.6		4.73
Nine Months		1,084						
	463				6.674	59.9		6.67
Ten Months		621						
	511				9.411	48.1		9.41
Eleven Months		110						
	110				13.269	7.3		13.27
Twelve Months		0						
TOTAL LOSS				191.1		639.9		1,693.3
Percentage of Actual Production at Maturity			1.21		4.05		10.72	15.98

Source: (3,p.V-17)

EXHIBIT 2 (Cont'd.)

Table D-6:

Loss reduction intervention: Crib drying followed by shelling and insect treatments

	apparent consumption and/or loss during period	Stored at and of period *	TYPE OF LOSS				TOTAL LOSS	
			BIRD LOSS	INSECT LOSS		MOLD LOSS		
	('000 Bags)	('000 Bags)	(%)	('000 Bags)	(%)	('000 Bags)	(%)	('000 Bags)
Potential pro- duction at maturity	191	15,991	1.19	191.1			1.19	191.1
Actual prod- uction at maturity	920	15,800			.59	93.1	5.23	826.3
Actual Prod- uction at harvest time	2,370	14,880			.117	16.0	4.11	362.9
One month after harvest	2,606	12,510			.303	34.0	2.07	232.0
Two Months	1,826	9,904			.602	54.2	.80	71.9
Three Months	2,159	8,076			.21	18.9		.21
Four Months	2,291	5,917			.29	30.0		.43
Five Months	1,416	3,626			.42	20.0		.42
Six Months	431	2,210			.60	17.5		.60
Seven Months	260	1,779			.84	16.75		.84
Eight Months	434	1,519			1.18	19.13		1.18
Nine Months	463	1,084			1.67	21.73		1.67
Ten Months	511	621			2.35	20.03		2.35
Eleven Months	110	110			3.32	12.13		3.32
Twelve Months		0						
TOTAL LOSS				191.1		273.45		1,693.3
Percentage of Actual Prod- uction at Maturity			1.21		1.73		10.72	14.29

\*The DPRA analysis did not alter harvest nor stored grain levels due to the reduction in preharvest losses. The result is that the figures for stored grain at the end of each period is inaccurate, however, the impact of this error would not appreciably change the results.

Source: (3 p. V-16).

EXHIBIT 2 (Cont'd.)

**Table D-7:**  
Loss reduction-intervention: Early harvest and platform drying

	Apparant consumption and/or loss during period ( <sup>'000</sup> Bags)	Stored at end of period * ( <sup>'000</sup> Bags)	Type of Loss				Total Loss ( <sup>'000</sup> Bags)		
			Bird Loss (%) ( <sup>'000</sup> Bags)	Insect Loss. (%) ( <sup>'000</sup> Bags)	Hold Loss (%) ( <sup>'000</sup> Bags)				
Potential production at maturity		15,991							
Actual production at maturity	191		1.19	191.1			191.1		
Actual production at harvest time	299	15,800		.58	93.10	1.30	205.99	1.90	299.0
One month after harvest	2,370			.117	16.02			.12	16.00
Two Months	2,606			.303	33.96			.30	33.96
Three Months	1,826	9,904		.602	54.12			.60	54.12
Four Months	2,159	8,076		.849	59.40			.85	59.40
Five Months	2,219	5,917		1.198	57.16			1.20	57.16
Six Months	1,416	3,626		1.689	49.29			1.69	49.29
Seven Months	431	2,210		2.381	47.49			2.38	47.49
Eight Months	260	1,779		3.357	55.36			3.36	55.36
Nine Months	434	1,519		4.733	61.60			4.73	61.60
Ten Months	463	1,044		6.674	56.90			6.67	56.90
Eleven Months	511	621		9.411	34.40			9.41	34.40
Twelve Months	110	110		13.269	7.30			13.27	7.30
TOTAL LOSS				191.1	626.10		206.6		1,023.81
Percentage of actual production at maturity			1.21	3.96		1.31		6.48	

\* See note on Table 5.

Source: (3,p. V-17).

EXHIBIT 2 (Cont'd)

Table D-8:

Loss reduction intervention, early harvest, platform drying, and complete insect treatment

	Apparant consumption and/or loss during period ( <sup>'</sup> 000 Bags)	Stored at end of period* ( <sup>'</sup> 000 Bags)	Type of Loss				Total Loss		
			Bird Loss (%)	Insect Loss (%)	Mold Loss (%)	Total Loss (%)			
Potential Production at maturity	191	15,991	1.19	191.1			1.19	191.00	
Actual production at maturity	299	15,800			.58	93.10	1.30	205.99	
Actual production at harvest time	2,370	15,501			.03	4.10		4.10	
One Month after Harvest	2,602	12,510			.08	8.95		8.95	
Two Months	1,826	9,904			.15	13.48		13.48	
Three Months	2,159	8,076			.21	14.70		14.70	
Four Months	2,291	5,917			.30	14.30		14.30	
Five Months	1,415	3,626			.42	20.04		20.04	
Six Months	431	2,210			.60	11.96		11.96	
Seven Months	260	1,779			.84	13.85		13.85	
Eight Months	434	1,519			1.18	15.40		15.40	
Nine Months	463	1,084			1.67	14.24		14.24	
Ten Months	511	621			1.35	8.59		8.59	
Eleven Months	110	110			1.32	1.66		1.66	
Twelve Months		0							
<b>TOTAL LOSS</b>				<b>191.1</b>		<b>266.60</b>		<b>206.60</b>	<b>624.30</b>
Percentage of actual production at maturity			<b>1.21</b>		<b>1.43</b>		<b>1.31</b>		<b>3.95</b>

\*See note on Table D-6.

Source: 3, p. V-18).

EXHIBIT 2 (Cont'd.)

- (4) Same as "3" but only one-half of the grain is shelled and treated with an insecticide. The treated grain was used after the untreated grain, Table D-9. This practice would reduce shelling labor at harvest time and save some cost for insecticides, thus, be less expensive labor and costwise, than intervention "3".
- (5) Harvest at about 25 percent moisture, about one month after maturity, crib dry in cribs about one and one-half meter wide then shell and treat one-half the grain. (Tests by FAO during 1979 indicate the probable success of this practice in reducing field and storage losses.) Based upon the DPRA survey results, FAO unpublished data, and estimates by the DPRA team, it is estimated that field mold losses will be reduced 50 percent, storage mold losses by 50 percent because crib drying time will be reduced by over 50 percent compared to present practice, and insect losses on one-half the crop would be reduced by 75 percent. Table D-10.

Tables D-6 through 10 present the scenarios of the losses which occur with each of the interventions selected. Table D-11 summarizes the loss results from all the models. DPRA concludes that the most attractive alternative for future analysis is number 4, harvesting early to reduce field losses followed by platform drying to eliminate the mold losses while crop dried in the crib and treating one-half the crop with insecticides. This intervention will reduce smallholder losses by about 72.5 percent, which is equivalent to 164,000 MT. Using the value for importing a metric ton of maize into Kenya results in a possible value of grain saved at over US\$ 30 million (K.Sh. 220 million).

Advantages seen for this recommendation include:

- (1) Harvest is spread over a one month period which should reduce peak labor requirements.
- (2) Harvest will be completed about one month earlier giving more time to prepare for the next crop in two crop regions.
- (3) The only new facilities required will be a relatively inexpensive drying platform which can usually be made from local materials, a mat to lay on the platform when drying shelled corn and a cover to protect

EXHIBIT 2 (Cont'd)

TABLE D-9:

Loss reduction intervention: Early harvest, platform drying, shell and treat one-half.

	Apparant consumption and/or loss during period ( <sup>'000</sup> Bags)	Stored at and of period * ( <sup>'000</sup> Bags)	Type of Loss							
			Bird Loss		Insect Loss		Mold Loss		Total Loss	
			(%)	( <sup>'000</sup> Bags)	(%)	( <sup>'000</sup> Bags)	(%)	( <sup>'000</sup> Bags)	(%)	( <sup>'000</sup> Bags)
Potential production at maturity		15,991								
	91		1.19	191.1						191.1
Actual Production at maturity		15,800								
	299				.58	93.10	1.30	205.99	1.20	299.09
Actual production at harvest time		13,501								
	2,370				.117	16.00			.117	16.00
One month after harvest		12,510								
	2,606				.303	33.90			.303	33.90
Two months		9,904								
	1,826				.602	54.10			.602	54.10
Three months		8,076								
	2,159				.210	14.70			.210	14.70
Four months		5,917								
	2,291				.300	14.30			.300	14.30
Five months		3,626								
	1,416				.420	12.25			.420	12.25
Six months		2,210								
	431				.600	11.96			.600	11.96
Seven months		1,779								
	260				.840	13.85			.840	13.85
Eight months		1,519								
	434				1.183	15.35			1.180	15.35
*Nine Months		1,084								
	463				1.670	14.24			1.670	14.24
Ten Months		621								
	511				2.350	8.58			2.350	8.58
Eleven Months		110								
	110				3.320	1.82			3.320	1.82
Twelve Months		0								
TOTAL LOSS				191.1		304.10		205.99		701.00
Percentage of actual production at maturity			1.21		1.92		1.30		4.44	

\*see note on Table D-6.

Source: (3,p. V-19)

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ANNEX D

Table D-10:

Medium harvest, dry in narrow crib, shell, and treat one-half

	Apparant consumption and/or loss during period ( <sup>'000</sup> Bags)	Stored at end of period * ( <sup>'000</sup> Bags)	Type of Loss			Total Loss ( <sup>'000</sup> Bags)
			Bird Loss (%) ( <sup>'000</sup> Bags)	Insect Loss (%) ( <sup>'000</sup> Bags)	Mold Loss (%) ( <sup>'000</sup> Bags)	
Potential production at maturity		15,991				
	191		1.19	191.10		1.19 191.10
Actual production at maturity		15,800				
	458			.29 46.40	2.61 411.76	2.90 458.16
Actual production at harvest time		15,342				
	2,370			.117 16.02	2.05 280.70	2.05 296.72
One month after harvest		12,510				
	2,606			.303 33.96	1.03 115.40	1.03 149.26
Two months		9,904				
	1,826			.602 54.12		.60 54.12
Three months		8,076				
	2,159			.210 14.69		.21 14.69
Four months		5,917				
	2,291			.300 14.31		.30 14.31
Five months		3,626				
	1,416			.420 12.96		.42 12.96
Six months		2,210				
	431			.600 17.51		.60 17.51
Seven months		1,779				
	260			.840 13.85		.84 13.85
Eight months		1,519				
	434			1.200 19.79		1.20 19.79
nine months		1,084				
	463			1.700 22.13		1.70 22.13
Ten months		621				
	511			2.300 19.61		2.30 19.61
Eleven months		110				
	110			3.300 12.06		3.30 12.06
Twelve months		0				
TOTAL LOSS				191.1 296.70		807.86 1,295.57
Percentage of actual production at maturity			1.21	1.88	5.11	8.20

\* see note on Table D-6.  
Source: ... (3.p. V-20)

Table D-11: Effect of interventions on reduction of maize losses

Type of treatment	Present practice	(1) Crib drying, shell, insect treatment	(2) Early harvest, platform dry	(3) Early harvest, platform dry, treat 100%	(4) Early harvest, platform dry, treat 50%	(5) Medium harvest dry in narrow crib, treat 50%
Total loss, '000 bags	2,524.0	2,257.0	1,023.0	624.0	701.0	1,295.00
Loss, Percent	16.0	14.3	6.5	4.0	4.4	8.5
Reduction in loss, '000 bags		267.0	1,501.0	1,900.0	1,823.0	1,229.00
Metric Ton Equivalent		24,030	135,090	171,000	164,070	110,610
Reduction in loss, percent		10.6	59.3	75.0	72.5	48.4
Value of grain saved, US \$000 MT		4,446	24,992	31,635	30,353	20,463
Value of grain saved, K.Sh.000 MT*		32,230	181,189	229,354	220,059	148,356

\*U.S.\$1 = 7.25 K.Sh.

EXHIBIT 2 (Cont'd.)

from rain. The cover can be sheet metal for greater durability, but would also be higher initial cost; or a plastic sheet, which would be much cheaper but less durable.

- (4) Existing cribs need not be replaced but should eventually be replaced with cribs or storages which provide better rodent protection and better ventilation.
- (5) By shelling and treating only half the crop there will be a lower cost for insect protectants and if insect-proof containers (gourds, jars, etc.) are used only half as many will be required. If insect-proof containers are used insect losses should be reduced almost 100 percent of half the crop rather than the 75 percent on which was assumed here.

The recommended change technique involves procedures which are known in Kenya. Most farmers are aware that grain can be harvested at maturity and dried in the sun because many, particularly smaller farmers, practice this to obtain grain for immediate consumption when supplies of the previous crop are depleted. A lot of farmers are aware of drying crops because the technique is widely used by smallholders for drying coffee and pyrethrum. The use of insect protectants is well known because 40 percent of the smallholders interviewed now practice it in some form.

Losses of sorghum and beans can be reduced by the same basic techniques. However, only 18 samples of sorghum were collected during the field survey, the number of samples collected was too small to determine the effect of storage time on level of loss or to estimate preharvest losses. The average mold loss was 6.3 percent and the average insect loss was 40 percent. Bird losses could not be estimated but are generally estimated to be higher than for maize. Harvesting at maturity, platform drying, threshing and applying an insect treatment is estimated to reduce sorghum losses to 10 percent.

The Integrated Rural Survey for 1975-76 reported 445,000 holdings producing an average of 493 Kg/holding or a total of

EXHIBIT 2 (Cont'd.)

219,000 tons. Reducing sorghum losses from 46 percent as found to 10 percent would reduce losses from 100,000 MT to 22,000 MT or a saving of 78,000 MT. With average sorghum prices of 2.37 K.Sh/kg the loss reduction would have a farm value of K.Sh. 185,000,000 or \$25,675,000. It is very doubtful that this loss saving is possible because the percentage loss in the 18 samples found seems inordinately high. However, losses might be reducible by 50 percent to K.Sh 100 million or \$7 to \$14 million as a more reasonable estimate. Farms which have a drying platform for maize would have no additional facility costs when drying sorghum.

The losses of beans were already low (2%) compared to maize (16%) and sorghum (46%), thus the value of loss reduction was not determined.

EXHIBIT 3

ECONOMIC COMPARISON OF CURRENT PRACTICES AND THE  
RECOMMENDED DPRA INTERVENTION.

To determine the worth of adopting the proposed intervention, the costs and returns involved were examined. Table D-12 presents the costs of the drying platform recommended by DPRA. Although the improved storage crib was not selected as the recommended intervention by DPRA, its construction costs are presented as a comparison point. The platform's imputed cost, excluding labor, from using locally available materials was around K.Sh 175/-. However, the project plans to provide, in-kind, the plastic sheet, thus reducing the cost of materials to about K.Sh 155/-. The improved local crib, at its cheapest is almost twice as expensive as the drying platform. Its construction time would also be more than the estimated 24 hours needed to construct the platform.

Analyzing the recommended intervention independent of the farmer's entire operation, (Table D-13) shows an undiscounted benefit-cost ratio of 8.9/1. The undiscounted return to labor of K.Sh 3.0 per hour was about the same as the value of smallholder supplied labor found by an AID financial study (7) undertaken in the project area. The profitability of the intervention itself is favorable, however, if the return to labor were above the estimated average in the project area, it would have been more favorable. For this intervention, the largest imput by far is the smallholder's labor.

The next step in the analysis is to determine the impact of this intervention on the smallholder's entire farming operation. Due to the unavailability of information concerning the smallholder's entire operation (i.e., maize, sorghum, livestock, etc.), the analysis was restricted only to examining the impact of the DPRA intervention on maize production.

The average smallholder in the project area produces about 1,900 kg per year, which is above the national average. Table D-14 summarizes selected characteristics of the smallholding. The imputed value of maize produced is about K.Sh 1577 per year. This was based on the average price farmers have received over the past five years. The imputed costs of maize production, excluding crib construction and maintenance, is about K.Sh 1533 per year. Although the spread appears small (K.Sh 44 per year),

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Table D-12: Cost of Constructing Drying Platform and Improved Storage Crib

<u>Item</u>	<u>Cost</u>
1. Drying platform	
a) Locally available materials <sup>1</sup>	155 K. Sh.
b) Plastic sheet or sheet metal	20 K. Sh. 285 K. Sh.
2. Storage Crib	
a) improved storage crib, purchased materials and hired labor **	1,250 K. Sh.
b) Local crib adapted with poles, rat guards, and narrower design	300 K. Sh./Max.
3. Cost range estimates by DPRA of recommended innovations (platform and crib)	475 - 1,630 K. Sh.

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\* Estimated construction time 24 hours.

\*\* DPRA estimates (3,p. V-11) no cost breakdown provided. Annex P, Tables A & B lists materials needed to make crib and drying platform and provides detailed drawings.

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Table D-13: Costs and Returns of DPRA Recommended Practice for a Smallholding in Project Area.

	<u>Crop Year</u> (K.Sh.)	
	1	2-10
dryer construction platform with material (plastic cover provided in kind)	155	0
Annual costs of Malathion at 12 K.Sh/kg with 1/2 crop treated	5	5
Total Costs	160	5
Total Value*	183	183
Undiscounted benefit - cost ratio**:	8.9	
Benefit-cost ratio discounted at 15%	5.7	
Undiscounted average return to labor for an individual smallholder***	3.0 K.Sh/hr.	

\*Losses on 1,900 Kg. stored:  
 current practice - 16% loss 304  
 recommended practice  
 4.4% loss 84  
 loss reduction 220

Value of maize 0.83 K.Sh/kg. which is average value of maize received by smallholders during 1975-1979.

\*\* Excludes family labor.

\*\*\* 24 hours to construct, 56 hours of annual turning time, and 2 hours annual maintenance

EXHIBIT 3 (Cont'd.)

Table D-14: Selected Summary Profile of the Average Smallholder in the Project Area.

<u>Characteristic</u>	<u>Mean Imputed Value</u>
1. holding size	2.2 hectares
2. holding under maize production*	55 percent (approx.)
3. holding's maize production**	1,900 Kgs/Holding/yr.
4. cost of maize production, excluding crib costs ***	1,533 K.Sh/hectare/yr
5. cost of traditional crib construction****	257 K.sh/crib/10yrs.
6. cost of traditional crib maintenance***	25 K.sh/crib/yr
7. value of maize 1975/79 (K.sh. 83 per 100 kg.)	1,577 K.sh/holding/average yr.

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\*Estimated, based on 7, p.96 and author's discussion with GOK Officials.

\*\*Includes both hybrid and traditional maize varieties.

\*\*\*Adapted from: costs include seed, hired labor, imputed value of family labor, management, overhead. Value of land per year was proxied by using rent paid per year. Information on rates charged for renting land in project area from MOA officials and residents in project area by Mission.

\*\*\*\* DPRA estimate (e,p.IV-3).

Source: Adapted from (1), (2), (3), (4), and (7).

EXHIBIT 3 (Cont'd.)

it must be remembered that these are imputed values not actual cash flows, and the complementarity of the maize operation with the farm's overall operation has not been accounted for.

Tables D-15 and D-16 present the costs and value of the current and modified practices. A ten year time period of analysis was used since that was the expected useful life of a traditional storage crib found by DPRA. It was assumed the useful life of drying platform was also ten years although DPRA did not estimate it. The plastic sheet for the platform will be provided in kind during project and in future years in return for a smallholders attendance on grain storage courses.

Table D-17 presents the internal rates of return, benefit-cost ratios and net present values of the two operations. To determine the later two measures, a discount rate of 15 percent was used. The analysis shows for both operations (current and recommended) a negative rate of return. Several points must be remembered when interpreting this. First, an imputed value of labor was used. This value was drawn from an earlier study in the project area. The labor values used reflected that family labor is worth less than hired labor, which is usually hired during peak labor demand times, thus costing more. Second, the internal rate of return (IRR) and net present values (NPV) are, due to the imputed value of labor, imputed values themselves. Thus, the NPV of K.Sh. -172 is not an actual net cash loss, it is an imputed economic loss. Finally, the results are not substantially different in direction or magnitude from other works done in Kenya. The aforementioned study (7) found smallholders in the project area lost an average of K. Sh. 10 per year during 1977. A more recent analysis (1979) estimated commercial farmers were losing over K.Sh. 100 per acre (K.Sh. 247 per hectare). The low levels of indigenously financed smallholder development activities and a continuing migration to the urban areas also reflects on the fact that smallholding farming is not a very profitable undertaking.

More importantly for this project, though, is the almost negligible difference between the benefit-cost ratio between the current and recommended practices. This implies that while summing the benefits across all the adopting smallholders amounts to considerable maize saved, the benefits to an individual smallholder may not be perceived to be worth the extra effort that he must

EXHIBIT 3 (Cont'd)

Table D-15: Estimated Costs and Value of Current Maize Production and Storage Practices on an Average Smallholding in the Project Area.\*

	<u>Crop Year</u> (K.Sh.)	
	<u>1</u>	<u>2-10</u>
1. Total cost of maize production	1,824	1,567
a) production costs, excluding storage	1,512	1,512
b) crib construction (traditional)	257	0
c) crib maintenance	55	55
2. Total value of maize produced	1,577	1,577
3. Imputed cash flow	-247	10

\*See Table D-14 for definitions.

EXHIBIT 3 (Cont'd.)

**Table D-16: Estimated Cost and Value of Current Maize Production Practices and DPRA Recommended Innovations on an Average Smallholding in Project Area.\***

	<u>Crop Year</u> (K.Sh.)	
	1	2-10
1. Total costs of maize production	2,148	1,688
a) production costs, including DPRA recommended practices	1,512	1,512
b) crib construction (traditional)	275	0
c) crib maintenance	55	55
d) grain dryer construction**	155	0
e) labor to construct dryer	48	0
f) grain dryer maintenance***	4	4
g) labor to use grain dryer****	112	112
h) insecticide (treating 1/2 crop)	5	5
2. Total value of maize produced	1,760	1,760
3. Imputed cash flow	-388	72

\*See Table D-14 for definitions.

\*\*Excluding plastic cover cost, which will be supplied in-kind.

\*\*\*DPRA has no maintenance estimate, thus author estimated two hours per year. Imputed value of labor used from information in (7,p.20)

EXHIBIT 3 (cont'd.)

Table D-17: Comparison of Estimated Costs and Value of Current and Recommended Practices on Average Smallholding in Project Area.

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<u>Current Practice</u>	<u>Value</u>
Internal rate of return (IRR)	- 28 percent
Benefit-cost ratio (B/C*)	0.98
Net present value (NPV*)	-172 K. Sh.
<u>Recommended Practice</u>	
IRR	- 8 percent
B/C*	1.00
NPV*	- 38 K. Sh.

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\*Discount rate of .15 percent used

EXHIBIT 3 (Cont'd.)

undertake. Recall most of the added effort is in the form of labor, not cash outlays. This suggests that working more will return more maize to him, but at roughly the same rate as his current effort. It suggests that the smallholder is close to the margin in terms of costs and benefits and whether he/she adopts will be his personal valuation of that additional bag of maize.

Not included in the above analysis was the generally improved quality of the stored grain and the resulting improved health and nutritional status. This would undoubtedly improve the benefit-cost ratio, but how much is indeterminate. If rodent losses (not estimated by DPRA) are as significant as smallholders estimate them to be (about 10 percent), then the profitability of the recommended practices would undoubtedly improve since these losses would also be reduced by this intervention. However, the percentage of losses due to rodents in the project area remains unknown.

These results imply that the extension of information to communicate all the sources and amounts of losses and the potential nutritional grains will be important in helping a smallholder determine whether or not to adopt, because if the smallholder is convinced his losses are larger than he currently perceives them, he will be more likely to adopt.

Due to the importance of the value of maize used in this analysis, a sensitivity analysis using alternatively higher maize prices was undertaken. Maize prices of 2.5 percent and 5 percent higher were examined. The analysis of only recommended intervention, did not change appreciably. The benefit-cost ratio rose slightly from 8.9 to 9.3 when the price rose by 5 percent (see Table D-18).

The sensitivity analysis for the overall maize production operation for both current and recommended practices shows no appreciable change in any of the benefit-cost ratios. The IRR and NPV were substantially altered (See Table D-19). With a 5 percent increase in the average price received by smallholders the IRR made the recommended practices change from a -8 operation to a positive 6 percent. The 5 percent increase in price also improved

EXHIBIT 3 (Cont'd.)

Table D-18: Sensitivity of Analysis of Recommended Maize Storage Practices to Changes in Value of Maize

	<u>Value of Maize (K.Sh/kilo)</u>		
	0.83	0.85	0.87
undiscounted benefit-cost ratio	8.9	9.1	9.3
undiscounted return to labor (K.sh/hr)	3.0	3.1	3.2
discounted benefit-cost ratios	5.7	5.9	6.0

EXHIBIT 3 (Cont'd.)

Table D-19: Sensitivity of Analysis of Current and Recommended Maize Production and Storage Practices to Changes in Value of Maize.

	<u>Value of Maize (K.sh/kilo)</u>		
	0.83	0.85	0.87
<b>current practice</b>			
IRR (%)	-28	- 9	1
B/C*	0.98	1.00	1.03
NPV*(K.Sh)	-172	21	210
<b>recommended practice</b>			
IRR (%)	- 8	0.4	6
B/C*	1.00	1.02	1.04
NPV*(K.Sh)	- 38	172	387

\*Discount rate = 15%

EXHIBIT 3 (Cont'd.)

the current practice IRR to a positive 1 percent from a minus 28 percent. With a 5 percent high maize value the resulting spread between the current and recommended practices became 5 percent this is not a large improvement. Again, the analysis did not account for the benefits gained from the quality improvements in the grain, nor reduction losses due to rodents, both which would improve the returns found by this analysis.

The possibility that those farmers who stored grain under the recommended practices would be able to sell their grain at a higher price later in the season was not quantitatively analyzed due to the unavailability of reliable information concerning price movements throughout the crop season.

EXHIBIT 4

IMPACT ON RURAL MARKETS

It is not expected that there will be significant negative impacts on local markets due to the efforts of this project. Given that many smallholders are not obtaining the minimum recommended levels of calories and to some degree are malnourished, it is expected that most of the increased grain savings will be consumed on the smallholding before it reaches the market. It is possible that if many smallholders adopt the recommended drying platform, that demand for maize later during the crop season may decline and price may also decrease. However, given Kenya's rural population growth rates and expected size over the next twenty years, even if the growth rate drops to replacement, the increase in available maize supply will be easily absorbed by the new births.

EXHIBIT 5DETAILED ECONOMIC ANALYSISPROJECT WORTH1. General Approach

This introductory section outlines the general approach taken in conducting the analysis, including the length of project period for economic analysis, estimation of costs and estimation of benefits. Section 2 and 3 detail the costs and benefits expected. Section 4 combines the estimated costs and benefits to derive an internal rate of return to the project. It also includes a sensitivity analysis and discusses the implications of this analysis for the success of the project.

a. Length of Project Period

The life of the project as laid out in Chapter II is five years. However, owing to the nature of the project, it is unrealistic to think that the project could pay for itself in this period of time. The project in its initial years involves considerable expenditures by both GOK and USAID to train MOA personnel in postharvest and storage technology, to set up backstopping for the extension service, and to conduct adaptive research. The effect of these activities in terms of helping the ultimate beneficiaries - the small-holder farmers in Kenya - can only be many years down the road. Therefore, it is necessary to estimate the costs and benefits of the project for more than five years. As an alternative, DPRA decided to perform the analysis for a 15 year period starting in project year one. The present value of \$1.00 of benefits 15 years in the future discounted at 15 percent is only 12¢. Hence, while it is worthwhile performing the analysis for up to 15 years, it would probably make little difference to the overall results if it were done for more than 15 years.

b. Estimation of Costs

The major concern is to estimate the return which GOK and USAID derive from resources which they commit to the project. Therefore the appropriate costs to include in the cost-benefit analysis are the additional costs to GOK and USAID. These have already been estimated, component by component in Chapter III. USAID costs, of course, terminate at the end of project year five. GOK costs, on the other hand, continue for the entire 15 years. The major part of section 2 is concerned with estimating the additional GOK costs for 15 years.

EXHIBIT 5 (cont'd)

c. Estimation of Benefits

The primary beneficiaries of the project are the smallholder farmers of Kenya and the ultimate benefits are reduced postharvest grain losses on smallholder farms. Conceptually, this is a tangible benefit being so many tons of grain valued at some appropriate price. But in order to reach the smallholder farmers and to achieve such reductions in grain losses, it is first necessary to develop recommended postharvest practices, to set up institutional backstopping for the agricultural extension service, and to train extension personnel, and to train farmers. These are all benefits in their own right which flow from project activities to support research, and to assist the Ministry of Agriculture, the University of Nairobi, Egerton College, and Embu/Bukura Institutes of Agriculture. But these are less tangible and given the project's purpose, only a means towards achieving the purpose. Therefore, the only benefits estimated are the value of grain saved on smallholder farms that would have been lost due to molds, insects, and birds, if the project had not taken place and the impact of these saved grains in the project area. The expected nutritional benefits were not quantified, nor were benefits from reducing rodent losses.

In order to estimate these benefits it is necessary to make assumptions about how many smallholders will adopt the improved post harvest practices in each project year and how much each adopting smallholder saves. The assumptions DPRA developed are based upon their best estimate of the situation. The major part of section 3 below details the assumptions DPRA made.

There is the question of what type of grains will be saved. Maize is the staple grain of Kenya, but smallholders also grow beans, sorghum, millet, and peas. If implemented, the project should lead to a reduction in postharvest losses of all these grains. Therefore, there is an argument for estimating the amount of each grain saved as a result of project activities. However, the DPRA believed that the project could pay for itself simply in terms of the amount of maize that is saved. Since maize losses represent more than three-quarters of the grain that can be saved, the analysis below is simply conducted in terms of the amount of maize that is saved. To the extent that the project can pay for itself in terms of maize it will also be able to pay for itself if the other grains are included. Maize is also the grain for which there are the most reliable estimates of present losses and possible reductions in losses as a result of improved postharvest practices.

EXHIBIT 5 (cont'd)

There is the question of what constitutes economic loss. Table D-1 presents estimates of postharvest weight losses due to birds, insects and molds. In the analysis, these are taken as direct economic losses. There were other losses discussed in Exhibit 1 (Annex D). These include weight losses due to rodents that were not estimated, quality losses such as grain only partially damaged by insects, and the intangible loss associated with aflatoxin-infested grain. These are real losses but they are not readily quantifiable and were not included as economic losses in the analysis. Once again, to the extent that the project can pay for itself in terms of pure weight losses that are reduced, it will also be able to pay for itself if the other types of losses are included. The internal rates of return estimated in section 4 below should be considered conservative.

Finally, there is the question at what price to value maize that is saved. After consultation with GOK and USAID officials, DPRA agreed to value maize at the import price, c.i.f. Mombasa, plus transportation to Nairobi. Though Kenya has been roughly self-sufficient in maize over the last decade, the prospects for importing it is increasing due to population growth and the current limits to rapidly expanding production. Therefore, from the point of view of GOK and USAID, the presumption is the maize saved as a result of the project is less maize that would have to be imported. As there is little prospect of importing maize from neighboring African countries, this maize would have to be imported through Mombasa and transported to Nairobi (as a central location representative of Kenya as a whole).

d. Shadow Pricing

There is almost no need for shadow pricing in this project owing to the nature of the project. So much of the project costs are for salaries and training of personnel. Commodity costs are relatively small and many are locally manufactured. The only cost in the entire analysis that is shadow-priced is the cost of transporting maize from Mombasa to Nairobi. This is because freight charges do not represent actual costs to GOK. Part of the freight charges are government taxes on items such as fuel, and <sup>the</sup> other part is revenue that accrues to GOK. Scott, MacArthur, and Newbury's (9) estimate of the shadow price of rail transport was used in section 4 below.

There are some foreign exchange commodity costs to GOK

EXHIBIT 5 (cont'd)

which could have been shadow priced but, again owing to the nature of the project, these are outweighed by foreign exchange benefits to GOK. For instance, the project provides for 16 person-years of expatriate technical assistance paid for by USAID. To the extent that these personnel spend money on local goods (over \$30,000 a year) represents a foreign exchange benefit to the GOK. The project also provides for USAID to pay some of the cost of farmer training, salaries of Kenyan personnel involved in research, salaries of two Kenyan administrative assistants, most commodities, all of which represent foreign exchange benefits to the GOK.

Total foreign exchange benefits to GOK are estimated at over \$5 million in 1980 prices in the first five years of the project. On the other hand, GOK foreign exchange costs are roughly estimated to be under \$2 million over the entire fifteen years. In other words, even at a social discount rate of zero percent, the project results in a net foreign exchange benefit to GOK of over \$3 million. Therefore, it was decided not to shadow price GOK foreign exchange costs.

e. Use of Constant vs. Current Prices

The entire cost-benefit analysis is carried out in constant 1980 prices. In general, the only reason for allowing for inflation in cost-benefit analysis is if some prices are likely to increase more rapidly than others, rather than all prices going up at the same rate. Although there is a presumption that, over fifteen years, fuel costs will increase more rapidly than, say, Kenyan salaries, it is judged that the increased complexity in allowing for differential rates of inflation in the analysis would scarcely improve the precision of the internal rates of return calculated in section 4 below. Therefore, for simplicity, the entire analysis is conducted in constant prices.

2. Estimation of Costs

USAID costs and GOK financial contribution to the project's first five years are summarized in Chapter IV. In this section it is necessary to estimate the actual additional GOK costs during the first five years and then for the remaining years. These estimates are presented in Table D- 20 by type of cost.

TABLE D-20 CONTINUING GOK PROJECT COSTS\*

COSTS (including contingency and escalation)	Y E A R										TOTAL	
	6	7	8	9	10	11	12	13	14	15		
L-T TA support	-	-	-	-	-	-	-	-	-	-	-	-
S-T consultant support	-	-	-	-	-	-	-	-	-	-	-	-
Training	-	-	-	-	-	-	-	-	-	-	-	-
Vehicle support	117	117	117	117	117	117	117	117	117	117	117	1170
Vehicle replacement	450						450					900
Maize purchase	26	26	26	26	26	26	26	26	26	26	26	260
Commodities	9	9	9	9	9	9	9	9	9	9	9	90
Commodities replacement	38	89	51	-	-	-	38	89	51	-	-	356
Training (LEO/HE)	52	52	52	52	52	52	52	52	52	52	52	520
Construction surveys	-	-	-	-	-	-	-	-	-	-	-	-
Costs + Platform Tests	220	220	220	220	220	220	220	220	220	220	220	2200
<b>TOTAL</b>	<u>912</u>	<u>513</u>	<u>475</u>	<u>424</u>	<u>424</u>	<u>424</u>	<u>912</u>	<u>513</u>	<u>475</u>	<u>424</u>	<u>424</u>	<u>5496</u>

\*Economic costs only. Finance costs are dealt with separately elsewhere.

EXHIBIT 5 (cont'd)

In order to derive these estimates, it was necessary to make some assumptions about the nature of the GOK's costs. What follows is a brief description of these assumptions.

a. Kenyan Personnel

It was stressed upon the Mission that all Kenyan personnel would be transferred from existing positions and no new personnel would be hired. The Permanent Secretary stated that there is sufficient underutilization of the present MOA staff to allow such a small transfer in personnel without significantly hampering operations in those departments from which the personnel were taken. Therefore, while the Kenyan personnel assigned to this project qualify as a financial contribution to this project, they do not qualify as an additional cost to the GOK and thus do not appear in the economic assessment of costs.

b. Staff Training

It is assumed that all USAID-funded staff training programs will be discontinued at the end of year five. The only additional staff training costs of GOK are for training CBS supervisors and enumerators for the collection of grain samples. Training of LEO/NE's outside of the project area are part of the normal duties of district and Divisional Officers, thus are not considered additional to the GOK budget.

c. Commodities

Commodity costs are incurred under most project components and after project year five, these will have to be borne entirely by GOK. As a general rule, it is assumed that the vehicles supplied under the project will have to be replaced at the end of every six years and that all other commodities, with two exceptions, will have to be replaced between the years 6-8 and 12-14. As is standard practice in cost-benefit analysis, the costs of new commodities are charged against the years in which they are replaced. The cost of depreciation is not charged against any years as this would represent double-counting.

d. Farmer Training

In years three thru five, the project will average 11 courses per year per FTC and 50 field courses per district per year. Of

EXHIBIT 5 (Cont'd.)

these courses offered in the project area, 10,000 participants will be provided with a partial grant to construct the new innovation confirmed by the FTDU. For the purpose of this analysis, it was assumed that ~~the~~ innovation package is the one discussed in Exhibit -2 (Annex D). During year 6 it is assumed that the project trained provincial, district, and divisional extension personnel would train LEOs/HEs in other provinces to teach some courses. However, after year 5 it is assumed the project trained extension agents would be more in a teaching (of LEOs/HEs) role than monitoring and backstopping the activities in the original project area. This explains the drop in course offerings from year 7-15 as compared to year five. It is further assumed that in year six the relative number of residential courses at FTCs versus field courses at community centers will undergo a change. There are two reasons for this assumption. First, there is already a great deal of pressure on FTC time and it is likely that after several years of devoting a large percentage of teaching time to grain storage at each FTC, GOK will want to reallocate this time somewhat. Secondly, field courses which cost less than FTC courses are better value for the money to farmers. At the time of writing the field courses represent very much of an experimental innovation which is why it is unrealistic to plan for any more in the first five years of the project, but by year 6 GOK should be in a position to expand them having gained the necessary experience to do so.

Table D-21 details the estimated number of farmer training courses expected to be held during the 15 years of the project.

3. Estimation of Benefits.

a. Value of Maize Saved.

At the time of writing, the world price of maize is approximately \$115 a metric ton at the Gulf Ports, U.S.A. According to officials at the National Cereals and Produce Board the cost of transportation and insurance to Mombasa is \$50 a ton and the cost of rail transport to Nairobi is K. Shs. 20 a bag. At 90 kg. to a bag and a shadow price of 0.67, the latter works out to approximately \$20 a ton. Therefore, for the purposes of this project, maize that is saved is valued at \$185 a ton or K. Shs. 1,322 a ton.

b. Benefits an Adopting Smallholder Receives.

DPRA has estimated that the average maize producer in Kenya loses 15.98 percent of his actual maize production at maturity to molds, insects, and birds. DPRA has also estimated that a farmer could reduce these losses to 4.44 percent.

EXHIBIT 5 (Cont'd.)

Table D-21: Farmer Training Courses to be Held.

Type of Course	Project Year					
	1	2	3	4	5	6 .....15
Field courses	0	0	740	1,850	2,960	700.....700
FTC courses	0	0	24	72	108	75..... 75

EXHIBIT 5 (cont'd)

by adopting a package of practices which include harvesting at maturity, drying the maize down to 13% moisture on a drying platform, and treating half the maize with an insecticide. This represents DPRA's recommended post-harvest practices to smallholders maize producers in Kenya.

It is likely that some farmers impacted by the project will refuse to adopt any of these practices, others will adopt some of them, and still others all of them. This pattern of response arises from such things as different levels of maize production by smallholders, striking differences in climate throughout Kenya which influence the relative benefits of different practices, and of course, the psychology of the smallholder farmer. Because it is impossible to sort out the different response patterns and the different benefits derived from different responses, the remainder of the analysis concerns itself only with those farmers who adopt the entire package of recommendations.

This is not as arbitrary as it may sound. Gerhart (10) in his study of the diffusion of hybrid maize in Western Kenya found that the adoption of hybrid maize tended to be a (binary) process in which the adoption of hybrid maize tended to lead to the adoption of improved agronomic practices such as planting in rows and applying fertilizers. Similarly, one can argue that the adoption of a drying platform will lead to earlier harvesting and appropriate treatment with insecticides in order to get the maximum benefit from the crib and the drying platform. It is also possible in the remaining analysis to compensate for the fact that not all farmers who adopt will adopt the complete package by being conservative with regard to the number of adopters.

A smallholder who adopts will almost certainly not achieve the ultimate reduction in grain losses during the first year of adoption. Rather it is more likely that he/she will undergo a learning process which a few years down the road will lead to the 72.2 percent reduction in losses from 15.98 percent to 4.44 percent. Therefore, it is assumed that the farmer who adopts has a learning curve as represented in Table D-22.

Table D-22: Estimated Curve for the DPRA Technology

	Year of Adoption					
	0	1	2	3	4	5
Grain loss (percent)	15.98	10.50	8.53	6.57	4.44	4.44...
Percentage reduction	9.0	34.3	46.6	58.9	72.2	72.2 ...

EXHIBIT 5 (Cont'd.)

Before adoption the smallholder experiences losses of 15.98 percent. The first year he/she adopts, he/she builds a drying platform, harvests at the same time as before (about 20 percent moisture content) and reduces his/her losses by 34.3 percent. The second year, he/she harvests somewhat earlier at 25 percent and the third year at the recommended practice of 35 percent. Finally in the fourth year, he/she has learned how to apply insecticides effectively and he/she is about to reduce his/her losses down to the objective of 4.69 percent. In all subsequent years, he/she maintains his/her losses at this level.

c. Number of Adopting Smallholdings.

This project provides for different forms of face-to-face contact between extension personnel and farmers: field courses and courses at FTC. Of the courses leading to a partial grant, DPRA assumed that 2/3 of the participants will adopt. Of the field and FTC courses without grants, DPRA assumed adoption rates of 1/2 and 1/3, respectively. DPRA further assumed the numbers attending the courses to average 20 for field and 70 for FTC courses.

d. The Spread Effect.

Face-to-face contact between farmers and extension personnel at field training courses and FTCs are not the only means of inducing farmers to adopt new postharvest practices. Farmers have neighbors with whom they discuss their farming methods. They attend gatherings where agriculture is discussed. They visit and are in turn visited by extension personnel. They listen to radios. To a considerable degree, the importance of these other types of change-agents depends on the initiative and imagination shown by extension personnel at the location and sub-location level.

Although few will deny the existence of a spread effect as the "progressive" farmers adopt first and others follow, there are widespread opinions concerning its magnitude. For the purpose of estimating benefits, it is here assumed that for every farmer who adopts the entire package of postharvest recommendations as a result of attending a farmer training course, two of his neighbors will also adopt one year later.

EXHIBIT 5 (Cont'd.)

As a result of the assumptions made, it is now possible to calculate the number of farmers who will adopt the recommended post-harvest practices during the fifteen years of the project. These calculations are shown in Table D-23. Out of 1.7 million (Table D-24) smallholdings in Kenya that grow maize, 1.6 percent will have adopted after 5 years, 5.3 percent after 9 years, and 10.6 percent after 15 years. In the project area, by year 5, an estimated 4.3 percent will have adopted the recommended postharvest practices. Considering the magnitude of the effort being made in the proposed project, DPRA feels these percentages do not sound unreasonable. They might even be somewhat pessimistic.

e. Other Assumptions.

In 1979, the Central Bureau of Statistics estimated that smallholders in Kenya produced 14.88 million bags of maize or an average of 7.71 bags each. DPRA estimates that a farmer producing as little as 4 bags of maize a year will find it profitable to adopt the recommended practices. Still, if experience is any guide, the first farmers who adopt the recommended practices will on the average produce more than 7.71 bags. It is here assumed that the average farmer who adopts produces 11.57 bags, or 50 percent more than the average. This is almost certainly a conservative assumption. In the initial project years, it will more than likely be larger than this, which would increase the flow of benefits from the project.

Finally, maize production in Kenya is not stationary. From a base of 14.88 million bags in 1979, it is assumed that maize production will increase at 2 percent per year, or more specifically that those farmers who adopt increase their maize production at 2 percent a year. This is below the long-term trend in Kenya over the last 15 years.

f. Total Estimated Benefits Arising from the Project.

On the basis of the assumptions made, the average farmer who adopts and who produces 11.57 bags a year will save 0.67 bags of maize in the first year that he adopts, 0.91 bags the second year, 1.16 bags in the third year, and 1.42 bags every year thereafter. Given the number of adopters as presented in Table D-23, it is a simple matter to calculate maize savings as shown in Table D-25. The estimated benefits to the project, based on all the assumptions made, are shown by year on the bottom line of this table. The total benefits arising from the project to smallholdings by the end of 15 years is estimated at \$U.S. 61.4 million (K.Sh 445.1 million).

Table 23: Number of Smallholder Families Adopting Recommended Postharvest Practices.

Reason for Adopting	1	2	3	4	5	6	7	8	...	15	15 year total
1. Attended field course (those who received partial grant)	-	-	5,045	10,500	15,515	3,500	3,500	3,500	...	3,500	66,060
	(-)	(-)	(2,345)	(2,010)	(1,340)	(-)	(-)	(-)	...	(-)	(5,695)
2. Attended FTC course (those who received partial grant)	-	-	728	1,833	2,686	1,732	1,732	1,732	...	1,732	22,567
	(-)	(-)	(335)	(335)	(335)	(-)	(-)	(-)	...	(-)	(1,005)
Neighbor of (1)	-	-	-	10,090	21,020	31,030	7,000	7,000	...	7,000	125,140
Neighbor of (2)	-	-	-	1,456	3,666	5,372	3,464	3,464	...	3,464	41,670
Annual Total	-	-	5,773	23,879	42,887	41,634	15,696	15,696	...	15,696	255,437
Cumulative Total	-	-	5,773	29,652	72,539	114,173	129,869	145,565	...	255,437	255,437
Percent of small holders in project area during first 5 years	-	-	0.9	4.8	11.7						
Percent of small-holders nationwide	-	-	0.3	1.7	4.3	6.7	7.6	8.5	...	15.0	15.0

Exhibit 5, (Cont'd.)

Exhibit 5 (cont'd)

Table D-24: Smallholders in Kenya and in Project Area.\*

	Number of Households (000)	Number of persons (000)	Percent of national population	Percent of all smallholdings
1. Smallholders nationwide	1,704*	10,464**	66%	100%
2. Poor small- holders nationwide	708	3,894	25%	42%
3. Smallholders in project area	619**	4,333	27%	36%
4. Poor small- holders in project area	289	2,025	13%	17%

\*average household size 1979 (CDSS) = 5.5 nationwide

\*\* national population 1979 (CDSS) = 15.8 million

\*\*\*average household size 1979 in project area = 7.0

Source: (6, and updated CDSS 1982-85 figures)

Table D-25: Amount of Maize Saved by Adopting Smallholder Families (metric tons)

No. of Adoptees in each year	Project Year															15 yr Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1. 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. 0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. 5,773	-	-	479	652	837	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	12,068
4. 23,879	-	-	-	1,982	2,698	3,462	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	4,179	45,753
5. 42,887	-	-	-	-	3,560	4,846	6,219	7,505	7,505	7,505	7,505	7,505	7,505	7,505	7,505	74,665
6. 41,634	-	-	-	-	-	3,456	4,705	6,037	7,286	7,286	7,286	7,286	7,286	7,286	7,286	65,200
7. 15,696	-	-	-	-	-	-	1,303	1,774	2,276	2,747	2,747	2,747	2,747	2,747	2,747	21,835
8. 15,696	-	-	-	-	-	-	-	1,303	1,774	2,276	2,747	2,747	2,747	2,747	2,747	19,088
9. 15,696	-	-	-	-	-	-	-	-	1,303	1,774	2,276	2,747	2,747	2,747	2,747	16,341
10. 15,696	-	-	-	-	-	-	-	-	-	1,303	1,774	2,276	2,747	2,747	2,747	13,594
11. 15,696	-	-	-	-	-	-	-	-	-	-	1,303	1,774	2,276	2,747	2,747	10,847
12. 15,695	-	-	-	-	-	-	-	-	-	-	-	1,303	1,774	2,276	2,747	8,100
13. 15,696	-	-	-	-	-	-	-	-	-	-	-	-	1,303	1,774	2,276	5,353
14. 15,696	-	-	-	-	-	-	-	-	-	-	-	-	-	1,303	1,774	3,077
15. 15,696	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,303	1,303
<b>Total</b>	-	-	479	2,634	7,095	12,774	17,416	21,808	25,333	28,080	30,827	33,574	36,321	39,068	41,815	297,224
estimated amount saved @2% increase in production per year	-	-	488	2,699	7,324	13,325	18,347	23,295	28,290	30,906	34,327	37,802	41,332	45,068	48,710	331,914
Value in U.S. \$000s	-	-	90	499	1,355	2,465	3,394	4,310	5,234	5,718	6,350	6,944	7,646	8,338	9,011	61,404
Value in K. Sh.000s	-	-	655	3,620	9,823	17,872	24,608	31,246	37,944	41,453	46,041	50,702	55,437	60,447	65,332	445,180

EXHIBIT 5 (Cont'd.)

4. Project Work.

a. Estimated internal rate of return, net present value and benefit cost ratio.

Table D-26 summarizes the project's estimated costs and benefits. The project does not yield positive benefits until year six. By year 15 the estimated value of maize saved is \$9.0 million. This represents about a 21 percent reduction in the total value of maize lost annually.

The internal rate of return (IRR) of the project is estimated at 24.1 percent. When evaluating this figure, it must be remembered that additional benefits such as quality improvements and reduced rodent losses are not included. Secondly, the benefit flow was calculated only on the value of maize saved. Thus, the actual IRR is higher.

Using a 15 percent discount rate, the benefit-cost ratio and net present value of the project are 1.6 and \$5.0 million, respectively.

b. Sensitivity Analysis.

The results presented in section a above are based on the numerous assumptions that have been made throughout this section. The project will pay for itself to the extent that these assumptions are realistic. This is particularly true of the assumptions concerning the rate of adoption and the amount of maize that each adopter saves over time. In this section the sensitivity of the above results to some of the assumptions are analyzed. The results of the sensitivity analyses are contained in Table D-27. The assumptions varied were:

1) No Growth in Maize Production Over Time.

The basic case assumed that smallholder maize production would increase at 2 percent per year over the 15 years of the project. Maybe this is too optimistic or maybe production will increase only as a result of an increasing number of smallholdings, not as a result of increasing productivity per smallholding. If no growth in productivity is assumed to occur, then the rate of return to total project costs is 22.2 percent.

EXHIBIT 5 (CONT'D)

TABLE D-26: ESTIMATED PROJECT COST AND BENEFIT FLOWS (000 U.S.\$)

YEAR	C O S T S			BENEFITS	NET BENEFITS
	AID	GOK	TOTAL		
1	\$399	\$77	\$476	\$0	\$476
2	\$2421	\$406	\$2827	\$0	\$2827
3	\$2089	\$1314	\$3403	\$90	\$3313
4	\$1524	\$1075	\$2599	\$499	\$2100
5	\$1332	\$1049	\$2381	\$1355	\$1026
6	-	\$912	\$912	\$2465	\$1553
7	-	\$513	\$513	\$3394	\$2881
8	-	\$475	\$475	\$4310	\$3835
9	-	\$424	\$424	\$5234	\$4810
10	-	\$424	\$424	\$5718	\$5294
11	-	\$424	\$424	\$6350	\$5926
12	-	\$912	\$912	\$6994	\$6082
13	-	\$513	\$513	\$7646	\$7133
14	-	\$475	\$475	\$8338	\$7863
15	-	\$424	\$424	\$9011	\$8587
TOTAL UNDIS-COUNTED	<u>\$7765</u>	<u>\$9417</u>	<u>\$17182</u>	<u>\$61404</u>	<u>\$44222</u>
DISCOUNTED 15%			<u>\$8892</u>	<u>\$13869</u>	<u>\$4979</u>

EXHIBIT 5 (Cont'd.)

Table D-27: Sensitivity Analysis Summary.

Assumptions Covering Benefits	Percent Adoption After		Internal Rate of Return to GOK and USAID
	5 years	15 years	
1. basic case as outlined in text	11.7	15.0	24.1
2. basic case with no growth in maize production over time	11.7	15.0	22.2
3. basic case with ultimate reduc- tion in grain loss of only 50%	11.7	15.0	8.3
4. basic case but only one neighbor adopts	8.8	10.1	14.5

EXHIBIT 5 (Cont'd.)

ii) Reduction in Maize Loss of only 50 Percent Per Adopter.

The basic case assumed that a smallholder who adopted the entire package of recommendations would ultimately reduce his postharvest maize losses to 4.44 percent, equal to a reduction of 72.2 percent from the initial losses of 15.98 percent. Although the consultants believe that this is possible, this may be overly optimistic. Suppose that the learning curve remains the same as in the basic case but that the smallholder who adopts reduces his losses by only 23.8 percent in the first year of adoption, 32.3 percent in the second year, 40.8 percent in third year, and 50.0 percent in every year thereafter. Then the rate of return to total project costs 8.8 percent. That the rate of return to total project costs falls to 8.8 percent is a measure of the importance of appropriate recommendations that really will reduce grain losses by as much as 72.2 percent. In a certain sense, the difference between 24.1 and 8.8 percent can be viewed as a return to the research that is financed under the project and points out the need for this research to be included in the project.

iii) A Smaller Spread Effect.

The basic case assumed that for each farmer who adopted the package of postharvest recommendations as a result of attending a farmer training course, two of his neighbors would adopt one year later. This may also be overly optimistic. On the assumption that only one neighbor adopts, then the rate of return to total project costs is 14.5 percent. This points out the importance of the spread effect and the importance of change-agents other than farmer training courses. For the project to pay for itself, the recommendations must also be communicated in other ways such as local meetings, extension visits, and on the radio. Thus, the support that the project gives to these activities is also significant.

c. Conclusions.

In all the cases presented above, the rate of return of the project is at least 8.8 percent. Thus, the worth of the project from the point of view of the Government of Kenya should not be in doubt, simply in terms of reducing the amount of maize imports that might otherwise be required if the project is not implemented.

EXHIBIT 5 (Cont'd.)

At a time when the long run prospects for self-sufficiency in maize production look worse than in the past, the project deserves serious consideration.

DPRA estimates that the project can pay for itself simply in terms of the amount of maize saved in kilograms that would otherwise be lost on smallholder farms to insects and molds. But there are still other reasons why the consultants recommend that both GOK and USAID implement the project. These include the quality and other intangible losses discussed in Annex D, Exhibit 1 above. Clearly, the most important of these is the alarmingly high incidence of aflatoxin found in maize samples collected throughout the country. It is impossible to measure accurately the benefit that Kenya would receive in terms of the improved health of its citizens from a reduction in this high incidence of aflatoxin, but there should be no doubt that these benefits are substantial and taken alone could conceivably justify the project.

EXHIBIT 5 (Cont'd.)

DETAILED ECONOMIC ANALYSIS

Table D- References.

1. Annual Price Review, 1978/79. GOK
2. Casley, D. J. and Marchang, T. J. "Smallholder Marketing in Kenya," Marketing Development Project (KEN 75/005) UNDP/FAO, May 1979.
3. Development Planning and Research Associates, Inc. (DPRA). Kenya National Crop Storage Study. USAID contract AID/AF-C-1562, May 1980.
4. Economic Survey for 1980, GOK
5. Gerhart, John. The Diffusion of Hybrid Maize in Western Kenya Abridged by CIMMYT. Mexico City: CIMMYT, 1975.
6. Integrated Rural Surveys 1974-77. GOK
7. Kenya Smallholder Production Service and Credit Project Baseline Survey: Agricultural Year 1975-76. American Technical Assistance Corporation. USAID contract AID/AFR-C-12B.
8. Postharvest Food Losses in Developing Countries. National Academy of Sciences, Washington D.C. 1978.
9. Scott, Maurice, F. G. MacArthur, J.D, and Newburg, DMG. Project Appraisal in Practice. London: Heineman, 1976.
10. Wogan, G. N. (ed.). Mycotovins in Foodstuffs. Proc. of an International Symposium of Mycotovins in Foodstuff, Mar. 18-19, 1964. Mass. Inst. of Technology, Cambridge. USA. 1965.
11. World Bank Report P-270-KE, "Kenya Structure Adjustment Credit," February 11, 1980.

ANNEX E  
EXHIBIT 1

Project Detail Costs

By Outputs

(Expressed in U.S. Dollars)

	<u>AID Contribution</u>		<u>GOK</u>	<u>Total Project Cost</u>
	<u>FX</u>	<u>LC</u>	<u>Contribution</u>	
			<u>LC</u>	
<u>FTDU:</u>				
Long Term Personnel	687,440	-0-	\$ -0-	687,440
Support Costs	463,420	39,960	46,080	549,460
Contractor Overhead	462,250	-0-	-0-	462,250
Contractor Fee	115,200	-0-	-0-	115,200
Short Term Consultants	432,000	-0-	48,000	480,000
Participant Training	181,200	-0-	87,320	268,520
Vehicles	-47,000	36,000	107,750	190,750
Staff	-0-	-0-	320,470	320,470
Maize Purchases	-0-	52,500	-0-	52,500
Cribs and Platforms	-0-	30,000	-0-	30,000
Commodities	-0-	6,000	5,000	11,000
Structures	-0-	207,000	-0-	
<b>Total FTDU</b>	<b>2,388,510</b>	<b>371,460</b>	<b>614,620</b>	<b>3,374,590</b>
<u>Extension:</u>				
Long Term Personnel	298,340	-0-	-0-	298,340
Support Costs	235,520	19,980	9,360	264,860
Contractor Overhead	200,600	-0-	-0-	200,600
Contractor Fee	57,600	-0-	-0-	57,600
Short Term Consultants	324,000	-0-	36,000	360,000
Participant Training	490,200	-0-	178,115	668,315
Vehicles	136,250	141,000	275,125	552,375
Staff	-0-	-0-	1,186,724	1,186,724
Cribs and Platforms	-0-	500,000	-0-	500,000
Commodities	71,000	-0-	17,500	88,500
Structures	-0-	166,500	-0-	166,500
Other Training Costs	-0-	-0-	15,000	15,000
<b>Total Extension</b>	<b>1,813,510</b>	<b>827,480</b>	<b>1,717,824</b>	<b>4,358,814</b>
<u>Educational Institutions:</u>				
Short Term Consultants	108,000	-0-	12,000	120,000
Participant Training	175,200	-0-	49,060	224,260
Commodities	30,000	-0-	4,000	34,000
Research Grants	-0-	-0-	103,240	103,240
<b>Total Education Instit.</b>	<b>313,200</b>	<b>-0-</b>	<b>168,300</b>	<b>481,500</b>

Project Detail Costs  
By Outputs

(In U.S. Dollars)

	<u>AID Contribution</u>		<u>GOK Contribution</u>	<u>Total Project Cost</u>
	FX	LC	LC	
<u>Grain Monitoring Unit:</u>				
Staff	-0-	-0-	589,000	589,000
Maize Purchases	-0-	9,100	-0-	9,100
Commodities	35,000	-0-	-0-	35,000
Structures	28,000	130,000	26,600	184,600
Total GMU	63,000	139,100	615,600	817,700
<u>Evaluation:</u>				
Short Term Consultants	189,000	-0-	21,000	210,000
Project Sub-Total	4,767,220	1,338,040	3,137,344	9,242,606
Contingency 10%	476,722	133,804	313,734	924,260
Escalation: 15%	715,083	-0-	470,602	1,520,195
25%	-0-	334,510	-0-	-0-
PROJECT TOTAL	\$5,959,025	1,806,354	3,921,680	11,687,059

Project Detail Costs  
By Inputs  
(Expressed in U.S. Dollars)

	<u>U.S. Contribution</u>		<u>GOK</u>
	<u>FX</u>	<u>I.C.</u>	<u>Contributi</u> <u>LC</u>
<u>Long Term Personnel:</u>			
Salaries (216 mm)	\$679,850	\$ -0-	\$ -0-
Benefits (30%)	203,955	-0-	-0-
Post Differential (10%)	67,985	-0-	-0-
Cola (5%)	33,990	-0-	-0-
Sub-Total	985,780	-0-	-0-
<u>Support Costs:</u>			
Travel To/From Post	48,900	-0-	-0-
Travel - Home Leave	48,900	-0-	-0-
Air Freight	21,000	-0-	-0-
Storage	51,300	-0-	-0-
Household Effects Ship	68,400	-0-	-0-
Auto - Ship	26,400	-0-	-0-
Temporary Lodging	-0-	18,900	-0-
Medical Expenses	10,500	-0-	-0-
Insurance (Work comp 9%)	61,190	-0-	-0-
Furniture	151,500	-0-	-0-
Education Allowance	232,050	-0-	-0-
Guard Service	-0-	41,040	-0-
In Country - Per Diem	-0-	-0-	37,440
Language Training	7,000	-0-	-0-
	-0-	-0-	-0-
Short-term Travel + Per Diem	7,800	-0-	18,000
	598,940	59,940	55,440
<u>Short Term Consultants:</u>			
78 Person Months @ \$15,000 person months including including \$50 days per diem (GOK)	1,053,000	-0-	117,000
<u>Participant Training:</u>			
Long Term Training Costs	266,400	-0-	-0-
Air Fare	5,400	-0-	5,400
Salaries During Training	-0-	-0-	125,580
Short term Training Costs	357,000	-0-	-0-
Air Fare	15,300	-0-	15,300
Salaries During Training Incountry - 1 session x 3 months 37 Tot="1	-0-	-0-	88,952
TPI Consultants 5pr x 3 Mos	202,500	-0-	22,500
Salaries 37 Trainees	-0-	-0-	56,763
Total Participant Training	846,600	-0-	314,495

Project Detail Costs

By Inputs

(In U.S. Dollars)

	<u>U.S. Contribution</u>		<u>GOK</u>
	<u>FX</u>	<u>LC</u>	<u>Contribution</u>
			<u>LC</u>
<u>Vehicles:</u>			
Sedans (2)	\$ 20,000	\$ -0-	\$ -0-
LWB LandRover 4WD (4)	-0-	72,000	-0-
Pick-up Truck (1)	12,000	-0-	-0-
Stake Bed Truck (1)	35,000	-0-	-0-
4WD Suzuki Vehicle (7)	65,000	-0-	-0-
Motocycle (125cc) (50)	50,000	-0-	-0-
Bicycles (700)	-0-	105,000	-0-
Helmets (50)	1,250	-0-	-0-
Operating Expense (Gas/Oil/Maint.)	-0-	-0-	382,815
	<u>183,250</u>	<u>177,000</u>	<u>382,875</u>
<u>Staff:</u>			
Professional Staff	-0-	\$ -0-	\$ 1,045,644
Secretaries	-0-	-0-	304,800
Ag Helpers 8 x 5 yrs	-0-	-0-	126,000
Misc. Casual Labor 15 per year	-0-	-0-	30,750
Laboratory Tech. 10 person	-0-	-0-	229,000
CBS Enumerators (800) (\$150 ea per year) 3 yrs	-0-	-0-	360,000
Total Staff	-0-	-0-	<u>2,096,194</u>
<u>Maize Purchases:</u>			
FTDU 2.75 yrs x 127 = 349 tons x 150	-0-	52,500	-0-
GMU 10,000 samples 1kg annually 50,000 kg = 110,000 lbs = 55 ton + 10%	-0-	9,100	-0-
Total Maize	-0-	<u>61,600</u>	-0-
<u>Cribs + Platforms</u>			
FTDU - 300 Test Cribs \$100	-0-	30,000	-0-
Extension - 10,000 kits \$50	-0-	500,000	-0-
Total Cribs + Platforms	-0-	<u>530,000</u>	-0-
Contractor Fee \$800 per person month	172,800	-0-	-0-
Contractor OH 75% Salaries	662,850	-0-	-0-
	<u>735,650</u>	-0-	-0-

Project Detail Costs  
By Inputs  
(In U.S. Dollars)

Project Detail Total

	U.S. Contribution		GOK Contribution
	FX	LC	LC
<u>Commodities:</u>			
Laboratory = Test Equipment	25,000	-0-	-0-
Office Furniture + Equipment	10,000	-0-	-0-
Office Supplies	-0-	-0-	5,000
Workshed Tools + Supplies	21,000	-0-	-0-
Recurrent Supplies - Shed	-0-	-0-	17,500
Training + AV Equipment	80,000	-0-	-0-
Service on AV Equipment	-0-	-0-	4,000
Shelters - 300	-0-	6,000	-0-
<b>Total Commodities</b>	<b>136,000</b>	<b>6,000</b>	<b>26,500</b>
<u>Structures:</u>			
House Construction (6)	-0-	310,500	-0-
Laboratory + Office	-0-	130,000	-0-
Cold Room	28,000	-0-	-0-
Worksheds (6 at FTC, 1 mobile)	-0-	63,000	-0-
Land	-0-	-0-	10,000
Operating Maintenance Lab	-0-	-0-	16,600
<b>Total Structures</b>	<b>28,000</b>	<b>503,500</b>	<b>26,600</b>
<u>Other Training Costs:</u>			
Research Grants:			
10 Students 2 years tuition	-0-	-0-	79,500
Residence Fee	-0-	-0-	18,740
Test Equipment	-0-	-0-	5,000
Use of FTC for Training	-0-	-0-	15,000
<b>Total Other Training Costs</b>	<b>-0-</b>	<b>-0-</b>	<b>118,240</b>
<b>TOTAL Project Cost</b>	<b>\$4,767,220</b>	<b>\$1,338,040</b>	<b>\$3,137,344</b>

Analysis of GOK Contribution  
(Expressed in U.S. Dollars)

	<u>Present</u> <u>Recurrent</u> <u>Cost</u>	<u>Additive</u> <u>Recurrent</u> <u>Cost</u>	<u>Non-Recurrent</u> <u>Project</u> <u>Cost</u>	<u>Total</u>
<u>Long Term Personnel:</u>				
In-Country Per Diem	\$	\$	\$ 55,440	\$ 55,440
<u>Short Term Consultants:</u>				
Per Diem			117,000	117,000
<u>Participant Training:</u>				
One-way Airfare Long Term			5,400	5,400
Salaries During Training LT	125,580			125,580
One-way Airfare - Short Term			15,300	15,300
Salaries - Short Term	88,952			88,952
TPI Consultants' Per Diem			22,500	22,500
Salaries - In-country	56,763			56,763
<u>Vehicles:</u>				
Operation + Maintenance		382,875		382,875
<u>Professional + Technical Staff:</u>				
FTDU + Extension Officers	1,045,644			1,045,644
Secretaries		304,800		304,800
Ag Helpers (FTDU)	126,000			126,000
Casual Labor		30,750		30,750
Laboratory Technicians		229,000		229,000
CBS Enumerators	360,000			360,000
<u>Commodities</u>				
Office Supplies		5,000		5,000
Workshed Supplies + Tools		17,500		17,500
Service on AV Equipment		4,000		4,000
<u>Structures:</u>				
Land	10,000*			10,000
Operation + Maintenance GMU		16,600		16,600

\* Non-Cash Itc

Analysis of GOK Contribution

	<u>Present</u> <u>Recurrent</u> <u>Cost</u>	<u>Additive</u> <u>Recurrent</u> <u>Cost</u>	<u>Non-Recurrent</u> <u>Project</u> <u>Cost</u>	<u>Total</u>
<u>Other Training Costs:</u>				
Research Grants - Tuition + Board	\$	\$	\$ 98,240	\$ 98,240
Test Equipment			5,000	5,000
FTC Fees			15,000	15,000
Project Sub-Total	\$1,812,939	\$ 954,775	\$ 369,630	\$3,137,344
Escalation and Contingency	453,234	238,694	92,408	784,336
<b>PROJECT TOTAL</b>	<b>2,266,173</b>	<b>\$1,193,469</b>	<b>\$ 462,038</b>	<b>\$3,921,680</b>

REPUBLIC OF KENYA  
OFFICE OF THE VICE-PRESIDENT AND MINISTRY OF FINANCE

Telegraphic Address:  
FINANCE-NAIROBI  
Telephone: 334433  
When replying please quote  
Ref. No. EA 9/03  
and date



THE TREASURY  
P.O. Box 30007  
NAIROBI  
KENYA

29th August, 1980

Mrs. Allison B. Herrick,  
Director,  
USAID Mission to Kenya  
P. O. Box 30261,  
NAIROBI.

Dear Mrs. Herrick,

The Ministry of Finance of the Government of Kenya hereby formally request USAID's assistance in improving on-farm grain storage for subsistence grain farmers and to assist in the establishing a national grain monitoring capacity within the Ministry of Agriculture. The assistance required is described in the Project Identification Document (PID) titled the Food Crops Storage and the Project Paper (PP) titled On-farm Grain Storage (Project No. 615-0190) and is for advisory services, training, and procurement of equipment and facilities primarily for the Ministry of Agriculture. The Ministry of Planning/Central Bureau of Statistics and the Ministry of Education will also receive some assistance. This assistance is necessary and important to permit the Government to reduce losses and improve postharvest handling of grain. We understand that the project described in the Project Paper has been designed in cooperation with the Ministry of Agriculture to meet our specific priorities and needs. Based upon the PID, which we discussed with you at the first of this year, preliminary costs for the overall project are estimated at approximately \$10,900,000 of which the Government will provide not less than 25 per cent. We understand that the AID contribution could consist entirely of grant funds, but given the importance of the project, we are certainly willing to discuss the possibility of loan funding this project if necessary.

The Government recognizes the potential recurrent cost implications of the proposed assistance and can assure AID that this project will not place an unsurmountable burden on our budget.

As you know, one of the major priorities of the Government of Kenya is to improve our overall grain situation, Therefore we are most anxious for this AID assistance programme to be implemented at the earliest possible date. Your earliest attention to this matter would be appreciated.

Yours sincerely,

( ALFRED VIENNA )

DIRECTOR OF EXTERNAL AID DIVISION



RESEARCH CAPACITY AT UNIVERSITY OF NAIROBI AGRICULTURE ENGINEERING FACULTY IS SEEN AS REMOTE FROM ACHIEVEMENT OF STATED PROJECT OBJECTIVE. ALSO UNCLEAR HOW MUCH INDIGENOUS TRAINING CAPACITY AT UNIVERSITY LEVEL IS NEEDED TO PRODUCE THE MANPOWER WHICH WILL WORK ON POST-HARVEST LOSS PROBLEMS. AID/W SUGGESTS IT MIGHT BE BETTER TO SEND PARTICIPANTS ABROAD FOR SUCH HIGH-LEVEL TRAINING IN THE COMPARATIVELY SMALL NUMBERS NEEDED FOR THE PROJECT'S SUCCESS. PROPOSED USE OF QTE EXISTING UNQTE PERSONNEL TO STAFF AND IMPLEMENT PROJECT ALSO REQUIRES ANALYSIS. WHILE EXISTING EXTENSION PERSONNEL MIGHT BE TRAINED TO CARRY OUT PROJECT FUNCTIONS, THIS WILL NECESSARILY INVOLVE DE-EMPHASIS OR CLOSEOUT OF SOME CURRENT DUTIES.

5. PROJECT DESIGN SHOULD TAKE INTO CONSIDERATION EXPERIENCE OF PEACE CORPS, WHICH HAS HAD SUCCESSFUL RESULTS IN ON-FARM SMALL-SCALE STORAGE. MISSION MAY WISH TO EXPLORE POSSIBILITY OF INCLUDING PEACE CORPS VOLUNTEERS AS PART OF EFFORT TO EXTEND TECHNOLOGY TO SMALL FARMERS. ALSO RECOMMENDED THAT ESTIMATION OF GRAIN LOSSES BE BASED UPON MANUAL DEVELOPED BY HARRIS AND LINDBLAD FOR THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS, WHICH HAS BEEN ACCEPTED BY AID, FAO, TROPICAL PRODUCTS INSTITUTE, AND GASCA AS STANDARD METHODOLOGY.

6. OTHER ISSUES/REQUIREMENTS:

A. IEE ADEQUATE FOR PID APPROVAL BUT PP MUST PROVIDE FOR RISK/BENEFIT ANALYSES, TO BE DONE DURING PROJECT IMPLEMENTATION FOR EACH PESTICIDE THAT IS USED. DS/AGR WILL CABLE INFORMATION ON LOCALLY AVAILABLE APPROVED INSECT-KILLING AGENTS.

B. WOMEN IN DEVELOPMENT COMPONENT ADEQUATE FOR PID BUT FULLER TREATMENT IN SPECIFIC ANNEX REQUIRED IN PP.

C. AT PAGE 31, LINE 13, WORD QTE ... FIRM OR CONSORTIUM ... UNQTE SHOULD BE CHANGED TO QTE ... FIRM, CONSORTIUM, OR UNIVERSITY ... UNQTE.

7. MISSION IS REMINDED THAT APPROVAL OF PROJECT ON BASIS OF ITS MERITS LEAVES SEVERE FUNDING PROBLEMS UNRESOLVED. GRANT FUNDS NOT PRESENTLY AVAILABLE OR IN REASONABLE PROSPECT. UNLESS MISSION CAN IDENTIFY INITIAL FEATURES SUITABLE FOR LOAN FUNDING, THEN FUNDING IN FY 80 MUST BE CONSIDERED UNLIKELY. CHRISTOPHER

BT

#4515

UNCLASSIFIED

RESPONSE TO PID APPROVAL

1. Paragraph 2: The Postharvest Storage Branch (PHSB) will function in a collaborative style with the Central Bureau of Statistics (CBS) for collection of grain samples; with agricultural institutions for training in grain drying and storage technology; and with the National Agricultural Laboratories for research into identified problem areas. No operating authority is required or desirable in these interdepartmental relationships. Within the Department of Agriculture the mandate of PHSB is as follows:

"The Postharvest and Storage Branch will be responsible to the Chief Crops Production Division for the establishment and development of an advisory service in postharvest handling of crops and their on-farm storage techniques.

The postharvest sub-unit will provide technical knowledge on harvesting, primary processing and infestation control as well as transportation and storage designs on the farm.

The stored products protection sub-unit will provide diagnostic services and stored produce protection work. It will also have diagnostic and infestation monitoring facilities.

The branch will develop capability at provincial and eventually at district level."

This is considered a satisfactory initial definition of PHSB responsibilities and authorities but will be reviewed during the life of the project by the Contractor's Project Coordinator who may then make recommendations to the MOA if alterations are deemed necessary.

2. Paragraph 3: Project Design Team agrees with primary focus and has attempted to so design the project. An important aspect of the project will be to investigate alternative methodologies to maximize spread of information and influence adoption of technology. Certainly private sector, VOLAGS and other government agencies will be considered by the FTDU.

3. Paragraph 4: Orientation of project changed significantly away from research, per se, to adaptive field testing and demonstration. Believe Detailed Project Description in PP now adequately justifies each project input. As mentioned in PP, subject of transferring present extension personnel into postharvest storage positions and of putting additional burdens onto Local Extension Agents (LEOs) and Home Economists (HEs) has been discussed at length with the MOA.

Conclusion in that there is underemployment due to lack of training and mobility of personnel in the Extension Service, and that there will be little problem in assigning additional duties to the numbers of employees proposed for the project.

4. Paragraph 5: Although not investigated thoroughly at the time of PP finalization, use of Peace Corp personnel will be considered by the USAID/Kenya Project Manager and by the CPC during implementation. Grain losses estimation methodology will be based upon Harris and Lindblad Manual. See Annex A, Exhibit 6, Mycologist/Entomologist Job Description.

5. Paragraph 6: (a) See Section III, G, "Environmental Impact". (b) WID fully treated as an integral part of Social Soundness Analyses/WID section of PP.

EXHIBIT 3

## 5C-1 - COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?
  - (a) It can be demonstrated that a significant amount but not all the contemplated assistance will directly benefit the needy
  - (b) The Department of State has made no such determination.
2. FAA Sec. 481. Has it been determined that the government of the recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?
 

No such determination has been made.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not dominated or controlled by the international Communist movement?
 

The Secretary of State has made such determination. Kenya is not a part of, or controlled by, the international communist movement.
4. FAA Sec. 620(c). If assistance is to the government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government?
 

No.
5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?
 

No.
6. FAA Sec. 620(a), 620(f), 620D; FY 80 App. Act. Sec. (511, 512, and 513.) Is recipient country a Communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos or Vietnam? Will assistance be provided to Afghanistan or Mozambique without a waiver?
 

No.

7. FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression? No.
8. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property? No.
9. FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason? Kenya has instituted the program.
10. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters, Kenya has not seized, or imposed any sanctions or penalty against, any U.S. fishing activity in international waters.
- a. has any deduction required by the Fishermen's Protective Act been made?
- b. has complete denial of assistance been considered by AID Administrator?
11. FAA Sec. 620; FY 80 App. Act Sec. (518.)  
(a) Is the government of the recipient country in default for more than six months on interest or principal of any AID loan to the country? No.  
(b) Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?
12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.) Yes, taken into account by the Administrator at time of approval of Agency OYB.

13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? No.
14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? Kenya is not in arrears.
15. FAA Sec. 620A, FY 80 App. Act, Sec. (521.) Has the country granted sanctuary from prosecution to any individual or group which has committed an act of international terrorism? Has the country granted sanctuary from prosecution to any individual or group which has committed a war crime? No.
16. FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA? No.
17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977, although not a "nuclear-weapon State" under the nonproliferation treaty? No.

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELGIBILITY

1. Development Assistance Country Criteria.

- a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy.

Yes, as most recently reported in USAID/Kenya cable Nairobi 19306 dated 10/26/79.

b. FAA Sec. 104(d)(1):IDC Act of 1979. If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, disease control, maternal and child health services, agricultural production, rural development, assistance to urban poor and through community-based development programs which give recognition to people motivated to limit the size of their families?

Yes. This specific activity is aimed at more fully involving the rural poor in planning and implementing economic development activities in their communities.

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has the country (a) engaged in a consistent pattern of gross violations of internationally recognized human rights or (b) made such significant improvements in its human rights record that furnishing such assistance is in the national interest?

Kenya has not engaged in a consistent pattern of gross violations of human rights.

b. FAA Sec. 533(b). Will assistance under the Southern Africa program be provided to Angola, Mozambique, Tanzania, or Zambia? If so, has President waived prohibition against the assistance by determining that such assistance will further U.S. foreign policy interests?

N/A.

c. 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?

Special Account arrangements will be an integral part of bilateral agreements which obligate ESF funds.

d. FY 80 App. Act Sec. [510]. Will assistance be provided 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?

No.

e. FAA Sec. 620B. P.L. 94-329 Sec.406. Will ESF be furnished to Argentina or Chile?

No.

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to individual funding sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Economic Support Fund.

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

A. GENERAL CRITERIA FOR PROJECT

1. FY 80 App. Act Unnumbered; FAA Sec. 534A; Sec. 653(b);  
 (a) Describe how authorizing and appropriations Committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure)?

- (a) Normal CN procedures will be followed.
- (b) No

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial, and 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) Yes
- (b) Yes

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

No further legislative action required.

4. FAA Sec. 611(b); FY 80 App. Act Sec. [501.] If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

No water or water-related land resource construction in this project.

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

Capital Assistance will not exceed \$1 million.

6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.

Project is not susceptible of execution as a regional project. As noted in PP, other donors are contributing significantly to the development of the target areas and elsewhere in Kenya.

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (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) The saved production under this project is for domestic consumption.
- (b) Yes
- (c) Yes, indirectly
- (d) Yes, indirectly
- (e) Yes (agriculture and commerce only)
- (f) Not applicable

Exhibit 3 (cont'd)

8. FAA Sec. 601(b). Information and conclusion 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).

The project will have minimal effect on U.S. trade, investment, and private U.S. participation in foreign assistance programs. U.S. contractors will be used as TA under project.

9. FAA Sec. 612(b); Sec. 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 to meet the cost of contractual and other services.

The GOK will contribute \$4.0 million, or about 24% of the total project costs and about 70% of the local currency costs. There are no U.S. owned foreign currencies available for the Project.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?

No

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes

12. FY 80 App. Act Sec. [521.] If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

Not applicable

EXHIBIT 3 (cont'd)

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

(a) This project involves working directly with poor rural farmers (smallholders) in a participatory approach. Smallholders will directly participate in implementing the project and will benefit directly from technical assistance to be provided by U.S. institutions.

(b) N/A

(c) Beneficiaries of this project will be required to contribute time, labor and some materials in which will be a self-help effort to improve grain drying and storage technology.

(d) Women and women's groups, both formal and informal, will be a primary beneficiary target of project and 15 percent of all new Postharvest storage positions will be filled by women.

(e) N/A

EXHIBIT 3 (cont'd)

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.)

(1) [103] for agriculture, rural development or nutrition; if so (a) extent to which activity is specifically designed to increase productivity and income of rural poor; [103A] if for agricultural research, full account shall be taken of the needs of small farmers, and extensive use of field testing to adapt basic research to local conditions shall be made; (b) extent to which assistance is used in coordination with programs carried out under Sec. 104 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; and (c) 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.

- (a) This project is basically an adaptive research and field testing project with necessary supporting elements. The participatory approach will take full account of farmers' needs.
- (b) A major thrust of project is to increase nutritional value of stored grains.
- (c) Project hopes to improve welfare of small farmers by reducing grain losses at the on-farm level which would reduce food importation requirements in the very areas most difficult to reach with distribution facilities.

EXHIBIT 3 (cont'd)

5C (3) - STANDARD ITEM CHECKLIST

Listed below are statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. Procurement

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? Yes
2. FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him? Yes
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will commodities be insured in the United States against marine risk with a company or companies authorized to do a marine insurance business in the U.S. Yes
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? Not applicable.
5. FAA Sec. 608(a). Compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum 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 that such vessels are available at fair and reasonable rates. YES
6. FAA Sec. 521. If technical assistance is financed, to the fullest extent practicable will such assistance, goods and professional and other services from private enterprise, be furnished on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? YES

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

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?

N/A Loan funded activity

f. FAA Sec. 291(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

At the field level the project will be directed and implemented by smallholder beneficiaries themselves and should directly reflect their particular needs, desires and capacities. All four of the country's agricultural education institutions will be upgraded and their existing expertise utilized in the project.

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

Yes

7. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S.-flag carriers will be utilized to the extent such service is available? N/A Loan Financed
8. FY 80 App. Act Sec. [505.] Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States? Any direct AID contracts will so provide.

B. Construction

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest? YES
2. 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
3. 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? not applicable

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? not applicable
2. 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? not applicable
3. 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
4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, sale, longterm lease, exchange or guaranty of motor vehicles manufactured outside the U.S. Necessary waivers have been requested.

EXHIBIT J (cont'd)

5 Will arrangements preclude use of financing:

- a. FAA Sec. 104(f). To pay for performance of abortions as a method of family planning or to, motivate or coerce persons to practice abortions; to pay for performance of involuntary sterilization as a method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? YES
- b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? YES
- c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? YES
- d. FAA Sec. 662. For CIA activities? YES
- e. FY 80 App. Act Sec. [504.] To pay pensions, etc., for military personnel? YES
- f. FY 80 App. Act Sec. [506.] To pay U.N. assessments? YES
- g. FY 80 App. Act Sec. [507.] To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multi-lateral organizations for lending.) YES
- h. FY 80 App. Act Sec. [511.] To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields? YES
- i. FY 80 App. Act Sec. [515.] To be used for publicity or propaganda purposes within U.S. not authorized by Congress? YES

ACTION MEMORANDUM FOR THE DIRECTOR, USAID/Kenya

THRU: D. Christenson, AGR Chief

DATE: Jan 26, 1981

FROM: Gary E. Lewis, AGR

SUBJ: On-Farm Grain Storage Project (615-0190)  
Proposed AID-Direct Construction Contracting

Problem

Recent experience indicates that cumbersome GOK procedures with respect to contracting for and construction of project buildings can delay project implementation, in a typical case, by as much as a year. AGR and M&E personnel and the REDSO/EA RCO believe that the period of time between signing of a project agreement and project implementation can be reduced by a minimum of 4 months by direct AID contracting for building construction. Accelerated construction would result in more timely project implementation and would limit inflation-induced cost escalation.

As detailed below, the subject project is a case in point. It is requested that the Mission seek, for this project, AID/W approval to permit direct AID contracting for construction services (pursuant to AID Handbook 11, Chapter 2, paragraph 2.1.2.) which would otherwise be the responsibility of the GOK's Ministry of Works (MOW).

Discussion

Certain USAID/GOK projects (e.g., Arid and Semi-Arid Lands and Kiboko Range Research) are seriously behind their original implementation schedules due to the long delays in the construction

- 2 -

of required project facilities. Construction delays result not only in increased costs of labor and material but also in delayed project implementation and late fielding of project technicians. USAID's M&E staff believe that such delays can be avoided in the On-Farm Grain Storage project if additional contracting responsibilities are undertaken by the Regional Contracting Officer (REDSO) in consultation with the USAID Mission. Specifically, these additional responsibilities would mean in this case that the RCO, with USAID contributions as appropriate, and with GOK concurrence, would assume responsibility for:

1. Contracting directly with a Kenya-based eligible architecture and engineering firm for:
  - (a) the site survey
  - (b) preparation and development of detailed plans
  - (c) developing cost estimates and Invitation for Bid document for construction and construction supervision.
2. Review of bid documents and selection of the contractor.
3. Execute the construction contract.

The construction under the subject project will consist of six staff houses (five in Kisumu and one in Kakamega) and the laboratory and office space facility at the Farmer Training Center in Maseno. Under AID's usual policy these construction functions would be the responsibility of the GOK. However, because of the heavy workload and insufficient staff of the Ministry of Works, and other reasons, delays of up to a year are being experienced for construction projects.

This experience is not unique to AID Projects. The World Bank project in Baringo was authorized to construct prefab houses but after 18 months has not received MOW approval of tenders for their construction.

The construction cost for project housing and laboratory/office facilities is estimated in the Project Paper (PP) at \$380,000. This amount is within the authorized level of the REDSO Contracting Officer. (See also discussion below concerning approval procedures.)

Direct contracting by AID would not require increased funding by AID. However, the AID-financed portion of the total project would increase by about \$57,000 (calculated at approximately 15 percent of construction costs for the houses and laboratory). That amount, representing the MOW contribution in kind of Architecture and Engineering services, was originally attributed to the GOK portion of the Project. With a reduction of such an amount the GOK would still be contributing approximately 34 percent of total project costs.

We anticipate a compensatory saving to the project due to quicker implementation, from reduced inflation on construction, and other commodities. MSE engineers advise us that the AID staff time required to perform contracting monitoring services should not be significantly greater than the time now spent actively monitoring GOK's direct contracting procedures. MSE staff further advise that, following the proposed AID-direct contracting and construction format

there should be a minimum savings of 4 months in the time required to prepare final plans and bid documents for the construction and in the award of a contract. This should result in dollar savings of perhaps \$65,000 as illustrated below:

A. The PP estimate for technical services and equipment is \$4,386,720 (without contingency and escalation factors).

1. Escalation allowed in the PP for U.S. dollar costs is 15 percent.
2. A 4-month saving represents a 1% saving.
3. 1% of \$4,386,720 = \$43,867.00 (saving).

B. The PP estimate for housing and laboratory construction is \$380,500 (without contingency and escalation cost).

1. Escalation allowed in the PP is 25 percent over 18 months.
2. A 4-month savings equals 5.5% (saving).
3. 5.5% of \$380,500 = \$21,138.88

Total saving = \$65,005.88

minus Added Expense

Expense                    57,000.00

Net Savings                \$8,005.88

Note: While only the monetary implications of project delays have been considered in this argument, timely implementation of projects also carries a strong positive value in bi-lateral relationships and stands as a second supportive argument.

Finally, it should be stressed that the request for exception to the current policy is only for the On-Farm Grain Storage Project and should not necessarily be viewed as a broader precedent

for other AID-funded activities in Kenya. In the instant project, the cost of construction activities is less than 10 percent of the total project cost, but the implementation of the main project's activities cannot proceed until the buildings have been constructed. Other projects should be considered on a case-by-case basis, in terms of contracting policy, at the appropriate time.

Procedure and Approval Authority

In order for AID to contract directly for the above activities, the Mission Director must determine that an exception to AID policy favoring host country contracting is necessary. The Mission must also request approval from the Regional Assistant Administrator, who must have, in order to approve, the concurrence of the Assistant Administrator for Program and Management Services.

The authority to approve an exception to AID's host country contracting preference with respect to construction services is provided in FD-68, "Mode of Contracting for Country Specific Bilateral Project Assistance Loan, or Grant Section II and III General Policy", which states:

"AID policy is, therefore, one of preference that the procurement of AID-financed project goods and services required to implement bilateral project arrangements be undertaken by Borrowers/Grantees rather than AID.---- USAID Directors, Representatives or Affairs Officers are responsible for assuring maximum feasible use of the country contracting mode.----. Exceptions to the policy are not to be based on whether a project is loan or grant funded but rather on exceptional circumstances."

In addition, Handbook 3, Appendix 8C, Guidance on the Assessment of Borrower/Grantee Procurement and Contracting Capability, states:

"When procurement and contracting needs are defined, an assessment must be made of the Borrower/Grantee's capability for performing such functions. ---- Procurement and contracting functions must be evaluated with respect to such points as feasibility, cost, excessive risk of delay, impact on project objectives, etc. A careful assessment of Borrower/Grantee capabilities must be made and a decision reached as to whether Borrower/Grantee capabilities can be satisfactorily augmented by third parties or whether AID contracting will be necessary to ensure the timely and cost-effective achievement of project objectives."

With respect to direct contracts for construction services

Handbook 11, Chapter 2, paragraph 2. 1.2. provides as follows:

"In very unusual cases, the Regional Assistant Administrator with the concurrence of the Assistant Administrator for Program and Management Services (AA/SER) may decide to use an AID-direct contract instead of a country contract. AID/Washington approval is necessary (even if the direct contract is with the Small Business Administration under the Section 8 (a) program) because special arrangements have to be made for direct contracting for construction services. Preferably, the decision is made early in project development and justified in the Project Paper in order to avoid unnecessary delays at the beginning of project implementation. If the decision is made after approval of the project, a request for authorization to use an AID direct contract is submitted to the Regional Assistant Administrator by the Mission Director."

#### Conclusion and Recommendations

We believe the above discussion presents a compelling case, on cost and other factors, for use of AID direct contracting procedures for construction activities. We therefore recommend that, by your signature below, you make the determination, pursuant to Handbook 3, Appendix 8C, that in this case direct AID contracting

"will be necessary to ensure the timely and cost-effective achievement of project objectives". We also recommend your signature on the attached transmittal memo to AA/AFR, which would seek AID/W approval as required under Handbook 11, Chapter 3, paragraph 2. 1.2.

Approved GB Lewis

Disapproved \_\_\_\_\_

Date 26 Jan 1981

Drafted: AGR: GLewis; rwn: 1/7/80

Clearance: AGR: DChristenson [Signature]  
M&E: KFO'Donnell [Signature]  
M&E: SShah [Signature] CPatalive [Signature]  
CONT: GRobinson [Signature]  
REDSO: JAnderson [Signature]  
RLA: GRisson [Signature] 22 Jan 81



UNITED STATES OF AMERICA  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
U.S.A.I.D. MISSION TO KENYA

Annex F  
Exhibit 5

UNITED STATES POSTAL ADDRESS  
NAIROBI (ID)  
DEPARTMENT OF STATE  
WASHINGTON, D.C., 20520

Office of the Director  
INTERNATIONAL POSTAL ADDRESS  
POST OFFICE BOX 30261  
NAIROBI, KENYA

ACTION MEMORANDUM

WAIVER FOR TRAINING

TO: Joseph C. Wheeler, Acting Administrator, AID

THRU: W. Haven North, Acting Assistant Administrator  
for Africa, AID

John F. Owens, Acting Assistant Administrator  
for Program and Management Services, AID

FROM: Allison B. Herrick, Director, USAID/Kenya

SUBJECT: Nationality and Sole Source Procurement  
Waivers for Services

We request a nationality waiver from Geographic Code 000 to Geographic Code 935 and a sole source procurement waiver to obtain the services of Tropical Products Institute (TPI), Slough, England.

a) Cooperating Country	:	Kenya
b) Authorizing Document	:	Project No. 615-0190
c) Project	:	On-Farm Grain Storage
d) Nature of Funding	:	Loan
e) Description of Services:	:	Technical Training; Farm Level Grain Loss Reduction
f) Approximate Value	:	U.S. \$250,000
g) Source	:	United Kingdom
h) Previous Waivers	:	None

**DISCUSSION:** As Acting Administrator you have authority to waive AID's nationality requirements for services pursuant to the criteria set forth in Handbook 1, Supplement B, Section 5C.4.a(2). The handbook waiver criteria for services include the following:

"(b) There are no suppliers from countries included in the authorizing geographic code available to supply the services."

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The Government of Kenya has requested AID assistance in reducing Kenya's on-farm grain storage losses. The training of Kenya extension and teaching personnel are required in order to help implement the Project and to be able to continue the Project after AID assistance stops. The Tropical Products Institute (TPI), Slough, England has been identified to train about 60 Kenyans in farm level grain loss reduction during various times between June 1981 and June 1982. The Tropical Products Institute is a recognized leader in training grain storage specialists at the small farm level. The quality of expertise shared among the staff is unequalled anywhere. Each year the TPI staff conducts a three month intensive grain storage course designed for individuals from developing countries. This specialized three-month training course for grain loss reduction or its equivalent is not presently available from any U.S. source. (See Annex A Exhibit 4 for details on TPI's capability).

Handbook 1, Supplement B, paragraph 12 C4c (1)(e) allows you to waive competitive selection of a contractor, in consultation with AA/SER, where

"(e) One institution or firm can be demonstrated to have the unique capability by reason of special experience or facilities, or specialized personnel who are recognized as predominant experts in the particular field to perform the services required for the project."

DSB's Food Storage Specialist who routinely works within this technical field of grain storage and backstops the centrally funded "Food and Feed Grain Institute" was requested for advice on where to obtain short term technical training for small scale on-farm grain storage in a LDC. This specialist, given his extensive previous experience and present working knowledge of grain storage, reviewed possible U.S. institutions that possibly could be used for short term technical training.

It was asserted, by this specialist, that no U.S. institution has had the necessary experience with small scale grain storage that would meet the technical needs for short term training of Ministry of Agriculture staff. He recommended such training should be provided to the project by the Tropical Products Institute in England.

The Tropical Products Institute is a scientific unit of the UK Overseas Development Administration. Its function

is to cooperate with developing countries in deriving greater benefit from their plant and animal resources, principally by dealing with the scientific, technical and economic problems that arise after harvest. It has a staff of 380 of whom almost half are qualified scientists, engineers and economists. TPI specialises in the post-harvest sector and emphasizes handling, drying and storage of crops. Since 1894 TPI has specialised in post-harvest activities, crop storage, and presently is recognized as a World Center for the Study of Post-Harvest Problems.

Twice a year TPI provides courses for participants from developing countries in Durable Agriculture Crops Storage. The institute offers "Mobile" training courses in developing countries, particularly on grain storage. TPI has had extensive experience dealing with post harvest activities in Kenya and other African countries including Ethiopia, Gambia, Lesotho, Malawi, Nigeria, Sudan, Swaziland, Tanzania, Uganda and Zambia.

The Tropical Products Institute with its intensive grain storage course, the specialized training facilities at Slough and the capability for small farm grain storage training qualifies under the proposed waiver criteria. Prior training experience by the staff at Slough also makes TPI uniquely qualified to conduct this training effort. TPI may be considered to have unique capability; and solicitation, formal or informal, of other groups would not reveal another institute fully qualified, as TPI is to carry out the training.

RECOMMENDATION: For the reasons stated above, it is recommended that you (a) approve a nationality waiver from Code 000 to Code 935, and (b) approve sole source procurement waiver to obtain the services of the Tropical Products Institute without solicitation of these services from other sources.

In so doing, it is recommended that you certify that the interests of the U.S. are best served by permitting the procurement of services from free world countries to other than the cooperating country and the United States.

APPROVED: \_\_\_\_\_

DISAPPROVED: \_\_\_\_\_

DATE: \_\_\_\_\_



UNITED STATES OF AMERICA  
AGENCY FOR INTERNATIONAL DEVELOPMENT ANNEX F  
U.S.A.I.D. MISSION TO KENYA Exhibit 6

UNITED STATES POSTAL ADDRESS  
US AID/NAIROBI  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D.C. 20523

INTERNATIONAL POSTAL ADDRESS  
POST OFFICE BOX 30261  
NAIROBI, KENYA

A C T I O N M E M O R A N D U M

WAIVER FOR VEHICLES

TO : Joseph C. Wheeler, Acting Administrator, AID  
THRU: W. Haven North, Acting Assts. Administrator for  
Africa, AID  
FROM: Allison B. Herrick, Director, USAID/K  
SUBJECT: Source/Origin and Proprietary Procurement Waiver  
for Vehicles

We request a source/origin procurement waiver from Geographic Code 000 to Geographic Code 935 for all the vehicles indicated below and a proprietary procurement waiver to obtain the Land Rovers and 1000 cc Suzukis required for the On-Farm Grain Storage Project (615-0190).

- a) Cooperating Country : Kenya
- b) Authorizing Document : Project No. 615-0190
- c) Project : On-Farm Grain Storage
- d) Nature of Funding : Loan
- e) Description of Commodities: One sedan, one pick-up, four long wheel base 4-wheel drive Land Rovers, seven 4-wheel drive Suzuki Jeeps, fifty 125 cc motor-cycles, and one stake bed truck.
- f) Approximate Value : U.S.\$309,000
- g) Probable Procurement Origin: United Kingdom (UK) and Japan
- h) Probable Procurement Source: Kenya, UK, and Japan
- i) Previous Source Waivers : Nationality waiver for procurement of training services (\$250,000)

DISCUSSION: Section 636(i) of the Foreign Assistance Act of 1961, as amended, prohibits AID from purchasing motor vehicles unless such vehicles are manufactured in the United States. Section 636(i) does provide, however, that "...where special circumstances exist, the President is authorized to waive the provision of the act in order to carry out the purpose of this act". Additionally, in accordance with AID Handbook 1, Supplement B, procurement of motor vehicles of other than U.S.

manufacture requires a waiver. The Handbook provides that a waiver may be granted when necessary to carry out the purpose of the FAA and if, inter alia, there is a present or projected lack of adequate service facilities and supply of spare parts for U.S.-made vehicles. The authority to (1) determine that special circumstances exist for purpose of Section 636(1) and (2) that there is adequate justification for a waiver under Handbook 1, Supplement B, has been delegated to AA/AFR. For purposes of safety, it is extremely important that the vehicles financed under this Project be right-hand drive, since by law all traffic in Kenya moves on the left side of the road. The types of vehicles required for the Project are not manufactured in the U.S. with right-hand drive.

The Government of Kenya has requested AID assistance in reducing on-farm grain storage losses. The above requested Project vehicles are required to provide needed mobility for the Project technicians and Kenya personnel assigned to the Project, who all have to work in areas where roads are usually rugged, unimproved tracks.

The right-hand drive sedan and pick-up is for use by the Project technicians and short-term consultants primarily for transport between Nairobi and the Project area. Being right-hand drive and locally assembled would contribute to driving safety and assure a timely and adequate supply of spare parts maintenance. Since no U.S. manufacturers can supply such a vehicle and support service, a source/origin waiver is requested for the sedan and the pick-up.

The long wheel base 4-wheel drive/right-hand Land Rovers are for use throughout the Project area by the Project technicians in order to complete their assigned tasks, distribute commodities (i.e., training aids), and transport personnel. While U.S. manufactured right-hand drive vehicles normally would have been satisfactory for this Project, it has been determined through experience that the constant shortage of spare parts and non-availability of qualified mechanics to work on U.S. vehicles in rural areas has caused major implementation problems where U.S. vehicles are utilized. The Government of Kenya through the Ministry of Agriculture depends primarily on Land Rover type vehicles for its transportation requirements. Unless Project vehicles are compatible with the country's maintenance system, adequate maintenance and ability to obtain spare parts are virtually non-existent.

Since no manufacturer can supply the Land Rovers except British Leyland, source/origin and proprietary procurement waivers are required for the Land Rovers. Land Rovers have been previously approved for the Kenya National Range and Ranch Project.

The small 4-wheel drive/right-hand drive Suzukis are for use in district sub-locations in the Project area by the district Project personnel in order to complete their assigned tasks, distribute commodities and transport personnel. The reason for these 1000 cc vehicles is that the required tasks of these vehicles will be too much for a bike or motorcycle and not enough to justify using a Land Rover. These vehicles are smaller, more manageable, and often do not get stuck where large 4-wheel drive vehicles do. The vehicles are also cheaper to maintain and operate (average 30 mpg of gasoline) and the spare parts are available in the rural areas. The vehicle would also have no difficulty in fitting into the MOA vehicle maintenance and support system. Since no manufacturer can supply these vehicles except Suzuki, source/origin and proprietary procurement waivers are requested for the Suzukis. Suzukis have been previously approved under the Kenya WID Extension Program Project.

The 125 cc motorcycles requested are for the use in divisional sub-locations in the Project area by divisional Project personnel in order for them to be able to cover the distances required in the completion of their duties. The purpose of this Project element is to supplement an existing Government of Kenya employee's purchase plan using this type of motorcycle which is already familiar to extension employees, suitable for their needs, and readily serviceable in the relatively remote Project area. Since no U.S. manufacturer makes 125 cc motorcycle, a source/origin waiver is requested.

The right-hand drive stake bed truck is for use in distributing Project commodities and grain drying and storage kits throughout the Project area to those communities which have Farmer Training Centers, Cooperative Officers or Kenya Farmers Association Stores. Being right-hand drive and locally assembled would contribute to driving safety and assure a timely and adequate supply of spare parts and maintenance. Since no U.S. manufacturer can adequately supply such vehicles and support services, a source/origin waiver is requested.

RECOMMENDATION: Based on the justification above, it is recommended you certify that (1) special circumstances exist to justify waiving the requirement of procurement of U.S.-manufactured vehicles under FAA Section 636(i); (2) special circumstances exist that justify as stipulated in Handbook 15, 3C4e(2) that a proprietary procurement waiver be allowed for

the Land Rovers and Suzukis; and (3) that exclusion of procurement of the above described Project vehicles from countries included in AID Geographic Code 935 would seriously impede attainment of U.S. foreign policy objectives and the objectives of the foreign assistance program.

APPROVED: \_\_\_\_\_

DISAPPROVED: \_\_\_\_\_

DATE: \_\_\_\_\_

DRAFT PROJECT AUTHORIZATION

Name of Country: Kenya  
Name of Project: On-farm Grain Storage  
Number of Project: 615-0190  
Number of Loan:

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the On-farm Grain Storage Project for Kenya ("Cooperating Country") involving planned obligations of not to exceed \$7.8 million in Loan funds over a five-year period from date of authorization, subject to the availability of funds in accordance with the AID OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project.
2. The Project provides technical assistance, training, commodities and construction in order to increase the use of more effective on-farm grain drying and storage practices in Kenya by increasing the capacity of the Postharvest and Storage Branch of the Ministry of Agriculture (MOA) to conduct adaptive research field testing; by increasing MOA extension capacities; by increasing the capacity of agricultural education institutions to provide grain drying and storage training; and by creating a nationwide capacity to monitor and evaluate grain losses.

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

4. a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the Date of the first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon, except.

b. Source and Origin of Goods and Services.

Goods and services, except for ocean shipping, financed by AID under the Project shall have their source and origin in countries included in AID Geographic Code 941, except as AID may otherwise agree in writing. Ocean shipping financed by AID under the Project shall, except as AID may otherwise agree in writing, be financed only on flag vessels of the United States of the Cooperating Country.

c. Conditions Precedent.

The Project Agreement shall contain conditions precedent substantially as follows:

(1) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement the Cooperating Country shall furnish in form and substance satisfactory to AID:

(a) 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 Borrower, and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all of its terms;

(b) A statement of the name of the person holding or acting in the office of the Borrower specified in Section 9.3, and of any additional representatives, together with a specimen signature of each person specified in such statement;

(c) Evidence that the GOK has made available for the project five acres of land with adequate services at the Masano FTC for construction of an office and laboratory facility for use by the Field Testing and Demonstration Unit (FTDU) and the Grain Monitoring Unit (GMU).

(d) Evidence that the GOK has made available for the project six improved lots suitable for the construction therein of staff housing for six U.S. project technicians. One such lot shall be located proximate to Kakamega and five such lots proximate to Kisumu. Improvements to be provided at Cooperating Country expense shall include adequate provision of water, sewage, electricity, and year-round serviceable road access to each lot.

(2) Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance host country contract activity, the Cooperating Country shall covenant:

(a) to finance host country contract activity, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.: An executed contract for the services of a U.S. consulting firm for the preparation of a master plan for Project implementation.

(b) to finance participant training, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D. evidence that qualified persons selected for training under the Project will be assigned to on-farm postharvest storage related positions and that their terms of employment after training will provide reasonable assurance that such individuals can be retained in such positions.

(c) to finance the purchase of bicycles and motorcycles for Government of Kenya employees, subject to the establishment of an employee purchase plan satisfactory to A.I.D.

(3) The Cooperating Country and the MOA shall also agree in substance to:

(a) Execution of the Project

(1) To carry out the Project with due diligence and efficiency, and in conformity with sound engineering, construction, financial and administrative practices.

(2) To officially establish all new postharvest storage positions as described in the Detailed Project Description Section of the Project Paper and to assign qualified staff, 15 percent of whom will be women, to assume these positions on a timely basis so as to enhance Project implementation.

(3) To cause the Project to be carried out in conformity with all plans, specifications, contracts, schedules, and other arrangements, and with all modifications therein approved by AID pursuant to this Agreement.

(4) Funds and Other Resources to be Provided. To make available on a timely basis any Kenyan currency and other agreed upon Cooperating Country inputs for the punctual and effective carrying out of construction, maintenance, repair and operation of the Project.

(5) Operation and Maintenance. To operate, maintain and repair Project equipment in conformity with sound operational, financial and administrative practices and in such a manner as to insure the continuing and successful achievement of the purpose of the Project.

(6) Management. To provide qualified and experienced management for the Project and to train such staff as may be appropriate for the maintenance and operation of the Project.

(7) Continuing Consultation. To cooperate fully with AID to assure that the purpose of the grant will be accomplished. To this end, the Cooperating Country and AID shall from time to time, at the request of either party, exchange views through their designated Project Coordinators with regard to the progress of the Project, the performance of the Cooperating Country and AID of their obligations under the Grant Agreement, the performance of consultants, contractors and suppliers engaged on the Project, and other matters relating to the Project.

5. Waivers

The following waivers to AID regulations are approved, based upon the justifications contained in Annex F Exhibits 5 and 6 of the Project Paper, and notwithstanding paragraph 3.a. above, I hereby:

a. Approve a nationality waiver from AID Geographic Code 000 (United States) to Code 935 (Special Free World) and a waiver to permit non-competitive procurement of training services for an estimated 54 local extension agents in grain drying at the Tropical Products Institute in Slough, England.

b. Approve an origin waiver from AID Geographic Code 000 (United States) to Code 935 (Special Free World) and with respect to brand-named items a waiver to permit proprietary procurement of the following commodities in Kenya: seven small four wheel drive Suzukis vehicles, four Land Rovers, one stake bed truck, one sedan, one pickup, and fifty motorcycles.

c. Certify (i) with respect to (b) above that exclusion of procurement from Free World countries other than the Cooperating Country and countries included in Code 935 would seriously impede attainment of U.S. foreign policy objectives of the foreign assistance program; and (ii) with respect to (a) above, that the interests of the U.S. are best served by permitting the procurement of services from Free World countries other than the Cooperating Country and countries included in Code 941.

d. Certify that special circumstances exist to waive and do hereby waive, the requirements of Section 636(i) of the Act.

6. Approval

Based upon the justification set forth in Annex F, Exhibit 4, I approve AID direct contracting for the construction services portion of the Project pursuant to Handbook 11, Chapter 2, paragraph 2.1.2.

Date: \_\_\_\_\_

\_\_\_\_\_  
Joseph C. Wheeler  
Acting Administrator

Concurrence:

\_\_\_\_\_  
Acting Asst. Administrator for Africa

\_\_\_\_\_  
Acting Asst. Administrator for  
Program and Management