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Evaluation of Project No. 519-0184 USAID/El Salvador, Office of Small-Scale Irrigation — Small Farm Irrigation Systems Project

(Evaluación del Proyecto No. 519-0184 USAID/El Salvador, Oficina de Pequeñas Obras de Riego)

Applied Social Science and Health Consultants, Inc.
and the
Water Management Synthesis Project

WMS Report 29

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WMS Report 29

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FOREWORD

The small-farm irrigation approach to providing irrigation infrastructure on agrarian reform farms in El Salvador is part of the USAID long-term agricultural development strategy. USAID believes such projects can make an important contribution to increasing the productive capacity of agrarian reform cooperatives through more intensive cropping and greater crop diversification.

This USAID project (No. 515-0184) finances OPOR (Office of Small-Scale Irrigation, Government of El Salvador) to construct small-farm irrigation systems for cooperatives and certain other groups in the agrarian reform sector. The project with extensions will be completed by February, 1985, covering a period of six years. In order to amend the project and possibly continue on into 1987, USAID asked for an evaluation of OPOR's institutional capabilities. The consultants were charged with providing a thorough assessment of the project's activities. This report contains both general and specific recommendations with regards to the continuation of the project, as well as the follow-through process needed to assure the expected benefits for the intended recipients. Opinions on the broader potential impacts that can be expected for cooperatives and the potential for future institutional change also are included.

The consultants addressed the following items as set out in the USAID statement of work and presented recommendations concerning each where appropriate:

1. Crop selection and diversification potentials;

2. Changes in cropping patterns, areas cropped, and yields;

3. Ability of cooperatives to manage irrigation systems, monitor progress, and conduct operation and maintenance;

4. Quality of supporting services affecting the project such as extension, credit, inputs, marketing, storage and transportation;

5. The adequacy and quality of design specifications and construction of irrigation systems;

6. Institutional capability of OPOR in meeting the demand for new irrigation projects;

7. Adequacy and capability of OPOR personnel, equipment and supplies, as well as its working relationships with ORE, CENTA, and USAID;

8. OPOR's ability to deliver and/or coordinate extension, engineering and technical assistant services supportive to the development of reform sector small-farm irrigation systems.

The evaluation team is appreciative of the support and assistance provided by the USAID/ES mission and the staff of OPOR. Special recognition must be given to Mr. Luis Palomo, USAID/ES, and Mr. Nelson Olaf González, of Servicios Técnicos del Caribe (STC), for their aid during the evaluation team's field visits and in providing background data on the cooperatives. Valuable assistance was provided by Mr. Elmer Guerrero, manager of OPOR, in providing information and arranging timely interviews with his staff and those of CENTA. Additionally, Mr. Tom King and Mr. Steve Haynes of USAID/ES/RDO were very helpful and supportive of all of the team's efforts during its stay.

Applied Social Science and Health Consultants, Inc. (ASSHC), is a private consulting company located in Denver, Colorado, USA. ASSHC has had extensive experience in water resource analysis rural sociology, human service agency development, and program evaluation both in the USA and other countries around the world. For this evaluation project, ASSHC utilized a group of professionals from the engineering, agronomic, economic, sociological and management evaluation disciplines. Important use also was made of Denver-based ASSHC personnel who assisted with documentation research and administration: Dr. Shirley Kurz Jones and Ms. Rolli Butler. Dr. Dan Lattimore's assistance through the auspices of the Water Management Synthesis Project was extremely valuable as well.

EXECUTIVE SUMMARY AND RECOMMENDATIONS

A. Introduction

The evaluation team has found that small-scale irrigation is a useful tool for increasing the agricultural production of El Salvador. The Oficina de Pequeñas Obras de Riego (OPOR) has proven to be a viable institution for developing these systems.

B. Major Recommendations

Oficina de Pequeñas Obras de Riego (OPOR), the Office of Small-Scale Irrigation:

The evaluation team recommends the continuation of the small-scale irrigation project under the direction of OPOR. This continuation can be accomplished through any of the three alternatives presented below. The evaluation team favors the first alternative as the most viable of the three.

Alternatives One and Two are based on several premises. If the primary objective is to substantially increase the program size (i.e., taking on 25 per cent more sub-projects), impact a greater number of cooperatives in a short period of time, expend available AID loan monies, and expand institutional visibility, then:

1. The OPOR staff should be substantially expanded in the engineering, design, socio-economic, administration, liaison and new sub-project monitoring areas. Salaries would need to be increased. Formalized linkages should be made with the Division of Irrigation and Drainage, with both units remaining in CENTA.

2. The OPOR staff should remain about the same size, but expand the number of sub-projects undertaken through substantial contracting to private El Salvadoran companies for design, survey, construction, monitoring, and technical assistance services. Skill upgrading for certain staff would be required, and salaries would need to be increased.

Alternative Three is based on the following premises: If the primary objective is to enhance program quality, improve consistency of effort, improve institutional stability, and improve sub-project monitoring and follow-through, then:

3. OPOR should be maintained at about the same staff size, and strengthened in the weaker areas of administrative support, socio-economics, liaison, and sub-project monitoring. Salaries would need to be increased. The number of sub-projects in 1985 should be reduced by 25 per cent. OPOR would remain a part of CENTA and work in a coordinated manner with the personnel in the Division of Irrigation and Drainage.

C. OPOR Overview

The major part of the evaluation focuses on OPOR and its activities.

The OPOR office was started in 1979 as a department under the Ministry of the Interior. During the following five years, OPOR was shifted several times and is now housed in the Ministry of Agriculture (MAG). By July 17,1984 OPOR had completed 30 sub-projects throughout much of El Salvador, with six others under construction and 11 in the design phase. At the sub-project level the AID Loan supports certain construction and materials costs. The construction labor costs are paid by PL-480 funds administered by the Office of Special Resources (ORE). The original loan amount was ₡5,750,000 ($2,300,000). As of April, 1984, ₡3,472,293 had been expended with ₡2,277,709 remaining to be expended by February, 1985. The financing for OPOR office staff comes from a combination of GOES counterpart funds and two sources derived from PL-480.

In short, OPOR serves the GOES as implementation control and coordination office for small-scale irrigation on Phase I and some Phase III (Decree 207) agrarian reform farms.

D. Purpose and Scope of Work

USAID/El Salvador requested the Water Management Synthesis Project through the Consortium for International Development (CID) to provide a multi-disciplinary team to evaluate the Small Farm Irrigation Project, No. 519-0184. CID contracted with Applied Social Science and Health Consultants, Inc. (ASSHC), a private consulting firm based in Denver, Colorado, to conduct the evaluation during the period 17 July through 30 August, 1984. ASSHC provided a full-time team consisting of rural sociologist/team leader, cooperative and community development specialist/co-team leader, agronomist, agricultural engineer, and economist in order to make the primary evaluation. They were assisted in the field for one week by an ASSHC consultant specializing in Central America and in Denver by a documentation specialist. The ASSHC consultants conducted studies of 16 cooperatives, seven of which are presented in the report in detail. Of the total, 15 have systems built or being designed by OPOR.

The evaluation team began its work with secondary data collection and bibliographic research in the USA. This process continued in El Salvador in conjunction with field visits to inspect the irrigation layouts and design, and to interview co-op leaders and members (i.e., project beneficiaries). Additional interviews were conducted with a number of GOES agency directors and staff (see Itinerary), as well as several private agency personnel, utilizing primarily open-ended and some forced-choice interview methodologies.

The original AID project paper (1978) directed this effort at small farms to aid them in year-round crop production and to provide a more secure employment pattern for the farmers. In 1981 the project was altered to work primarily with the Phase I cooperatives. The Phase I group consists of 439 properties representing over 250,000 ha. of land. Each expropriated holding (single or multiple parcels held by a single owner) exceeded 500 ha., with an estimated beneficiary number of 188,154 persons. Not all are organized into cooperatives; 220 groups currently exist in the country. The irrigable land estimates within the sector vary from 13,000 ha. suitable for gravity-fed irrigation to approximately 80,000 ha. with inclusion of pumped- and well-supplied systems.

E. Recommendations by Discipline

Each of the following is presented by discipline, in the order they appear in the regular body of the document. The first part of each presents a brief descriptive background, the second part key recommendations.

1. Agronomic and Agricultural Analyses: The climate of El Salvador is suitable for the production of many sub-tropical and tropical crops including those now grown in the project areas, and those suggested or planned. ET's are low to moderate. With the addition of phosphate and the crop's nitrogen requirements, the soils of the project are generally productive with high-yield potential. Irrigation is a new technology for the farmers. Technical assistance in the proper physical application of the water has been lacking, as has help in making better use of the new systems to maximize crop production. Supporting service and institutional liaison/communication linkages are weak, although CENTA and ISTA have much to recommend them. Farmers generally are enthusiastic and optimistic about the prospects of improving their incomes with irrigation.

Recommendations: It is imperative that the proper support be organized and implemented soon after sub-project completion.

* Extension should be strengthened and re-vitalized nationally so that sub-project cooperatives will benefit. Follow-through now is deficient.

* A liaison section should be set up in OPOR to implement coordination of all agricultural and related human-resource supporting agencies and institutions involved in the sub-project areas.

* A monitoring and visitation system for the sub-projectsshould b established with AID-OPOR participation.

2.Physical and Engineering Analyses: The OPOR sub-projects are mainly open-channel operated delivery systems with some variations. The design and construction of the delivery systems are, with minor exceptions, good. A strong engineering link between the design and construction phases does not exist. The present systems are designed with little farmer participation. The major problem associated with the sub-projects is that the irrigation systems are not easily farmer-manageable. A farming systems approach is not being taken by the cooperatives or by OPOR. The general recommend-ations address this major problem from an engineering view but with recognition of the necessary link to the other disciplines.

Recommendations : The overall emphasis must be placed primarily upon long-term human use and agricultural intensification rather than construction per se.

* Continue to build simple gravity-operated delivery systems for surface irrigation.

* Include as part of OPOR's design procedure an application syste i.e, a planned and designed field-level irrigation system with a strong link to drainage.

* Thoroughly train farmers in the use of their new-irrigation systems. This is especially necessary during the initial irrigation season.

* Establish regional demonstration farms. These farms would be models to promote and improve irrigation systems and agriculture in general through a farming systems approach. The farms would also serve for practical field training of extension agents.Recommended locations are the departments of San Miguel, Sonsonate, and coastal La Paz, with Chalatenango added if security conditions permit.

* Evaluate the irrigation systems themselves during an irrigation season by AID staff. This would be the best time to recommend and implement improved irrigation practices.

* Provide agricultural engineering support to the co-ops through CENTA extension. This support would address equipment selection and maintenance, and storage facilities.

* Establish a regional OPOR office in San Miguel. The construc-tion and operation of additional sub-projects in this area is warranted.

3. Institutional Analysis: The OPOR office was first opened in January, 1979. It is presently located within the CENTA directorate of MAG. In terms of an institutional analysis, viewed both structurally and functionally, its existence has been characterized by structural instability and functional success in some (but not all) areas. The structural instability and shifts in OPOR's institutional placement primarily have resulted from factors external to OPOR, rather than to poor internal management. Overall cooperative-based small-scale irrigation goals, as measured in terms of 1978 expectations for numbers of sub-projects to be completed and hectares to be irrigated, have not been achieved. However, major changes in the program in 1981 linking it to Phase I of the agrarian reform have enabled the program to become somewhat more manageable internally and considerably more realistic in program focus. In the opinion of the consultants those OPOR functions that currently are being executed well include intra-office coordination, delegation of authority, document processing, basic engineering and design, technical assistance as provided by Servicios Técnicos del Caribe, and budget management. Those functions that are being executed moderately well include general management, agronomic analysis, economic analysis, construction supervision, topographic surveying, and budget analysis. Those functions which are in need of substantial improvement include inter-agency liaison and communication, post-construction engineering follow-up, extension outreach (now definitely planned), hydrology, socio-economic analysis of beneficiary needs, and use of sub-project selection criteria. Certain of these needs have been addressed above under "Major Recommendations".

Recommendations: OPOR cannot become an established institution without improved inter-agency coordination and support.

* Priority attention must be turned to the institutional stabilization of OPOR. It should be retained within CENTA. This will enable much better sub-project follow-up and the meeting of beneficiary needs (including those of extension and human welfare).

* The staff should be expanded with the addition of nine technical and professional personnel, five of whom would be based in a newly proposed OPOR liaison section.

* OPOR should not take on an in-house extension function. The linkage to the farmer through CENTA and ISTA should be emphasized.

4. Sociological Analysis: The cooperative organizational structure is the tool used to develop the Phase I farm in El Salvador. This tool has numerous incentives associated with it, including the opportunity for democratic self-governance, a practical yet simple philosophical base (usually formed by persons with a common pre-existing bond), potential economic viability, and the opportunity for developing indigenous leadership. But the co-op movement has yet to demonstrate its long-term viability. The evaluation team found the constraints to be similar to those observed in other developing nations. The agricultural support

institutions of the GOES have not utilized an integrated farming systems-community development approach. Ongoing training and interagency communication have been very limited, resulting in poor agricultural and community development on the cooperatives. The strongest cooperatives now are those that inherited economical strong farms from the former owners. Most cooperatives are lacking both short- and long-range community and agricultural development plans as well as management training for their members. The OPOR program has not been provided an opportunity to help with these, thus frustrating the farmers in their quest to best utilize the new irrigation systems.

Recommendations: A greater amount of feedback from cooperativ farmers needs to be integrated into OPOR's planning. CENTA can assist in this effort.

* Within an integrated community and farming systems developmen approach,OPOR should use PL-480 monies for land contouring, reforestation projects,soil conservation, road and bridge construction, and rural electrification programs on those co-op farms where these felt needs are greatest.

* All agricultural support (e.g. ISTA) and extention agents should meet regularly to promote their programs, share technical information, and coordinate their outreach in a more integrated fashion. An inter-agency steering group (including co-op and OPOR representatives) should be formed within each of the four agricul-tural regions.

* All agricultural extention and support agents of the GOES agencies should receive training (coordinated by CENCAP) in community and cooperative development methodologies, as well as in technical agriculture and irrigation.

* A human welfare and resource measurement scale should be developed by the OPOR socio-economic department for use in better determining proposed sub-project beneficiary needs. A co-op's "state of readiness" for an irrigation system should also be determined.

5. Economic Analysis: Average construction costs per irrigated hectare at sub-projects have been on the order of ₡3,477 , covering direct costs incurred for construction materials and labor. The internal rates of return (IRR) for sub-projects,based on average costs per ha. and average number of ha. irrigated, are about 20 to 23 per cent depending on crops--a strong indicator.

Recommendation: In planning future small-scale irrigation systems OPOR should broaden its plans to comprise a "package" consisting of the irrigation system, any related improvements that are urgently needed such as a storage shed or land smoothing, and training for the farmers in how to irrigate.

* Enough money should be budgeted to pay for everything in the package. This type of planning and budgeting may result in higher overall cost per irrigated hectare, or fewer sub-projects, but the average benefits per hectare should also be attained more quickly and more surely.

* The 1985-87 selection of OPOR sub-projects should be based upon criteria of cost effectiveness (lowest cost per irrigated hectare), helping the relatively poorer cooperatives, "state of readiness", and system's technological simplicity. This needs to occur within the broader context of improved project selection and prioritization by OPOR, and of regional targeting and access to cooperative-based demonstration farms.

* More long-term emphasis should be placed on simple gravity-flow irrigation systems, as opposed to systems which require pumping. Operation and maintenance constraints must be minimized. Uncertainly about future trends in price of imported petroleum products would indicate avoidance of systems using diesel-powered pumps.

* Directors of cooperatives will need continuing help from MAG in how to maximize their profits from use of an irrigation system. In some instances they may need guidance to understand the concept and need to become "profit maximizers", those engaged in management of a true farming enterprise.

F. Demand for Small-Scale Irrigation Projects

Demand is linked to the needs of potential beneficiaries. The consultants have determined that (after initial promotion) the concept of small-scale irrigation to intensify crop production has "taken hold" among the cooperatives, and that initiation of sub-project proposals now primarily originates with small farmers. This innovation is diffusing most rapidly through the western region. In the foreseeable future there will be more requests than OPOR can handle. However, factors of program scale and quality dictate that (if expanded) the office take on no more than 25 per cent additional sub-projects annually. It should be noted that OPOR sub-projects currently and potentially impact only a small percentage of El Salvador's potentially irrigable land, and only a small percentage of the available land of the co-ops. One reasonable estimate of the potential gravity-fed irrigable land of the agrarian reform Phase I cooperatives (including those yet to be organized) ranges from 13,000 to 17,500 ha. Other sources provide estimates that are somewhat larger. OPOR will have irrigated approximately 2,700 of this amount by February 1, 1985, representing 15 to 21 percent of the potential.

. Demand is affected, and therefore ultimately limited, by: (1) agro-economic factors such as ava lable water and suitable soils; (2) sociological factors such as the ability of co-ops to manage irrigation systems; and (3) institutional factors such as the ability of OPOR to implement enough systems while retaining standards of quality. None of these at present serves as a severe constraint.

PROJECT DESCRIPTION DATA

1.	Country:	El Salvador
2.	Project Title:	Small Farm Irrigation Systems
3.	Project Number:	AID 519-0184
4.	Loan Number:	AID 519-T-021
5.	Project Dates:	
	a. Project identification	Early 1976
	b. PRP approval for intensive review	November, 1976
	c. First project agreement	May 13, 1978
	d. Original life of project (as planned)	Aug. 30, 1978 - Sept. 1, 1983
	e. First project extension	Sept. 1, 1983 - Sept. 1, 1984
	f. Second project extension	Sept. 1, 1984 - Feb. 1, 1985
	g. Current Project Activity Completion Date (PACD)	February 1, 1985
6.	Project Funding ($ million):	
	a. AID loan	$2.3
	b. Other major donors	None
	c. Host country counterpart funds	$2.0
	d. AID loan funds not yet expended	($0.9)
	TOTAL	$4.3
7.	Mode of Implementation:	
	Creation of gov't entity	OPOR (Oficina de Pequeñas Obras de Riego)
8.	Project Design:	
	All sub-projects	OPOR
9.	Responsible Mission Officials:	
	a. Interim Head, RDO	Thomas King
	b. Project Manager	Steven Haynes
	c. Project Officer	Luis Carlos Palomo
10.	Previous Evaluation Reviews:	
	a. Transcentury Corporation	December, 1981
	b. USAID/ES. Document I	June, 1983

GLOSSARY OF ACRONYMS

ACOPAI	-	Asociaciones Cooperativas de Producción Agropecuaria Integradas (Cooperative Associations for Integrated Agricultural Production)
BFA	-	Banco de Fomento Agropecuario (Agricultural Development Bank)
CATIE	-	Centro Agronómico Tropical de Investigación y Enseñanza - Costa Rica. El Salvador is co-participant (Tropical Agronomical Center for Research & Training)
CCAS	-	Consejo Consultivo Agropecuario Sectorial (Agriculture Sector Advisory Council)
CDG	-	Centro de Desarrollo Ganadero (Center for Livestock Development)
CEA	-	Consejo de Entidades Agropecuarias. (Agricultural Entities Council)
CENCAP	-	Centro de Capacitación Agropecuaria (Center for Agricultural Training)
CENREN	-	Centro de Recursos Naturales. Formerly called CRN (Center for Natural Resources)
CENTA	-	Centro Nacional de Tecnología Agropecuaria (National Center for Agricultural Technology)
CODIZO	-	Comité de Dirigentes Zonales (Zonal Leaders Committee, a part of ISTA)
CORACOL	-	Asociación Cooperativa de la Reforma Agraria Copapayo de R.L. (Cooperative Association of Agrarian Reform Copapayo R.L.)
DGRD	-	Dirección General de Riego y Drenaje (proposed) (Directorate of Irrigation and Drainage)
DIDECO	-	Dirección de Desarrollo Comunal (Directorate for Community Development)
DRD	-	División de Riego y Drenaje (Division of Irrigation and Drainage, a part of CENTA)

FAO	-	United Nations Food and Agriculture Organization (Organización de las Naciones Unidas para la Alimentación y la Agricultura)
FESACORA	-	Federación Salvadoreña de Cooperativas de la Reforma Agraria (National Federation of Agrarian Reform Cooperatives)
FINATA	-	Financiera Nacional de Tierras Agrícolas (National Finance Office for Phase III Agrarian Refor Lands)
IDB	-	Inter-American Development Bank (referred to in Spani as BID) (Banco Interamericano de Desarrollo)
ISTA	-	Instituto Salvadoreño de Transformación Agraria (Salvadoran Institute for Agrarian Transformation)
MAG	-	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
OCOPROY	-	Oficina Coordinadora de Proyectos (Coordinating Office of MAG-AID Projects)
OPOR	-	Oficina de Pequeñas Obras de Riego (Office of Small-Scale Irrigation, a part of CENTA)
ORE	-	Oficina de Recursos Especiales (Office of Special Resources)
STC	-	Servicios Técnicos del Caribe (Caribbean Technical Services)

CHAPTER I

INTRODUCTION

This evaluation deals with the viability of small-scale irrigation in El Salvador. An analysis is provided of the Oficina de Pequeñas Obras de Riego (OPOR) and its link to other organizations. Also presented is an evaluation of the sub-projects (irrigation systems) designed and constructed by OPOR, as well as future incentives and constraints to such development.

The consultants visited sub-projects selected from the lists in Table I-1, I-2 and I-3. Emphasis was placed on constructed sub-projects. However, sub-projects in various stages of construction and design were also selected on the criterion of length of time in operation.

The evaluation is based on the consultant's understanding of the general objectives of irrigation systems. The consultants utilized several guiding principles in framing their analyses. The objectives and principles are presented in the following chapters, and summarized in the first part of Chapter VIII.

TABLE I-1

SUB-PROJECTS CONSTRUCTED

	NAME AND COMPLETION DATA	IRRIGATED AREA(ha.)	DEPARTMENT
	Las Conchas (12-15-82)	35	Santa Ana
	San Antonio Zacamil (06-05-81)	15	Santa Ana
*	Las Bromas (02-15-82)	100	Ahuachapán
	El Obrajuelo(03-30-81)	86	Ahuachapán
	San Raymundo (09-02-81)	42	Ahuachapán
*	Cara Sucia (08-14-81)	42	Ahuachapán
	Nueva Guyapa (07-24-81)	80	Ahuachapán
	California (-02-83)	35	Ahuachapán
*	San Martín Larín (10-02-83)	35	Ahuachapán
	Amatal (05-20-83)	56	Sonsonate
	Pushtan (07-04-80)	73	Sonsonate
	El Zope (09-25-81)	45	Sonsonate
*	El Edén (03-25-83)	50	Sonsonate
	Palo Combo (03-31-82)	100	Sonsonate
*	La Bolsona (08-27-81)	100	Sonsonate
	La Chapina (04-02-82)	80	Sonsonate
	La Fortuna (01-22-81)	60	Sonsonate
	Níspero Montes (10-31-81)	100	Sonsonate
*	Plan de Amayo (09-17-81)	60	Sonsonate
	Las Victorias (07-29-81)	55	Sonsonate
	El Carmen (07-28-81)	20	Sonsonate
	Taquillo (09-04-81)	35	La Libertad
*	El Tatuano (12-15-82)	10	La Libertad
	Aldea Vieja (04-10-80)	11	Chalatenango
	Llano Grande (07-17-80)	15	Chalatenango
	El Recuerdo (-06-83)	60	La Paz
*	Singaltique (03-15-82)	100	San Miguel
*	Rancho Grande (-03-84)	40	San Miguel
	Meanguera (01-10-80)	10	Morazán
*	Primavera I (-03-84)	71	San Vicente

* Sub-projects visited by the evaluation team. Note should be made that the list of sub-projects contained in Tables I-1, I-2, and I-3 is not intended to correspond to that presented in Table VII-1.

TABLE I-2

SUB-PROJECTS IN DESIGN

	NAME	IRRIGATED AREA(ha.)	DEPARTMENT
	San Cayetano	100	Santa Ana
*	San Rafael	100	La Paz
	Santa Emilia	10	La Libertad
	Melara	50	La Libertad
	Santa Anita	35	Usulután
	El Congo	30	Usulután
	Divina Providencia	70	San Miguel
	La Ceiba	70	San Miguel
	Miraflores	100	San Miguel
	San Ramón	40	La Unión
*	Maquigüe	40	La Unión

TABLE I-3

SUB-PROJECTS IN CONSTRUCTION

	NAME	IRRIGATED AREA(ha.)	DEPARTMENT
	San Francisco Guajoyo	84	Santa Ana
*	Primavera II	82	San Vicente
	La Paz	40	San Vicente
*	Miramar	60	San Vicente
	Achichilco	16	San Vicente
*	La Canada	86	Sonsonate

* Sub-projects visited by the evaluation team

CHAPTER II

BACKGROUND

On July 9, 1984, a contract was signed between the Consortium for International Development (CID) and Applied Social Science and Health Consultants, Inc. (ASSHC) to enable an evaluation to be made by ASSHC of the USAID/El Salvador Small Farm Irrigation Systems Project (519-0184). CID is a member of the Water Management Synthesis II Project, headquartered in Ft. Collins, Colorado and funded by USAID. ASSHC is an independent, privately-held consulting firm headquartered in Denver, Colorado. The evaluation was conducted in El Salvador during the period July 17-August 30, 1984.

The evaluation was conducted in response to a request received by the Water Management Synthesis II Project (WMSP-II) from USAID/El Salvador (USAID/ES). The intent was to assess past performance of Project 519-0184, to assist in the development of future program strategy involving Phase I cooperative based small-farm irrigation (see below), and to provide information of use in the preparation of the Project Paper Amendment. Prior to the arrival of the ASSHC Team a decision had been made to extend the PACD to February 1, 1985 to allow completion of 11 sub-projects already underway. A tentative decision had been made to extend the PACD until May 1, 1987, subject to results of this evaluation and discussions with the government of El Salvador.

The Small Farm Irrigation Systems Project Agreement was signed August 30, 1978. The initial intent was to expand the capability of the Government of El Salvador (GOES) to assist independent low-income small farmers obtain and use water resources. The project was to be implemented throughout El Salvador, emphasizing the application of appropiate irrigation technology building upon demonstrated community interest (thus aiding access to necessary self-help local labor and construction materials). As all of El Salvador's arable land was (and is) being used, the project's objectives fall within the broad GOES goal of agricultural intensification; extensification is not possible.

As originally intended, the project was to include the following: (1) establishment of a project office for implementation control 1/; (2) construction of approximately

1/ The office was originally to be named the Office of Small Scale Irrigation Systems-OSSIS. The name now used is Oficina de Pequeñas Obras de Riego, OPOR.

5,000 hectares (ha.) of small-scale irrigation systems; (3) training of approximately 100 extension agents; (4) short-term training in irrigation science of approximately four engineer-agronomists attached to the project office; (5) approximately 48 person-months of long-term technical assistance provided by a U.S. project advisor; (6) approximately 12 person-months of short-term technical assistance to assist the project advisor; (7) construction materials and equipment; (8) community labor and materials; (9) GOES salaries and operating expenses to assist with community organization and development, engineering and design, and construction supervision. The initial loan was for U.S.$ 2,300,000, to be repaid over a 20 year period, and to be disbursed over the period FY 1978 - FY 1982.

The OPOR office was opened in 1978. It was initially part of the Ministry of the Interior, but for a variety of administrative reasons has been shifted several times and now is housed in the Ministry of Agriculture (MAG). Project implementation activities began in March, 1979. However, of the 90 potential sub-projects initially identified (all in the northern part of the country) only four had been completed by October, 1980. The level of violence in the north prevented project implementation, and wide-spread unemployment obviated the use of volunteer labor for construction.

The project focus was substantially modified in 1981. This was intended to overcome the hurdles previously encountered, and to link with the aims of the new GOES agrarian reform program announced through Decrees 153 and 154 in March, 1980.

As the first major attempt to achieve fundamental changes in the ownership of agricultural land since 1882, the 1980 agrarian reform set out (among several provisions) to transfer ownership and management of land expropriated from hacienda owners to cooperative associations. Three phases of expropriation were announced, with the intention that they run concurrently: Phase I (encompassing the lands of most of the sub-projects covered in this evaluation) affected owners whose total holdings in single or multiple properties exceeded 500 ha. total. According to USAID 360 properties owned by 262 landholders were expropriated. An additional 66 Phase II farms were voluntarily sold to the GOES during Phase I implementation. The 426 properties (some temporarily abandoned) are known as the Phase I Reform Sector. About 200,000 ha., or 15% of the country's agricultural land, is included. In addition, Phase I includes 103 farms acquired by the state between 1932 and 1979, accounting for an additional 5% of agricultural land. The Instituto

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de Transformación Agraria (Institute of Agrarian Transformation, ISTA) acquires the land, and is responsible for transferring these estates to the cooperatives. ISTA was founded in 1975.

Phase II covers properties of 100 - 500 ha. in size, and has yet to be implemented. ISTA also would administer this. Phase III, the so-called "land to the tiller" program, covers claims to freehold title of up to seven ha. by small-scale cultivators. This phase is underway. It is administered by FINATA, Financiera Nacional de Tierras Agrícolas (The National Financial Institute for Agricultural Lands). Phase III was authorized in April, 1980, with the announcement of Decree 207. According to USAID, it is difficult to determine the number of properties potentially affected. Size varies widely. One estimate indicates that 198,500 ha. (14% of the agricultural land) may be affected. Some Decree 207 farms are covered by Project 519-0184.

Therefore, a key modification made to 519-0184 in 1981 was the inclusion of agrarian reform farmers. In addition, the GOES requested that the project be implemented in conjunction with the employment generation project. This enables the United States PL-480 Title I local currency generation funds to be used to pay for labor, thus allowing for remunerated rather than voluntary labor by the beneficiaries. More secure geographic regions in the western and central portions of El Salvador were selected for sub-project sites, although possible northern and eastern sites were not excluded from consideration.

In December of 1981 the project was evaluated. Recommendations were made as to additional technical assistance and training requirements. Analyses were included as to the history of apparent prioritization shifts in overall GOES and AID goals bearing upon 515-0184 during the period 1978-1981: Employment generation, income redistribution and agrarian reform, economic efficiency, and institutional development were mentioned. In 1983 a second evaluation was made.

In August of 1983 the USAID/ES mission requested a one-year extension of the PACD. After an initial AID/Washington (AID/W) rejection of the request, a 45-day extension was granted during which time the mission responded to questions raised by the bureau. Significant progress was shown by the mission to have been made in construction and project quality. This, plus optimism associated with plans for 18 sub-projects during 1984, led to a PACD extension until September 1, 1984.

As of July 17, 1984, initial construction had been completed on 30 sub-projects. Although the geographic spread covers 10 of the country's 14 departments, 19 of the sub-projects are located in the two departments of Sonsonate and Ahuachapan. As of July 17, 11 sub-projects were in design, and six were under construction (see Table I-1). During the course of the evaluation 15 of these sites were visited by the ASSHC Team; a 16th non-OPOR site (Mosquitia) also was visited.

* * *

The following assumptions or premises underlie the analyses presented in this report. These assumptions are specific to El Salvador, and to the best of the consultants knowledge are shared by USAID/ES and GOES as well:

- Small-scale irrigation is a viable method to enhance agricultural production. At the institutional level it is viewed as a relatively new technological complex, although large-scale irrigation system (e.g., Zapotitán) have been in existence for a long as 11 years.

- Small-scale irrigation development can be attempted within the context of agrarian reform. Within the parameters of the present project, it can be attempted by utilizing the emerging cooperative structure. A lead agency, such as OPOR, is necessary.

- Cooperatives of various types have existed in El Salvador for several decades. AID has been involved in cooperative development in the country since 1964. However, the Phase I agrarian reform cooperatives are new and therefore should not be viewed as proven entities. The potential for irrigation development to enhance cooperatives' agricultural and livestock development exists, but has yet to be consistently demonstrated.

- Irrigation development must take place within a broad context of farming systems development. This is a context which treats efficient farming as a means to the betterment of the human condition and which views a farming system as being comprised of technical, socio-economic (including employment and marketing), management, and extension components.

- Irrigation and the construction of irrigation systems are not ends in themselves, but means to the end of agricultural intensification.

CHAPTER III

AGRONOMIC AND AGRICULTURAL ANALYSIS

A. BACKGROUND EVALUATION

This chapter provides background information and guidelines to those making decisions concerning the agricultural impact of the OPOR irrigation projects. It will also be useful in the planning of support programs that will affect the sub-project areas after actual construction of the irrigation systems. The analysis is based on the general premise that the end product of an irrigation project should be the improvement in the income of the farmer, which in turn contributes to the total food and livestock output of the country.

1. Methodology -- The short visit of the consultant team and the large number of assigned tasks did not allow for complete analysis of the agricultural situation at each of various sub-projects. Data collected were not always detailed. Most remarks will in this section of the chapter are of necessity general, unless otherwise noted. As an example, the topography was observed at each sub-project site as it would affect distribution of irrigation water and thus crop growth and selection. This was only done visually even though maps that were available were too large in scale, with no slopes measured on-site.

Visits were made to 14 cooperative locations by the agricultural consultant. Farmers from one cooperative that could not be visited met with the consultants in San Miguel. Farmers were interviewed and cropped areas studied. There was no application of irrigation water at the time of the visits. Soils were visually examined to 90 cm and rough determinations made of pH at some locations. The sub-projects visited represented seven of El Salvador's 14 departments.

An attempt was made to determine the present areas planted, areas irrigated, crops grown, cropping intensity, yields and the level of inputs used (fertilizer, insecticide, herbicide). Varieties planted and seed sources were checked where considered appropriate. Crop production methods were noted and the amount of labor required in general, but without collecting specific numbers. Also noted was mechanization, if any. Particular cropping constraints were recorded. Harvesting, cleaning and/or processing, and marketing methods were investigated in many cases but are not considered an essential part of this study. The agricultural engineer observed the on-farm storage facilities.

Where possible, it was determined what future areas could be irrigated. Crops planned, their expected yields, and associated farmer incomes were estimated. An attempt was made to assess the co-ops concept of the possible benefits that could be expected with

irrigation. Inquires were made to determine the way cropping and related enterprises were planned and what decision making processes were used. Crop production related to the livestock units was observed briefly. The level of income from livestock products as it relates to unit area of land was more difficult to ascertain.

The CENTA director provided the consultants with a thorough briefing on the organizational functions of research, extension and seed production in El Salvador. The CENTA staff were thoroughly interviewed as well.

2. Natural Resources -- The OPOR sub-projects are scattered throughout the country. However, the western departments proportionately have more than the others.

Some general information on natural resources has been published. Also, specific data is found in some of the individual AID document files for each sub-project. The purpose of this section of the report is to provide background information as it pertains to the potential production of the sub-projects.

a. Climate: The climate of El Salvador has been variously described as warm sub-tropical or tropical (savannah or humid forest) monsoonal with a usual six-month wet period (May-October) and a six-month dry period (November-April); this discussion focuses on the lower slopes in the southern 1/2 to 1/3 of the country. The more hilly central and northern portions exhibit different climatological features.

Average monthly temperatures do not vary greatly during the year and even the average maximums (32-34°C) and minimums (21-23°) exhibit a narrow range of about 11°C. Highs of 40°C or more and lows of 10°C or less can occur. Relative humidity is higher in the wet season as expected but not as low as would be expected for such a long dry season. It averages about 70 percent.

On average it is reported that 95% of the annual precipitation occurs in the wet season. Average rainfall normally falls in the range of 1400 to 2300 mm per year with the long-range average in a narrower range of 1600-1800 mm. Generally the eastern part of the country has less rainfall than the central and western portions. The eastern area regularly has mini-dry periods of 15 to 22 days duration in the wet season. The usual fluctuations of weather can also cause periods of little or no rainfall in the rest of the country. Therefore, it is important to note that there are wet-season periods when irrigation can be beneficial and help avert crop losses. During the course of the Utah State University irrigation investigations at San Andrés, water was applied fourteen times on one upland rice experiment during the wet season of 1976. This covered the period July 15 to October 21. A total of 318 mm was applied. There were 80 days of less than 5 mm rainfall during the period of this experiment. This was a

lower than normal rainfall period but illustrates the demands for irrigation that can occur in the wet season. For most crops and with normal rainfall, the average number of times a crop could be beneficially irrigated in the wet season is estimated to be three to six.

Detailed figures on cloud cover or percent sunshine were not available; estimates were given in some of the project documents. It would be expected that the percent sunshine would be fairly low in the wet season. However, when lesser cloud cover occurs in the daytime and rains come mostly in late evening or night, percent sunshine can be favorable for good crop growth. One report surprisingly indicated that percent sunshine even in the dry season averaged only about 62 percent. With approximately 80-120 mm of rain on the average occuring in the dry season, it can be assumed that cloud cover without rain occurs 60 percent of the time. This would have an adverse effect on the maximum crop yield potential that could be expected.

The shorter day lengths in December and January are 1.5 hours less than the longest in June. This has only a slight affect on photoperiod sensitive crops but most now have non-sensitive varieties that have been developed by plant breeders.

Although some high maximum winds are recorded in El Salvador during concentrated storms, the average monthly wind speeds over the project areas are low. Most fall in the range of 4 to 10 km/hr with dry season winds averaging 15-25% higher than the wet season.

ET (evapotranspiration) determinations were made by the Utah State group at San Andrés by using three methods for comparison (On-Farm Water Management Research, 1982). Some of the ET's and crop water requirements (CWR's) were determined for the OPOR sub-projects using the Hargreaves method. The climatological features of El Salvador (as discussed above) provide a situation where ET's are not high and thus CWR's are reasonable. An ET of 5 mm could be used even in the dry season for a site located at a fairly low elevation. The significance of these moderate ET's for OPOR irrigation sub-projects is that irrigation water can be used to cover a greater area than would be possible with higher ET's and CWR's.

b. Soils : Each sub-project document developed by OPOR includes a description of the soils, with brief comments about their capabilities. However, the documents are not uniform in their coverage. Some documents list the soils mapped by soil class. Auger examinations by the consultants found the reports to be accurate. Nearly all of the soils of the sub-project areas are of volcanic origin with some of those in the coastal plains being marine alluvials. The higher-elevation soils and some riverine alluvials are alfasols. The remainder are mostly either regosols or vertisols. The vertisols are dark-colored stickly and plastic clays on the surface, usually deep, changing in color and some in

texture below the top soil. Most of the regosols are medium textured (sandy clay loam) and of varying depth to clay sub-soils or other materials. In the hilly regions, the top soils frequently are medium-texture and friable, but tend to be fairly shallow. These are fragile soils for irrigating and will require positive measures by the cooperatives to prevent erosion.

The pH of nearly all the soils in El Salvador is low (from 5.4 to 6.5). The country imports all of its fertilizer. The source for the nitrogen used is ammonium sulphate because it is the most economical. Continual use of this source and/or application at high rates per unit area will add to the low pH problem. Phosphorus content is low in nearly all soils and a general problem of high fixation exists. Potash levels are high in nearly all soils. Use of 16-20, 20-20 and related types of fertilizer for part of the nitrogen requirements is of some help in addressing the low pH problem.

Cation exchange capacities (CEC's) are generally low on the hill lands but high on most of the other soils in the country. The calcium-magnesium ratio is quite high and problems with a few minor element deficiencies have been observed. Liming is reported to have accentuated minor element deficiencies and caused others. Dolomite (Ca + Mg) is the preferred and recommended soil amendment but is more expensive.

The soils laboratory at CENTA is well-run. It has been analyzing about 5,000 soil samples per year for Salvadoran farmers. There is no fee for this service. A recent reorganization at CENTA is assigning all soils staff personnel to the crop divisions. Soil samples will still be examined by the laboratory technicians but there will be no staff to make interpretations of the results for farmers. OPOR has made use of the laboratory for soil analysis in preparing sub-project plans and has a soils specialist from DRD.

2. Agricultural Production -- The sudden transitions in agriculture caused by the agrarian reform, combined with the political conflict, has resulted in the country becoming an importer of some basic grains and other commodities which were formerly being exported. El Salvador is still self-sufficient in sugar but exporting less (also see Appendix B). Two sugar refineries are not operating and most of the others are now under-utilized. Coffee is the largest agricultural crop in the country but is not included in any of the OPOR sub-projects. The same picture generally holds for livestock and livestock products as described above for sugar export

Many of the horticultural crops have good market demand, especially in the dry season when they can be grown with irrigation. Most depend on local markets and need careful planning to avoid over supply and low prices. Intra-seasonal price fluctuations have adversely affected co-op farmers. New and promising additional horticultural crops have been developed at CENTA, some of which may

also aid market stabilization. These can be used in the areas of the projects. Farmers would need help and guidance with these new crops, a function that the 20 to 28 new OPOR/CENTA extension agents will assist with.

Referring specifically to the consultants field visits, it was often difficult to obtain accurate or specific data, even on yields and inputs. With most co-ops also providing small single-family lands to each member, it was sometimes difficult to separate out their statements about these lands from those concerning the sub-project (irrigated area). This was more of a problem with the newer co-ops and those where a manager was not present.

Although most co-ops visited were either not yet using their new irrigation systems or inexperienced at it, many nonetheless indicated they would like to be able to have more water and increase their irrigated areas. This was mentioned in spite of the fact most are not now irrigating the full areas the systems were designed to cover. It is very important to note that in areas planned for (or actually under) irrigation there is a strong tendancy towards utilizing such lands for pasture and forage (green chop) crops. This may not be the best use nor provide the greatest investment return from irrigation. Most cooperatives with pasturage and livestock experience favor this course of action, with inadequate advice being provided by ISTA or CENTA on the systematic weighing of alternatives. To determine the viability of the livestock alternative, a thorough economic study would be needed. As stated elsewhere, developing an income per-unit-area analysis of such an enterprise requires a more in-depth approach than with crops.

Having noted the general tendency to grow more pasture and forage crops, some or all of the following crops are grown in the irrigated areas of each of the co-ops: Sugar cane, corn, rice and sorghum. Attempts had been made to grow beans in nearly all locations but several had abandoned the effort due to low yields. The following evalutations briefly cover the major crops grown in the sub-projects:

Corn : Yields of 4.0t/ha. were reported with irrigation. This basic grain crop is widely grown on individual plots and therefore receives little attention for possible inclusion on the irrigated lands. Yields under irrigation definitely are higher; many yields in the 1 to 2 t/ha were reported on non-irrigated areas. Corn does well as an irrigated crop in the dry season. Beans fare well in the dry season and can be interplanted with the corn. Hybrid seed (CVMMIT varieties) is produced in the country and one sub-project serves as a seed producer. Farmers are well acquainted with the advantage of using hybrid seed but some still save their own for planting. Fertilizer usage on corn is generally high. The principal constraint to high yields appears to be adequate stands. Several pests and diseases cause stand losses.

Rice : No paddy rice was found in the sub-projects visited. Several of them have suitable soils for paddy rice under irrigation but they would need land leveling. All of that observed was upland rice. Yields varied widely from 1.3 to 6.5 t/ha. Nitrogeneous fertilizer rates used varied from moderately low to about 70 percent of what is considered optimum. With CENTA HYV's widely used constraining factors other than variety and fertilization are involved. Uncontrolled grassy weed species and possibly blast disease at heading time (sheath rot) are likely causing problems. One co-op now grows two crops of rice per year with high yields. Since the country is not self-sufficient in rice production at present and must import it, rice becomes a good crop for the projects (especially in the dry season where higher yields with good harvest and drying conditions can be expected). This crop is also labor intensive.

Sugar Cane : Sugar cane is becoming a high-income crop for many of the farmers. Yet it does not receive the on-farm attention that it deserves, especially regarding fertilizer application and irrigation. At least two co-ops have over 100 ha. of sugar cane but not much is being irrigated. Most co-ops include only small amounts of sugar cane in their cropping patterns and only a relatively small part of this is irrigated, sometimes in deference to pasture. Yields of sugar cane quoted were in the 32 to 44 t/ha range but some poorly attended fields (with yields not given) were observed. The potential for significantly increasing sugar cane yields with irrigation has yet to be determined for El Salvador.

Sorghum : This crop is usually used as a relay or second crop with an early-planted crop of corn. Under this system, if it matures too late into the dry season, yields can be low. Irrigation would be of definite benefit. Sorghum now is quite widely grown because it is versatile in utilization (human-and livestock-wise), and is drought-resistance. Yield potential is not as high as with corn but 4 t/ha. is certainly attainable.

Pasture and Forage Crops : The fertilizer usage is low to moderate on forage sorghums but even lower on pastures. Weed control is practiced on some pastures but is generally neglected overall. Irrigated pastures have not been planted exclusively with improved species. In only a small percentage of the project areas is this now done.

Horticultural Crops : Some co-ops are already growing horticultural crops in the dry season using irrigation. Several others plan to do so. One co-op reported netting $1450/ha. from a tomato crop grown under irrigation during the dry season. Many other horticultural crops can be grown in the dry season with irrigation. Some of them are former temperate-climate crops that have been adapted to the tropics by plant scientists. These new crops have recently been introduced into the country. General and irrigation-specific knowledge of these should be provided the

co-ops as soon as possible.

Specialty Crops and Contracts : One co-op is now growing okra for a commercial processing firm. This is proving to be profitable. Other co-ops are planning to become involved. Two are planning to grow melons in the dry season for export to the U.S.A. Those co-ops with irrigation will be able to grow okra in the dry season when other growers cannot. Specialty crops therefore will serve as a big boost to the income and welfare of those who become involved. Not all will be able to do so, however. It is also important to note that CENTA states that at least five spice crops show promise of good returns under irrigation.

The cropping intensity could not be determined for each irrigation project area. Generally, intensities are not high but a few cooperatives get two crops per year on some of their lands. The average for all projects and areas is estimated to be significantly less than 2 (200 percent). Greater crop intensification and crop selection is needed in all sub-projects.

The quanity and availability of water for the various irrigation sub-projects will be quite variable. Crop planning and execution will be affected, but not seriously. It should be noted that at least one co-op reported having irrigation water available into the month of May. This extension of the growing season is highly desirable.

3. Cultural Practices and Methods -- The expropriation of farms by the state caused considerable disruption in farming practices, as has been mentioned. Land preparation was the most notable effected in that members do not own sufficient tractors and few have oxen. Nearly all former hacienda owners took the equipment and animals with them. As a result, a great deal of land preparation and cultivation is done by hand. Oxen are used where available. Some co-ops hire tractors. Those few that do own tractors are not following up on needed repair and maintenance procedures.

With irrigation, co-op owners are faced with the need for timely and adequate land preparation, plus additional operations into what had previously been a non-cropping dry period. A national program to finance machinery and repairs would certainly help but is not planned at present. Other alternatives such as small farm machinery for the more intensively irrigated farms have not been systematically explored. Being able to intensify cropping would be an important consideration and labor displacement would be minimal.

Back-pack type sprayers for applying insecticides and herbicides are widely used. Co-ops can afford to own several for community use. Hand weeding is still done where chemicals are not effective or cannot be used. However, the general use of chemicals seems to be excessive.

Cooperatives' planting and fertilizing operations are done by hand whereas in the past hacienda owners would have used equipment. It was observed that all of the fertilizer is placed or broadcast on the soil surface. This is acceptable for nitrogeneous fertilizers but for the better benefit of the crops, the phosphate fertilizers should be placed in the soil. The farmers do not appear to be aware of this factor.

All crops are essentially hand-harvested, with small tools and facilities available. Corn shellers are still being used at some locations.

The concept of crop irrigation is fairly new in the country. As noted elsewhere (Chapter IV), members have much to learn about physically applying the water and also about crop-water relationships. The proper use of scientific data to determine ET, CWR, and other factors affecting these relationships are important in designing sub-project. Those farmers new to irrigation will need even more assistance. A thorough understanding of the water requirements of crops will help members avoid yield reduction or crop losses due to rainless periods in the wet as well as dry season. It will be possible to build upon the general knowledge farmer's already have of a given crop's water needs.

4. Supporting Services -- Agricultural supporting services and institutions are vitally important to farming in all countries of the world. When new infrastructure (such as an irrigation system) or new directions are taken, the importance of such services is accentuated. This is the situation facing El Salvador. Not all supporting services are discussed in this report. The review is restricted to the status and ability of the major services to support the OPOR sub-projects.

Research : The crop research facilities and activities are centered at the CENTA-San Andrés facility. Livestock and pasture research is centered at Soyapango and is directly under MAG's control. All crop research is encompassed by one division; there are four other divisions within CENTA: Extension, Seed Technology, Seed Certification, and Irrigation and Drainage. Work is also conducted at regional sub-stations and other local sites but is becoming more difficult due to shortage of travel funds and the conflictive national situation. All divisions are well-staffed but short on funds for vehicle repair and laboratory maintenance.

The staff members interviewed expressed a desire to work more closely with extension and felt that their research findings were not being properly utilized by the farmers. Some expressed a desire to work directly with the farmers on the OPOR sub-projects. Staff members stress that they need funds for gasoline, for travel as well as per diem costs. Funds are not sufficient for the preparation of such materials as visual aids and bulletins for use by extensionists in meetings with farmers.

The agricultural research in El Salvador has been characterized by some as "variety-oriented". The use of improved or HYV's is widespread. Other successful research is being accomplished with some areas still lacking coverage. A step recently taken in CENTA was to integrate all the former cross-disciplinary activities (soils, plant pathology, entomology, etc) with each crop research activity. This may enhance research on a given crop but will, in the long run, weaken the non-crop scientist's position. His ability to make a broad contribution to agriculture will be diminished. As a result of this change, one problem has already surfaced. With no soil specialist present (all being assigned to crop departments), analysis still can be made of a farmer's soil but there is no one to interpret the results for him. While the soils laboratory can continue to operate with its technicians, they will eventually need staff guidance.

Extension : Agricultural extension is a vital link between research, existing agricultural knowledge, and the farmer. In all countries where international financial institutions such as I.BRD consider making large loans for irrigation projects, before loaning the money insistance is placed upon an active and viable extension service already being in place either in the country as a whole,or at least in the project area. This is considered essential to eventual project success. Some loans have provisions to strengthen the existing extension service unless this is already being done through a state, regional or national agency.

The agricultural extension service in El Salvador is presently well-organized and staffed. The level of education and training is adequate at certain levels in the organization but lacking, at the field worker level. It is evident that support was provided in the past. The organization is now in the position of needing financing for revitalization. Transportation is a major problem. As a result of this factor, plus the unstable political situation, the extension service is moving towards decentralization into regional units. In a country the size of El Salvador, such a change would not be considered wise under normal circumstances unless highly qualified administrative and support staff were already available.

Extension should be designed to fill the gap between research and the farmer; in other words, to"extend" and demonstrate to the farmer the latest or most pertinent agricultural knowledge. In almost all countries of the world, more information has been developed than is being used by the farmers there. In the OPOR sub-project areas the farmers are being faced with significantly increased needs for information and help in order to be able to fully utilize the irrigation systems. ISTA is effectively involved in the irrigation projects and other agencies will be expected

by MAG to do so. In order for such programs to effectively help the farmer, there will be a great need for good liaison between agencies (see Chapters V and VI). Extension will need to be at the center of this effort.

Crop and Livestock Inputs : It was found that fertilizers, insecticides, herbicides, fungicides and veterinary supplies are readily available in the country at well-situated outlets. Sub-projects located near main roads can expect timely deliveries of crop and livestock inputs. It was not possible to do enough pricing during the consultants' field visits to determine their relative level but nearly all farmers use a moderate rate of fertilizer and sometimes excessive amount of pesticide. Given these levels of usage there should be adequate and timely supplies of inputs for the increased demand with the sub-projects.

With a strong certified seed program at CENTA and their ability to produce foundation seed, the program of utilizing farmers as certified seed producers is on-going and successful. HYV's or improved seeds of nearly all crops are available in El Salvador.

It should be added that there are several other organizations or functions that can be considered as "supporting services" to the agriculture of the sub-project areas. It is not possible to discuss all of these here, but credit institutions are among the most important.

B. ISSUES AND RECOMMENDATIONS

The preceding detailed background evaluation has been presented with the intent of identifying problem areas that can adversely affect OPOR's planning activities, as well as presenting a concise overview of the country's agricultural situation. The linkages from the background evaluation to the issues are provided by the following summary paragraphs.

The sub-tropical to tropical climate is suitable for the production of all present and proposed crops. The climate generally results in a moderate ET's and thus moderate CWR. The percent sunshine does not allow maximum crop yields but moderately high yields can be attained throughout the year including the fairly rain-free dry period.

When phosphate and nitrogeneous fertilizers are added, soils of the sub-project areas have good production potential for all crops except legumes. Heavy clay soils of the sub-project areas are difficult to handle without mecanization but are very productive with good management.

The present level of crop yields can be sifgnificantly increased with irrigation. Irrigation will also allow a wider selection of crops, especially the new and more promising varieties. In reference to the more traditional major crops, there are good demand and market prospects for rice, beans, sugar and oil crops.

Farmers in the cooperatives with OPOR sub-projects will need a good deal of help with crop selection, crop intensification (inter-planting, relay planting, etc.) and available speciality crops in order to maximize their production with irrigation. Farmers need to be made fully aware of the potential for changed cropping patterns and higher yields with irrigation, especially in the dry season.

There is a need for on-site inspection of sub-projects in operation to assess efficiency of water delivery and its direct effect on crops. This should result in advice and guidance to farmers at existing systems as well as provide valuable information for planning future projects. There is insufficient monitoring of crop and livestock production at sub-projects, by OPOR or any other agency.

The number of extension agents in the country is adequate to be of help in OPOR sub-projects but they need strengthening, training and financial assistance to be effective.

An economic study is needed to compare the income potential of a livestock-pasture enterprise with an intensified crop production one. Although not a formal recommendation of the present evaluation, note also should be made of the importance of making a study of World Bank extension assistance loan possibilities. Such nation-wide low-interest loans have been made to a large number of countries.

The proposed inter-agency task force (see Chapter V) could effectively study such possibilities with the assistance of MAG (also see Issue No. 2, below)

B. ISSUES AND RECOMMENDATIONS

Issue No. 1 -- There is a strong tendency among cooperatives with OPOR irrigation systems to utilize their irrigated lands by planting pastures instead of high-income crops and/or using high intensification of cropping.

- It is not known how the income from a livestock enterprise compares with that of high crop intensification.
- The side benefits of the livestock enterprise such as milk for families and more year-round employment of members, have not been analyzed in comparison with crop production.
- More and specific information is needed regarding maximum production potential of improved pastures compared to unimproved or native pastures, under both good and poor management.
- The most profitable cropping system or enterprise should be determined for each irrigation system, taking into consideration soils, topography and capabilities of farmers.

Recommendation:

The evaluation team believes that it would be useful for OPOR and other agencies to compare the economic viability of a livestock enterprise with an intensive cropping operation, to advise cooperatives in best utilization of an irrigation system. An economic study should be made based on field visits and farmer interviews. It should provide information on the returns that can be realized from both an efficient, well run livestock enterprise using improved pasture plantings, forage crops for "green chop", good fertilizer usage, etc., compared to such an enterprise that is marginal in its operation and husbandry. These two variables should then be compared with the same type of situations (efficient vs marginal) in potential cropping systems under irrigation. Particular emphasis should be given to the advantage of being able to grow crops in the dry season since pastures will be in production at that time also.

The OPOR agricultural economists should request assistance and help from those in CENTA so that such a study would be timely.

Issue No. 2 -- Farmers faced with the problem of using irrigation on crops will be in immediate need of help in a myriad of ways. It is not within the capabilities of OPOR to furnish this help and it is not recommended that they attempt it. Extension (CENTA) with the cooperation of related agencies, is the organization

that should logically be responsible.

- Farmers need training in how to irrigate crops.
- Farmers need to be made aware of all the crops, cropping systems and methods available to them, so that the highest intensity and production can be realized with irrigation.
- Many specialty and new crops need to be demonstrated to farmers with irrigation.
- Extension will need to participate with irrigation engineers in demonstration farms proposed in this report. (see Chapter IV.)
- In order to be effective, extension is in need of financial help for transport, salaries, demonstration supplies, educational materials and training.
- Extension is well organized and covers the country with its staff placement, but needs the support mentioned in the item above.

Recommendation:

Financial help should be provided soon to strengthen the extension program, to assist farmers in the OPOR sub-projects to adjust to and benefit from their irrigation.

Issue No. 3 -- As farmers in sub-project areas need immediate help and OPOR is not organized and staffed to provide it, there is a need to coordinate the efforts of all agencies that can help the farmer in a sub-project areas.

- There are many agencies in El Salvador that deal with farmers such as extension, ISTA, credit banks development centers, grupos solidarios, plus others. It takes too much time for farmers to contact all these agencies. There is a need to coordinate and organize them in dealing with farmers.
- There is presently a need for greater communication, dialogue and liaison between OPOR and extension even at CENTA. Improvement is needed at all levels in both agencies.
- Several research people indicated that they have very little communication and liaison with both extension and OPOR.

Recommendation:

A liaison section should be established in OPOR to act as catalyst for organizing and coordinating assistance to farmers at OPOR sub-projects by supporting agencies. This section should be small. It's composition is suggested in Chapter V.

Issue No. 4 -- Although there is good research in crop producti at CENTA, there are two opportunities noted by the consultants for research that would be beneficial to OPOR sub-projects.

- Directors of several cooperatives visited by the consultants sta that sugar cane was a high income croo for them but none had concept of the magnitude of the benefits that could be realiz from irrigation of the crop.
- Due to the lack of experience with irrigation in El Salvador, there is a lack of knowledge about the benefits of irrigating sugar cane. Many hectares are irrigated, but yield are not documented.
- The consultant estimates that sugar cane yields can be improv 35 to 40 percent with irrigation.
- Yields of beans are so low in some areas that farmers no long grow them.
- Beans grown in the dry season would have less disease problem and could be grown in irrigation sub-projects.
- The soils of El Salvador are more acid than desirable for goo bean production.
- Other legumes such as pigeon pea, cowpea, and mung beans coul be grown in soils where the low pH has been corrected.
- Not enough research has been done on the correction of low pH to improve bean yields.

Recommendation:

Investigations should be carried out at CENTA and/or selected field locations to measure the benefits that can be derived from irrigation of sugar cane (in both the dry and wet seasons) to avoid any periods of moisture stress. Research should also be conducted to determine how the low pH of some soils can be corrected and the effect of this on growth of beans. This can be done in pots but yield trials should also be conducted. AID may wish to join with OPOR in urging CENTA to undertake this research.

Issue No. 5 -- Evaluation of the true benefits to crops under irrigation in the OPOR projects would be difficult and is not now being done. Monitoring of projects for the irrigation and cropping practices is needed but not done.

- Cropped areas, yields and production figures from OPOR projects are not complete. Those figures available may not be reliable.
- Benefits attributable to irrigation are not always measured or determined.

- A true picture of actual areas irrigated and the effect on crops is difficult to ascertain.
- OPOR is not responsible for collection of production data from sub-projects.
- Crop and livestock production results are needed to evaluate the benefits that may accrue to the irrigation projects.
- It is difficult to evaluate an irrigation system's effectiveness unless on-site visits are made at the time of irrigation.

Recommendation:

It is recommended that an informal evaluation team of AID and OPOR staff be set up (with flexibility as to members) to make on-site visits to all sub-projects in the dry season. A report should be made on observed water distribution and its effect on crop growth. Farmers from such USA areas as California or Arizona who have actual experience with irrigation would be able to provide valuable assistance as consultants.

CHAPTER IV

PHYSICAL AND ENGINEERING ANALYSES

A. BACKGROUND EVALUATION

The irrigation systems visited by the consultant team were small-scale (100 ha. or less). The systems (with two exceptions) are located on land owned by co-ops established under Phase I of the Agrarian Reform. The two exceptions were systems under Phase III, Decree 207. They are La Bolsona and San Rafael.

The general pattern for designing and construction of the irrigation systems was found to be consistent from sub-project to sub-project. Three main components were analyzed for each system:

1) Diversion
2) Conveyance
3) Distribution

The diversion is usually a weir-type dam across a river or spring. Flow to the sub-project is controlled with flash-boards used to change the elevation of the weir. The dams usually are of rock masonry construction. No storage of water during the non-irrigation season was being planned as part of the design. On some projects a pumping station (either diesel- or electric-powered) had been installed or designed to be installed. The pumping is directly from a river or spring. Therefore, most of the sub-project irrigation systems are run-of-the-river systems.

The conveyance component of the systems consists of open channels and closed conduits for culverts and siphons. The open channels are either trapezoidal or rectangular in cross-section. Typical cross-sections are presented in Figures IV-1 and IV-2. The construction is either of rock masonry or clay-brick masonry on a concrete foundation. The clay-brick lined canals are plastered with concrete to prevent seepage. The closed conduit for conveyance is either concrete pipe or PVC plastic pipe.

The distribution component is composed of clay-brick lined open channels or unlined earth canals. The lined distribution canals do not always have the clay-brick plastered. The typical cross-section is rectangular. The earth canals are typically hand-dug and trapezoidal in cross-section.

The drainage system usually incorporates the natural drain of the terrain on which the irrigation system was constructed. Some sub-projects also have surface drainage channels hand-dug with trapezoidal cross-sections. In most cases the hand-dug channels are linked to the natural drainage.

The drainage systems have concrete drop structures installed to help prevent soil erosion. The usual type of drop structure installed has a vertical drop of one meter or less. The same type of drop structure is used on the irrigation channels. The drops on the drains and unlined irrigation channels are formed concrete construction. There is no downstream bed protection at the drops, except for a short concrete apron.

The turnouts on the distribution channels in most cases were found to be simple openings on the sides of lined canals. The opening size and therefore the discharge is controlled by installing flashboards of various heights. There is no downstream bed protection at the turnouts.

It should be noted that one sub-project (El Tatuano) is an exception to the general pattern of surface-irrigated systems. The water source was found to be six shallow-point wells which are manifolded together and pumped by a diesel-powered centrifugal pump. The pump supplies water to a hand-move sprinkler system. The pumped water also is used to supply water for surface irrigation. This system is located on the flat coastal plain where groundwater is easily available.

Moving from an evaluation of the systems to an evaluation of OPOR engineering-wise, the design staff of OPOR is supported by a consulting engineer who provides training and technical assistance. The consulting engineer is an employee of Servicios Técnicos del Caribe (STC). The firm STC has a contract with USAID/ES for supplying technical support in several areas. A design phase procedure and construction phase procedure to be used by OPOR has been developed by the STC engineer. The PERT charts for both phases have been analyzed by the evaluation team. The main duties at present for the STC engineer are training and preparation of training materials A communication/liaison function also has been undertaken.

The OPOR design procedure (from preliminary reconnaissance to completion of construction drawing) takes on the average approximately two months. One engineer is assigned to each sub-project and is supported by OPOR surveying and engineering-drawing staff.

The construction of the sub-projects is contracted to a construction engineer or firm. Construction is done during the dry season and takes approximately three months to complete. Local labor is used to construct the irrigation and drainage system. Workers on sub-projects, in most cases are assigned very specific tasks, to be completed on a daily basis.

Topographic surveys for the design of the system originally were done by the OPOR staff. The present practice is to contract the survey work to private companies. This contracting has helped shorten the design phase. The present contour interval being used is one meter. On the older projects the contour interval extended to 5 meters.

The crop water requirements are calculated by the OPOR engineers using the Hargraves method. Canal capacities are calculated using Manning's equation with a roughness coefficient equal to 0.02. Overall irrigation efficiencies assumed for design vary from sub-project to sub-project. However, analysis of a representative sample of the sub-projects visited indicates that water supplied to the system varies from 1.1 to 2.0 l/s/ha.

Hacienda	Irrigated Area (Ha)	Water Supply (L/S)	L/S/Ha.
Rancho Grande	40	80	2.0
La Canadá	87	111	1.3
El Tatuano	9	14	1.6
San Rafael	136	240	1.8
La Bolsona	100	175	1.8
Las Bromas	54	60	1.1
Plan de Amayo	60	70	1.2
San Martín Larín	42	70	1.7
Maquigüe	40	60	1.5

This range is probably low since the actual area irrigated is usually less than the design area. However, even a slightly higher range is acceptable for gravity systems.

To evaluate the overall physical irrigation system it was broken down into four sub-projects (Diagnostic Analysis of Irrigation Systems, 1983). Each of these sub-systems was assessed as to adequacy and quality of design specifications, and construction where applicable. How well each sub-system was designed to meet its respective function was evaluated. Also assessed was the adequacy of the maintenance procedures and the present state of the sub-systems. The four sub-systems and their evaluated functions are briefly presented as follows:

1. Water delivery - from source to fields
   . at constant, regulated rate
   . at proper water surface elevation
   . without excessive erosion or seepage
   . with safety and access to fields

2. Water application - supplies water to field surface
   . with acceptable uniformity
   . without excessive erosion
   . with provision for surface drainage
   . in a manner acceptable and manageable to farmers

3. Water use - supplies water for plant growth
   . for peak and seasonal use
   . to prevent excessive stress

4. Water removal - removes and disposes excess water
   . to provide for proper root aeration
   . for improved workability of fields

At the time of this evaluation OPOR dealt mainly with the water delivery sub-systems. For this reason most of the discussion is devoted to this.

An evalution was made of the design and construction procedures used by OPOR. The ability of OPOR to turn over to farmers a manageable system is assessed. This assessment is made from the point of view of the farmer's present skill in irrigation and the training they would require for effective irrigation. A brief discussion is also presented on the present state of equipment maintenance and adequacy of storage facilities on the co-ops visited.

8. ISSUES AND RECOMMENDATION

Major issues are addressed for the evaluation with specific problems, positive aspects and recommendations presented. The evaluation is the result of site visits, interviews and review of documents.

There were 16 sites visited by the agricultural engineer. The sites and brief description are presented in Appendix A. The irrigation systems at each site were at various stages of construction and/or operation. Also, not all sites visited had irrigation systems planned or installed. Unfortunately, this evaluation was done during the rainy season. Therefore, farmers on the sited visited were not using their irrigation systems. Usually the agricultural engineer (AE) and agronomist (A) worked together as a team. In most cases the consultants arrived on site in the morning, then with one or more farmers the AE and A inspected the site. While the site inspection was taking place the farmers also were being interviewed by the AE and A. The questions related to

agricultural practices and operation or anticipated operation of the irrigation system during the dry season. (A better approach would have been to actually inspect sites during the irrigation season).

Interviews were conducted to determine capability of OPOR and MAG personnel and organization to implement and support small scale irrigation systems. The interviews also were used to determine specific implementable recommendations.

The issues and recommendations that follow are presented mainly from a engineering view point. Only through proper consideration and linkage to the recommendations of the other disciplines can manageable irrigation systems for farmers be developed.

Issue No. 1. Quality of Design and Construction.

The design and construction specification are in general adequate for water delivery from the source to the field. However, no design is provided below the farm turnout. The engineering training and ability of OPOR engineers are suited to attaining good water control within the delivery system. The construction methods used are appropriate to available labor and materials. The major problem associated with this issue is the lack of water control available to farmers at the field level. Both positive aspects and constraints related to this issue are presented with recommendations.

- There is a lack in the design procedure of present systems for integration of the four sub-systems into a unit. Particularly missing is a link from delivery to application. The link from water use to drainage also needs more attention.

- The ability to adequately operate the system will be hampered by farm turnout placement. The OPOR design now only provides one turnout per field from the distribution canals. Because some canal beds are well below grade, farm turnouts cannot command the area they are to irrigate.

- The use of a rectangular cross-section for lined conveyance canals is appropriate. The use of the more hydraulically suitable trapezoidal cross-section has been considered.

- Lined canals are sometimes used at the tail-end of the system. For complete water control it is desirable to have the entire system lined, up to the field application sub-system.

- Topography of farmer's fields in such that uniform water applications are not possible and over-irrigation is the result. Drainage is a problem on some fields due to inadequate drain design. Standing water was observed on some sites visited.

• On recent designs the lay out of a farm road system has been included with the irrigation system. Structures are provided so that the irrigation canals and drains are not barriers to individual fields.

• Minor construction flaws were noticed during site visits which could cause reduction in the effectiveness of the irrigation system. These flaws generally were not widespread. They include: (a) lack of clean-outs on siphons, (b) poorly constructed slots for boards at turnouts, and (c) poor concrete work on structures where canals crossover roads (essentially in the San Vicente area)

Recommendations:

1. The contour interval on topographic maps should be at least 0.5 meters. This would enable designers to better set turnouts. With a more detailed topographic map the drainage system can be laid-out to be more effective.

2. The drainage problem can be solved by land smoothing to allow fields to be more easily irrigated and drained The effect of good water control on crop growth (see issue No.4) needs to be demonstrated to farmers. On land not suited to land smoothing the drain density needs to be increased. The design should include natural drainage channels, but not rely on them entirely

   The land smoothing operation can be done in two ways:

   a.) Provide OPOR with equipment to do a land smoothing operation on land for which this is feasible. A medium-sized tractor and drag scraper are the minimum equipment needed.

   b.) Contract with private companies to provide this service with direct supervision from OPOR.

3. The design procedure used by OPOR should start with the design of a field irrigation layout. This would enable designers to calculate irrigation set size and specify required turnout spacing. The turnout size opening should be standarized within each subproject. This would make it easier for farmers to have pre-cut wooden board lengths on hand for use as gates and regulators on the turnouts. More care needs to be taken in layout of the irrigation canals. The water surface at the turnout under normal operating conditions should be at least 15 cm above the adjacent area to be commanded. The downstream side of each turnout should have a short concrete apron or be riprapped to prevent erosion.

4. Because part of the reason for building the sub-projects is employment generation the canals should be lined farther (up to the field). This practice will also allow farmers to expand their system more easily in the future. Maintenance of unlined canals in the rainy season and on farms with cattle will create major problems for farmers.

5. Use of the rectangular cross-section, especially in the lined distribution canals should be continued. This practice is suited to the skill level of the laborers involved in the construction of the projects. The clay brick should be pastered with mortar to prevent seepage and deterioration of the brick. If during an irrigation season evaluation of the clay brick demonstrates little seepage then the practice of plastering can be discontinued. The long conveyance canal from the water source to the field distribution system should continue to be trapezoidal in cross-section to minimize head loss.

6. Special care must be taken on lining canals in problem soils such as expanding clays. In general the canal must be over-excavated and partially back-filled with a sand cushion. Then the hard lining can be installed. Another method would be to use a flexible lining.

7. Soil conservation and water spreading methods should be applied to many of the projects. This would not only generate employment, but enhance the effectiveness of the sub-projects. Contour dikes and ditches to help spread water from turnouts are very much needed, especially in the hilly areas.

8. Engineers in OPOR should attend a course on design and operation of farm irrigation systems at the field level, with emphasis on hilly areas. The course should be presented in the country by an engineer and an agronomist with practrical experience in irrigated agriculture. Both the engineer and the agronomist should be required. to devote at least a week before the course is presented to visiting the co-ops. They would thus become familiar with the conditions prevailing on the co-ops and the course could be directed to those conditions. Designing systems to operate properly in hilly areas is critical to OPOR's success.

9. The technical assistance being provided by the STC engineer should continue. The PERT charts he developed should be modified to include a farm-level design. Also, the PERT charts should include a link to construction from design.

10. The engineer in charge of design should follow through into the construction and initial operation phase of the sub-projects (see Chapter V). This would allow the engineer to correct design and construction flaws before the system is turned over to the farmers. This would also make engineers more aware of the need for a "bottor up" approach to design rather than the present "top-dowr approach. Including farm road layout as part of the irrigation system design should continue.

Issue No. 2 -- A Farmer-Manageable Irrigation System

With this issue the ability of OPOR to provide co-op farmers with irrigation systems that can be used effectively is evaluated. The present skill levels of farmers with little or no background in irrigation must be addressed. How sophisticate should the system delivered by OPOR be in terms of both operatio and maintenance?

Extension agents with knowledge of irrigated agriculture nee to provide support to farmers. Should farmers be expected to grow high-value and possibly high-technology crops immediately with their new irrigation systems? The key points to consider are as follows:

- Maintenance of systems visited is poor. Poor maintenance procedures will impact co-ops with pumps more severely tha those that are entirely gravity-irrigated.

- Training of farmers in irrigation water control has not been part of OPOR's function. On some systems soil erosion is taking place due to poor water control. Systems are being under-utilized, in many cases, as to the crops being grown.

- Farmers generally lack input into the design procedure of OPOR. Farmers on some projects have removed bricks in the canal lining to obtain more turnouts. This would not have been necessary had they been consulted. Parts of the irrigation systems are not used because farmers recognize that soils will erode if irrigated with the present system layout. San MartinLarín is an example of incomplete design on a hilly area.

- Engineers in OPOR have not followed projects from design through to initial operation. Different personnel are responsible for design and for construction. So far no one has helped farmers operate the systems even in the initial start-up stages.

- In many cases projects are not followed-up by site visits from AID personnel or independent outside consultants.

Recommendations:

1. For the present OPOR-designed irrigation systems should be limited to less than 100 ha. in size. Co-op member management abilities are as yet not adequate to handle even moderately large systems. However, systems irrigating more than 100 ha. are a definite possibility for both OPOR and cooperatives in the future.

2. The present concept of building surface-irrigated systems should continue. The use of a pump as part of the design should only be used in special circumstances. The idea of keeping the systems simple should continue to receive very high priority.

3. The installtion of sprinkler and drip irrigation systems on co-ops is not recommended at present. Farmers need to have more experience in irrigation and extension agents need to have information on the irrigation of various crops. The added burden of maintenance to these systems under the co-ops present economic situation outweighs the advantage. There are sites where sprinklers would be suitable for the terrain. However, the location of the water supply would in most cases make pumping necessary. Studies on drip and sprinkler systems should continue. Engineers need to continue gaining experience in design, operation, maintenance and management of such systems.

4. If the present trend of using pumps in the design of irrigation system is continued, funds should be made available to co-ops for their maintenace (see Chapter VII).

5. The training of farmers should be coordinated through a liaison section which should be added to OPOR's organizational structure (see Chapter V). The training of farmers would include operation of the system as to timing and amounts of irrigation. Farmers should have personnel from OPOR work with them during the first irrigation season. The design engineer should be one of the personnel assigned to assist farmers during this period. This interaction of engineer and farmers also would make for better designs on future sub-projects. Farmers should not be expected to grow high-technology crops during the first irrigation season. The experiences gained with one year of hands-on irrigation will greatly benefit them. This also is the time for the greatest impact of training on the farmers.

6. Either AID personnel or independent outside consultants need to evaluate the projects during the irrigation season. The reason is to make certain that sub-projects are manageable by farmers and not simply "construction projects".

This is also the person to make checks on irrigation efficiencies and help farmers correct poor water control practices.

Issue No. 3 -- Sub-Project Selection

What are primary criteria which should be used to select sub-project locations? The sub-projects presently are selected on the basis of review of a petition from a co-op or its representative (e.g. CURACOL) and a preliminary survey of the co-op's land. The way in which the OPOR sub-projects fit into the overall water and land-use scheme of the country is unclear. Basically, the belief in OPOR and AID is that the projects are small and while important, will not impact the overall water and land-use schemes. Some co-ops have existing irrigation systems, mainly for unimproved pasture. Should these existing systems be rehabilitated or expanded? Important points are as follows:

- Some sub-projects of OPOR have expanded existing irrigated areas of co-ops. However, this expansion has been into areas of less desirable irrigation potential than the lands of the existing systems. El Eden is an example of this.

- Some co-ops are already complaining of water shortages. These shortages may be for lack of good irrigation water control or lack of available water during the dry season for the hydrologic basin of the sub-project. There are few measurement structures on sub-projects to actually determine water being used.

- Both AID and OPOR believe that more sub-projects should be selected in the San Miguel area and the hilly areas of El Salvador.

Recommendations:

1. The OPOR sub-projects need to be integrated into the Waste Water Plan (Plan Maestro de Desarrollo y Aprovechamiento de los Recursos Hídricos, 1982), which MAG has approved for implementation. The plan is macro-level in scope but the engineering is adequate for the scale presented. The plan is based on soils and available water resources. The plan identifies 106 irrigation units throughout the country with 260,000 ha. of total area. (The total irrigable area has been reported with various figures. The variability is probably due to the method used to determine irrigable lands. Sometimes only soils and topography are used and at other times available surface water is considered. Other factors are also considered on more complete studies.)

2. With OPOR sub-projects being part of the Master PLan not only would available water supplies be better established, but the sub-projects would become models for the larger units. Such models should be encouraged. Therefore, selection of sub-projects and proper design become even more important than just benefitting the co-ops.

3. Water measurements structures need to be built on the sub-projects to enable farmers to gain greater control as they gain irrigation experience. While not vital at present, the systems being built are well-suited to installation of broad-crested weir-type flumes (Design and Operation of Farm Irrigation Systems, 1980).

4. Besides being part of Master Water Plan the OPOR sub-projects need more hydrologic investigation of the available water supply. As part of the proposed new OPOR liaison section a hydrologist would be hired to do regular hydrologic investigations for the sub-projects. This person would also be available to co-ops to help petition for water permits with DRD and serve as a link between farmers and DRD in case of water disputes. He would work with the new socio-economist/water rights specialist. This hydrologist would become especially important if the new Directorate of Irrigation and Drainage (DGRD) is indeed formed. The weak link that exists now between OPOR and DRD will be aggravated without the hydrologist to serve as a liaison.

5. The selection of sub-projects which will rehabilitate existing systems is recommended instead of expanding into less suitable areas within co-ops, if this is the only other choice. The existing systems, on sites visited, generally are on land that is easier to irrigate and more productive. The former owners usually built systems to gain optimum benefit. While the irrigation of added areas may benefit these co-ops the greater benefit would be to rehabilitate the old systems and support through extension more intensive cultivation.

6. The potential for irrigated agriculture is very good in the San Miguel area if enough water is available. This is an area were the hydrologist should provide a valuable service to OPOR by identifying both available surface water and groundwater.

7. In the hilly areas OPOR personnel need to be very careful of their designs, following through to initial operation. Beneficiaries in these areas should be well-trained to operate their systems. If, as OPOR and AID personnel desire, sprinkler systems are used, then the designs should be simple; more important, technical assistance to teach farmers how to use the systems must be provided. While the example of the success of Guatemalan sprinkler

systems is often cited, it should be emphasized that the Guatemalan farmers had strong technical assistance provided Also, the Guatemalan systems stressed a complete farming systems support package for the farmers.

Issue No. 4 -- Demonstration Farms

Demonstration farms (not experimental stations) could serve as models for farmers to observe the effectiveness of good water control in the context of a cooperative setting. Also, new agronomic technology and farm management techniques could be presented. There is a need for co-op based training under practical conditions for the extension agents as well (also see Chapter VI). Important considerations include the following:

- A common meeting ground is needed for all institutions associated with supporting the co-ops.
- Farmers without experience in irrigation have difficulty appreciating the benefits to be derived from good water control.
- Engineers and planners need to see the results of their designs. In turn, these designs must be accepted by farmers for the installation of new technlogies to suceed. In El Salvador small-scale irrigation must be viewed as a new technology.

Recommendations:

1. AID and OPOR should establish demonstration farms on Phase I cooperatives in three areas and possibly a fourth (conflicts permitting). This would be part of a continuation of the small-scale irrigation project. The three areas recommended are Sonsonate, coastal La Paz and San Miguel. The fourth site when conditions permit is Chalatenango. The sites should be on co-op lands with sub-projects that are representative of conditions in that area.
2. The greatest benefit from the demonstration farms concept is that all the institutions working with the co-ops could come together. If the institutions are committed to helping the co-ops then this cooperative effort should benefit the co-ops. The proposed inter-agency task force would assist with this.
3. Detailed plans for the farms are beyond the scope of this evaluation. However, a brief outline of what should be presented on the farms is included below. These should not be farms where experiments are performed. Demonstrations should be presented with practical emphasis on what the institutions believe the co-ops should implement.

- Farm water contol; effects on crop growth due to good control, timing and amounts of applications and land smoothing.

- Agronomic and soil conservation practices; appropriate crops and varieties for region, fertilizer application methods and timing, planting methods and needed cultural care of various crops, tillage methods.

- Farm management;an agribusiness approach to farming, decision-making for stability and profit.

- Livestock management; improved pastures, record keeping and appropriate animal husbandry.

- Small equipment and machinery use;use and selection of equipment suited to each area. preventative maintenance procedures and practical repairs.

These farms could be training grounds for extension agents. Also, farmers rather than being told what is the better practices could actually see the practice and the results. This would make the implementation of many practices on a wide scale possible.

Issue No. 5 -- Agricultural Engineering Support for Farmers

Farmers need technical support in other areas besides irrigation. Farmers must deal with a variety of problems of which irrigation water control is only a part.

- Preventive maintenance programs do not exist on the co-ops visited which have machinery. Some co-ops do not have repair shops or even the basic tools (e.g, grease guns and wrenches).

- Grain storage facilities on most co-ops are poor or non-existent. Farmers must sell their production and then later purchase the grains for home consumption.

- A brief survey of the co-op machinery indicates that it is not being replaced when poor maintenance has shortened its life.

- It is unrealistic to expect co-ops with the above problems to successfully operate irrigation pumping equipment over a long period.

Recommendations:

1. Funds should be made available through the small-scale irrigation project for operation and maintenance support. These could be part of the operation and maintenance funds proposed in Chapter VII.

2. Basic tools to perform at least irrigation pumping-plant maintenance and minor repairs should be supplied to co-ops which have no tools. Presently, a brief training session on pump operation is provided to cooperatives receiving pumping plants as part of their irrigation system. OPOR should continue this practice and expand it to include minor repairs.

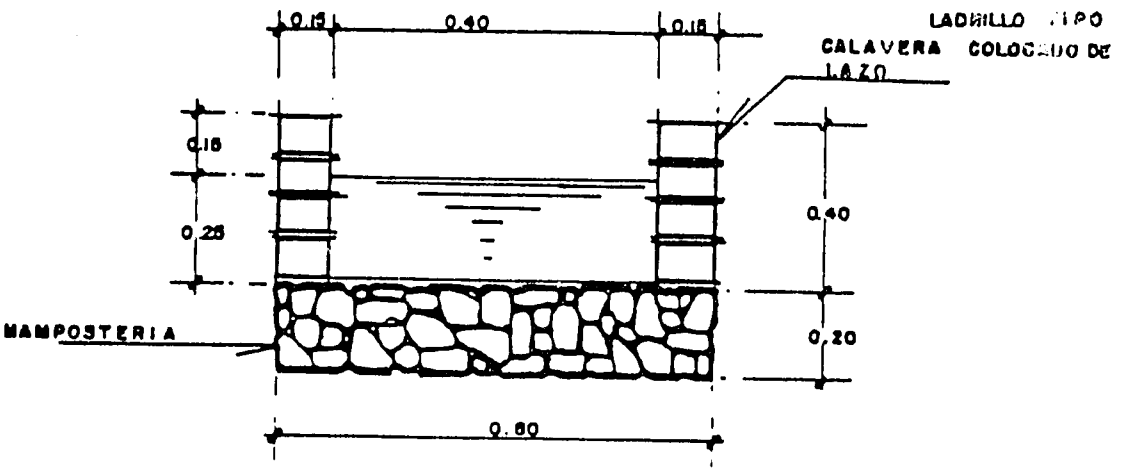
3. The basic agricultural engineering support should come from CENTA and be encouraged by OPOR. Extension should play a strong role in this area.

C. GENERAL SUMMARY

While the present design procedure is good as far as it goes, the design of the on-farm systems needs to be added to it. The construction phase should have follow-through by the design engineer. Farmers require training in the use of their system during the initial operational season. The system design should be kept simple in order to make them farmer-manageable. At present, systems irrigating less than 100 ha. are recommended. The establishment of demonstration farms and agricultural engineering support will provide for improved systems design and operation, with easier implementation of viable agricultural practices. The OPOR sub-projects should be integrated into a national water plan. The sub-projects need to be evaluated during an irrigation season. Continuity of evaluation over 5 and 10 year periods also is advisable.

FIGURE IV - 1

Typical Cross-Section of Lined Rectangular Canal



SECCION DE CANAL

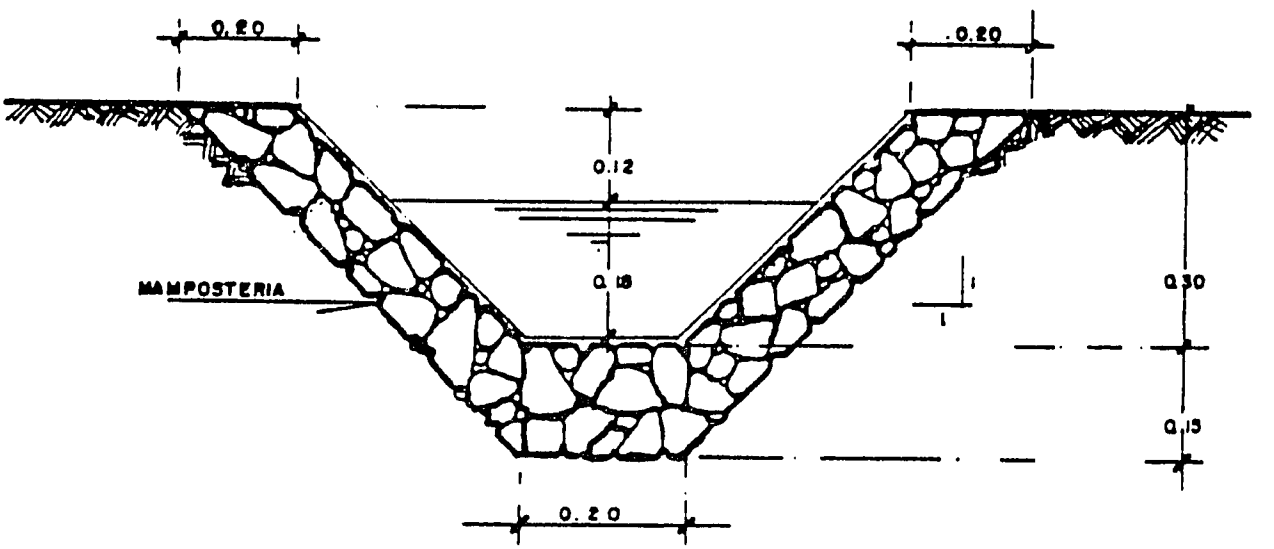
Esc. 1:20

CANAL	ESTACION		Q	S	N	b	d	A	bl	V
CONDUCCION -B-	KM	KM	M^3/Seg			M	M	M^2	M	M/Seg
	0+000	0+681	0.035	0.001	0.02	0.04	0.25	0.10	0.10	0.34

OPOR	MINISTERIO DE AGRICULTURA Y GANADERIA CENTRO DE TECNOLOGIA AGRICOLA OFICINA DE PEQUEÑAS OBRAS DE RIEGO
	SECCION DE CANAL DE CONDUCCION-B SUB - PROYECTO STA. ANITA
DISEÑO ING A ARTEAGA	REVISO DONADO
DIBUJO M ZALDIVAR	FECHA 22 / 2 / 84
	HOJA Nº 18

FIGURE IV - 2

Typical Cross-Section of Lined Trapezoidal Canal



SECCION DE CANAL

ESC. 1:10

CANAL	ESTACION		Q	S	N	b	A		Y	V	H	bl
	KM	KM	M^3/Seg			M	M^2	M	M	M/Seg	M	M
C-R-1	0+708.50 a 0+000	0+321	0.025	0.002	0025	0.20	0.068	0.21	0.18	0.37	0.30	0.12

OPOR	MINISTERIO DE AGRICULTURA Y GANADERIA CENTRO DE TECNOLOGIA AGRICOLA OFICINA DE PEQUEÑAS OBRAS DE RIEGO		
	SECCION DEL CANAL C-R-1 SUB-PROYECTO STA. ANITA		
DISEÑO: ING. A. ARTIAGA		REVISO: DONADO	HOJA Nº 20
DIBUJO: M. ZALDIVAR N.		FECHA: 22/2/84	

CHAPTER V

INSTITUTIONAL ANALYSIS

A. Background Evaluation

OPOR should properly be viewed as an institution. An institution can be defined as a formally sanctioned or legalized unit that is created by a group of individuals (such as the government) for a specific purpose. In most cases an institution is assigned responsibility for a set of objectives; it is goal-oriented. Although an institution can and does change, it has a recognized and accepted structure and function. In assessing the strength of an institution special attention must be turned to the structure. What subunits or departments is it composed of? How are these departments connected? Of equal importance is the function. What tasks have been assigned each department? Are these tasks being carried out correctly? Are stated objectives being achieved? An institutional analysis also looks at continuity, i.e., the stability of the institution through time. This includes an historical perspective. Personnel are assessed as to job performance. In the evaluation of OPOR, linkages with other institutions (e.g. ISTA) are analyzed as well.

1. Project Evolution -- As noted in Chapter II, the Small Farm Irrigation Systems Project Agreement was signed August 30, 1978. Formal approval for creation of the implementation control office that is now referred to as OPOR came in September, 1978. In reviewing the agreement as it was published in the document U.S. Treaties and Other International Agreements (TIAS 9499), the purpose is worth reiterating: "... to expand the capability of the GOES to assist low income small farmers obtain and utilize needed water resources". While developments in El Salvador within the past six years have created the necessity for a number of changes in project description and implementation, the evaluation team has used this statement as a bench mark against which to judge OPOR's institutional capability.

OPOR's office was first opened in January, 1979. It was originally located in the Ministry of the Interior. As mentioned in Chapter II, despite a broad initial plan aided by DIDECO for sub-project implementation in the northern sector of the country and irrigation by 1983 of 5,000 ha., very few sub-projects actually had been completed by late 1980. Violence in the north was partly to blame, as was the inability to effectively secure volunteer labor for construction as had been originally envisioned. Difficulties in OPOR's ability to manage its program due to structural shifts likely was a factor as well. It had

been transferred from the Ministry of the Interior to the Directorate of Irrigation and Drainage (DGRD) of MAG in July of 1980. Later this directorate was terminated.

Discontinuity in organizational structure and shifts in institutional setting have characterized OPOR's existence. In December, 1982, it again was transferred, this time internally to the Center for Natural Resources (CRN). This is another directorate of MAG. Despite the shift, considerable progress had been made in implementing sub-projects during 1981 while OPOR was part of DGRD. This was after a decision made to reorient OPOR activities to aid agrarian reform cooperatives and generate employment. During 1981 a total of 13 sub-projects were carried out.

Two formal evaluations of OPOR prior to the present study have been conducted. The first, by an outside evaluation team in December of 1981, recommended that OPOR be continued and "once again vigorously promote its program with communities of small farmers outside of Phase I". Subsequent developments have shown that confidence in OPOR's potential was well-placed, although the focus appropriately has remained on Phase I cooperative farms. The second evaluation, by AID in June of 1983, also was supportive of OPOR. At that time a recommendation was made to extend the project for 16 more months to enable completion of then-current sub-projects and initiation of new ones. As of June, 1983, 26 sub-projects had been completed, irrigating 1,342 ha.

OPOR's staff of technical personnel, as of June, 1983, consisted of three agronomical engineers, one agricultural engineer, two civil engineers, and two socio-economists. Of this number, three were regular OPOR staff members and five were seconded from CRN through the Division of Irrigation and Drainage. The staff of field work personnel consisted of 39 persons in the surveying, technical support, drafting, project promotion, and construction areas. Of this number ten were seconded from CRN. In the administrative area the staff consisted of 20 person, only one of whom was an administrator and 14 of whom were secretaries and drivers. Of this number eight were seconded from CRN. In addition, three topographic teams were contracted on a part-time basis. Therefore, of the 67 regular OPOR staff, 44 positions were financed by GOES counterpart funds and 23 through CRN. It is important to point out that 67 was a slight increase in the number employed one year earlier, in 1982. The seconding of personnel was the primary mechanism for expansion.

Constraints were seen to exist within the broader institutional framework supporting OPOR, and within OPOR itself, as of 1983. The need for improved project follow-up was recognized.

However, the second evaluation concluded that the constraints primarily were time- and staff-assignment related, rather than due to the qualifications of OPOR's personnel. Note was made at that time that OPOR planned to contract for as many as four technicians (financed by PL-480 counterpart funds) to concentrate on the provision of technical assistance and follow-up to project beneficiaries on irrigation use and crop diversification. This has yet to be implemented. It is now envisioned it will begin in September or October of 1984.

Sufficient progress was judged to have been made, so in August of 1983 the USAID/ES mission requested a one-year extension of the PACD. As mentioned in Chapter II, after revision in documentation as to what had been accomplished, an extension of the PACD to September 1, 1984 was granted. In December, 1983 another initially disruptive structural shift occurred. OPOR was moved to CENTA, yet another MAG directorate. OPOR's progress continued during the first six month of 1984, albeit more slowly project completion-wise than had been anticipated. During this period STC's efforts at technical assistance intensified and a new Project Officer (previously employed by OPOR) joined the USAID/ES/RDO Staff. Prior to arrival of the present consulting team a decision had been made to further extend the PACD to February 1, 1985 to allow completion of 11 subprojects already underway. In addition, prior to arrival of the present team a tentative decision had been made to continue the project to May 1, 1987. This decision remains subject to the results of the evaluation and discussions with the GOES.

1. Current Status -- Two kinds of interlocking institutional analyses have been conducted during the course of this study. One focuses on OPOR and the other institutions (such on CENTA and ISTA) that encompass and/or link with OPOR. The other focuses on the cooperatives as a new El Salvadoran institution; their links to OPOR bring the analyses full circle. The present chapter concentrates on OPOR but not to the exclusion of the coops. Chapter VI focuses on the cooperatives but not to the exclusion of OPOR

OPOR currently is a special semi-autonomous office of CENTA, which is in turn a directorate of MAG. CENTA is charged with executing El Salvador's basic agricultural extension, irrigation development, and research work (see Chapter III). There are five divisions within CENTA: Agricultural Research, Agricultural Extension, Seed Technology, Seed Certification, and Irrigation and Drainage. As a semi-autonomous unit OPOR comes under the jurisdiction of none of these. However, many of its personnel are seconded from the Division of Irrigation and Drainage (DRD).

OFFICE OF SMALL-SCALE IRRIGATION SYSTEMS
ORGANIZATIONAL CHART

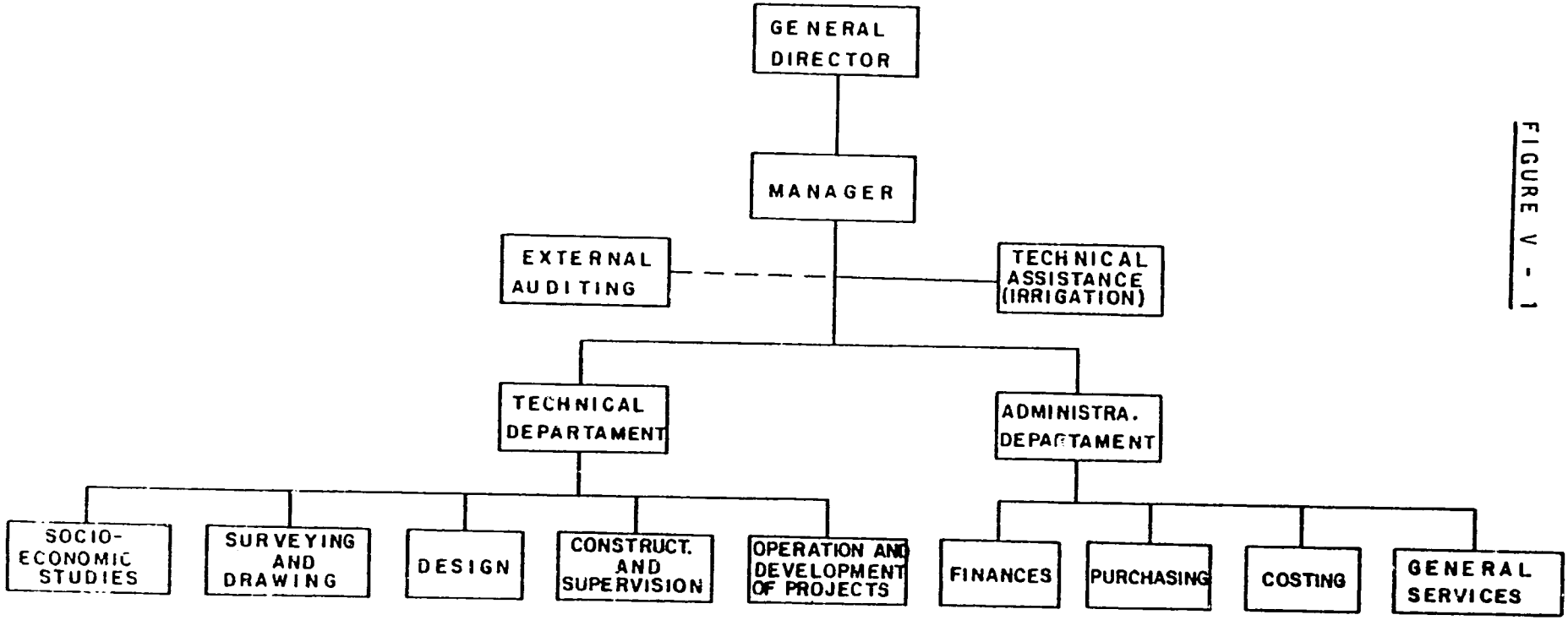


FIGURE V - 1

Viewed functionally, the current status of OPOR in a real sense mirrors the current status of the cooperatives. Both institutions are new. Both have experienced "growing pains" -- needed functions (operationalized tasks aimed at achieving specific goals)-- have yet to be implemented consistently throughout either institution. Stated differently, both OPOR and the co-ops execute certain of their functions well but are hampered in achieving overall objectives by lack of thorough execution of certain other functions.

In the opinion of the evaluation team, within OPOR those functions that are executed well include intra-office coordination, delegation of authority, document processing, basic engineering and design, STC's technical assistance, and budget management. Those functions that are executed moderately well include general management, agronomic analysis, economic analysis, construction supervision, topographic surveying, and budget analysis. Those functions which are in need of substantial improvement include inter-agency liaison and communication, post-construction engineering follow-up, extension outreach (to be initiated in September or October, 1984), hydrology, socio-economic analysis of beneficiary needs, and use of project selection criteria. Recommendations covering these functions are found in the next section of this chapter.

Viewed structurally, the current status of OPOR does not mirror the status of the cooperatives. OPOR has been subjected to three major institutional shifts and associated office relocations. These shifts have constrained OPOR's ability to perform its tasks consistently, or to implement as many sub-projects as originally had been anticipated. From a structural perspective it is a credit to the managerial staff that as much has been accomplished as has been. While the staff has been expanded considerably just since 1982 (when only three professional-technical and 29 field-work personnel were present), much of the expansion has been through the use of seconded personnel first from CRN and now primarily from the Division of Irrigation and Drainage. It should be noted that other professional activities and second jobs (or outside commitments) keep some of the seconded personnel and certain other of OPOR's staff from putting in full eight hour workdays.

The current OPOR staffing structure is presented in Table V-1. There are a total of 93 regular personnel (full and part-time). Sub-project workers are hired as needed. Of the 93 regular personnel 40 are being paid by OPOR through GOES counterpart funds and 14 are being paid by OPOR through PL-480 Title I counterpart loan funds. Of the 93 total, 35 are seconded from the Division of Irrigation and Drainage, 3 from CENREN, and 1 from CENTA.

Overall, two categories of funding are being used for this project: External AID funds and internal.external PL-480 funds. The U.S. PL-480 program provides food aid to El Salvador, with

TABLE V-1
OPOR STAFFING PATTERN

Department/Section	Position	No. of Staff	Funding Sou
Administration	Manager	1	OPOR
	Secretary	1	OPOR
Technical	Chief	1	DRD
	Secretary	1	OPOR*
Socio-Economics	Economist	1	DRD
	Economist	1	CENREN
	Assistant	2	DRD
	Assistant	1	OPOR
Surveying & Contours	Chief	1	DRD
	Surveyor	2	DRD
	Surveyor	3	OPOR
	Chainman	17	OPOR
Drawing	Draftsman	5	DRD
	Draftsman	3	OPOR
Design	Engineer	2	OPOR
	Engineer	2	OPOR*
Construction &	Engineer	1	DRD
Supervision	Engineer	1	CENTA
	Engineer	2	OPOR*
	Assistant	6	OPOR*
Administration	Chief	1	OPOR*
	Secretary	1	OPOR*
Finance	Accountant	1	DRD
	Book-keeper/clerk	4	DRD
Purchasing	Accountant	1	DRD
	Book-keeper/clerk	1	DRD
	Book-keeper/clerk	2	OPOR
Costing	Accountant	1	CENREN
	Accountant	1	DRD
	Accountant	1	OPOR*
	Secretary	1	OPOR
General Services	Chief	1	CENREN
	Drivers	14	DRD
	Drivers	4	OPOR
	Bricklayers	3	OPOR
	Secretary	1	OPOR
	Maintenance	1	OPOR
	Total Staff	93	

Source: OPOR office. An (*) indicates those staff positions funded by OPOR monies that derive from the PL-480 Title I counterpart loan. All other OPOR- funded staff positions are paid by GOES counterpart funds. The following regular contracted positions are paid from PL-480 Title I employment generation funds administered by ORE for each sub-project: Warehouse/materials supervisor, personnel supervisor (laborers), chief of bricklayers, and engineering assistant. The construction workers are paid from PL-480 funds as well.

monies generated going into a counterpart program which exclusively uses the local currency. Within these two broad categories there are four specific sources of funds: (1) Regular GOES counterpart funds, (2) PL-480 Title I counterpart funds, covering some personnel and service costs, (3) the regular AID loan (#519-T-021), and (4) the PL-480 Title I employment generation funds. Of the latter, 50 percent can be used for labor and 50 percent for materiales. The funds in (2) are committed as OPOR funds, those in (4) as ORE funds.

The funding structure for OPOR currently is cumbersome but workable. The manner in which the staff has been expanded on the one hand creatively has tapped two different kinds of PL-480 funds and uses a seconding process, which in turn has engendered further GOES financial support. On the other hand, increased structural stabilization has not been engendered by this "add-on" type of process. The frequent institutional shifts discussed earlier have exacerbated this problem further.

3. Assessment of Demand -- The assessment of demand for small-scall irrigation in the Phase I reform sector is perhaps the broadest topic that the evaluation team has been asked to address. It is also one of the most difficult, given the numerous opinions that exist in El Salvador, most of which seem to be based upon different premises and data bases of varying degrees of specificity. All five disciplines represented by the evaluation team have contributed to this particular interpretation (which in itself is useful but not totally definitive). It is presented in this chapter because of its importance to OPOR's overall planning and AID's loan prioritization.

A 1982 United Nations study of water resources in El Salvador states that there are 260,000 irrigable hectares in the country. Approximately 10 to 20 per cent of land is already under irrigation. A 1981 study by the Division of Irrigation and Drainage (DRD) of some of the agrarian reform properties that had been expropriated as of that time (a sample of 146) indicated that seven per cent of all agrarian reform land had potential for irrigation and 70 per cent of this seven per cent could be irrigated from surface waters. An additional study by ISTA in 1980 indicated greater amounts of irrigated land than the DRD study. Using DRD figures in conjunction with AID figures the evaluation team estimates that 250,00 ha. of all types of land are currently contained in the agrarian reform sector. By using the seven per cent figure from the 1981 study as a base for extrapolation, a maximum of 17,500 ha. are estimated to be irrigable by gravity within the Phase I reform sector. The June 1983 AID evaluation of OPOR estimated 13,00 ha. as irrigable by gravity-fed systems in the Phase I sector. It appears that a reasonable estimate of the range of irrigable lands is between 13,000and 17,500 ha. Field observations by the consultants

in nine of the nation's 14 departments support this, with the caveat that additional irrigable land may theoretically be available in the hillier areas; the exact amount is not known. Until additional data analyses have been obtained by DRD, this estimate likely is best. OPOR will have provided systems for 2,700 ha. of these lands (15 to 21 per cent) by February 1, 1985. Various AID staff have estimated that between 50,000 and 90,000 ha. maximum are irrigable by gravity and other methods within the Phase I reform sector.

Clearly, an update of the 1981 DRD study is needed, aimed at soils , topography, sources of water, present and potential water usage, economies of water distribution, and productivity of the land. This is necessary to complement the U.N. study. Further extrapolation from the United Nations study by DRD coupled with additional primary data collection on their part would provide a firmer estimate than that presented here.

The team's present interpretations of the demand picture can better be understood by addressing certain of the broader institutional issues. In the initial two years OPOR had to do a great deal of promotion of its program, selling the idea of irrigation and convincing cooperatives to build the systems. Additionally, the requirement to provide free labor and the increase in violence had distorting effects on the overall demand. In many cases it existed but could not be expressed. With the 1981 decision to pay for sub-project labor and the shifting to less conflictive areas of the country, OPOR has seen an increase in co-op generated requests for irrigation systems. As of July it had a list of over 20 requests.

The demand has been influenced by the supply potential of OPOR. Constraints have been severe. The office has been physically moved four times causing disruptions organizationally. The structural shifts already have been discussed. Staff have been loaned (seconded) from various other departments to OPOR. These factors have greatly hampered the organization's ability to provide a large number of sub-projects. Potential sub-project referral sources such as ISTA, FINATA and CENTA agents have not been adequately developed, yet informal communications amoung the cooperatives have had some success in spreading the word about OPOR. The professional/technical staff has remained relatively small and their skills have not been dramatically increased through special training programs since the initiation of the project in 1978. Finally, in the opinion of the consultants, in spite of two previous evaluations of OPOR no major effort has been made to address many of tne strengths and weaknesses of OPOR together, sytematically, as a "package".

There is no doubt that irrigation can benefit the farmer and the nation. Only through more intensive use of available land can agricultural production increase. Related to this is the potential of OPOR to respond to either actual demand as reflecting agricultural intensification goals or to deal with potential demand by attacking the need rather than the sub-project request that a co-op submits. OPOR staff believe, they have the administrative ability, if additional monies and technical assistance could be made available, to increase from 12-15 projects per year to as many as 40 to 50. While the consultants disagree strongly with the 40+ figure because of scale and management constraints, the optimism reflected in the staff's estimate is extremely important to note. They recognize a large unmet need. The needed technical manpower to handle even a modestly (and more realistically) expanded OPOR effort is available in the country if monies were made available. However the PL-480 component would also need to be enlarged, well beyond the FY 1984 $1.2 million. With greater emphasis placed on OPOR sub-project operations, maintenance and agro-economic productivity (as opposed to the number of systems constructed), substantially increased help from ISTA, ORE and CENTA extension definitely would be needed to handle the enlarged demand on personnel and resources. Greater attention would have to be given to coordination of the program and use of feedback obtained from beneficiaries.

In sum, there is little to debate with respect to demand when perceived as a theoretical need. Demand is somewhat greater that the supply of sub-project requests being generated and substantially greater than the capability of OPOR to handle all those that might be judged as viable to construct. Tremendous program expansion would adversely affect quality for at least two years, especially given the structural instability. The ultimate choice for the GOES and AID revolves upon a policy issue which is not being addressed by the consultants.

B. Issues and Recommendations

Issue No. 1 -- OPOR Staffing Patterns and Assignments

This issue deals with staffing needs of OPOR during the period 1985-87. The analysis is underlaid by the premise that OPOR is an emergent yet viable agency, and that whether it is housed in CENTA or DGRD (the latter as proposed by MAG), it can succeed in carrying out at least its basic engineering mission. However, virtually all of its broader mission (as the consultants envision it) can be accomplished if it remains housed in CENTA. Important factors to consider in staffing include the following:

- The current personnel vary in level of experience, prior training, and capability. However, the variation is not

extreme and all of the personnel that the evaluation team had time to assess were judged to have acceptable basic qualifications for their positions. Further, all seemed interested and committed to the concept of small-scale irrigation for El Salvador.

- A large number (35) of staff are seconded to OPOR from DRD. These personnel have provided important assistance and have been one of the reasons that the office has been able to increase its effective yearly sub-project work-load to 12-15. In addition, DRD is considerably less active project-wise than OPOR at present and seconding from that unit is appropriate. The process of seconding, while ideally not as preferable as regular staff hiring, is working moderately well at present.

- The acting director (manager) of OPOR has no deputy director. Although he handles most of his basic tasks efficiently, little assistance is available to him. Of the regular office staff of 93, only 11 are engineers and three of these (including the manager) spend most of their time on administrative duties. Actual on-line engineering capacity is less than it should be. Of the 93, 50 are support personnel (secretaries, drivers, chainmen, technical assistants, maintenance person). Given the number of professional and technical positions, the number of support personnel is high.

- Appropriately, no extension agents are a regular part of the OPOR staff, as its mandate is in "implementation control" (i.e., at present including sub-project selection, materials and labor procurement, agronomic / socio-economic analysis, basic engineering, and design and construction supervision). However, needed communication links to enable extension follow-up are not present (although definitely planned), nor are personnel to handle sub-project follow-up and monitoring. In the consultants' opinion, despite its mandate OPOR is too "construction-oriented".

- A number of staff hold outside jobs or have other commitments, which in some cases take them away from their OPOR jobs during the work day. Work productivity at times is affected, although apparently not seriously. Low salaries within OPOR are blamed by some OPOR and AID personnel as a mitigating circumstance. The manager's salary has yet to be upgraded despite several years service in this position; he is being paid at a technician's grade.

Recommendations

1. The consultants recommend that PL-480 monies be used to hire the following new staff, all five of whom would be housed in a

new OPOR liaison section: (1) One irrigation engineer, who would be responsible for strengthening communications between OPOR and DRD, and who would help coordinate sub-project follow-up activities so that on-field information could be channeled back to OPOR; (2) one socio-economist, who would enhance the current staff's capability to make more meaningful analyses of beneficiary needs, and who also would have expertise in water rights or water law. Little expertise is available anywhere in CENTA on water rights and dispute resolution for farmers; (3) one documentation and bibliographic resource communication specialist, who would monitor, read, and disseminate information to staff from all pertinent GOES technical and other professional publications. Current knowledge is lacking by many staff of important documents such as the U.N. water resources survey of El Salvador. Much better use also should be made of the technical documents already prepared for OPOR and CENTA by STC. An in-house library of key documents should be initiated; many of those listed in the reference section of this report would be appropriate acquisitions; (4) two extension liaison coordinators, who would coordinate the work of the 20 to 28 CENTA extension agents currently being prepared (with the help of STC) for work with the cooperatives. These liaison personnel would play an important role in sub-project follow-up.

Overall, the liaison section would strengthen intra-agency communications and enable human resource/agricultural intensification objectives to be addressed more directly. One of the other critical functions of the section would be to design and implement an improved sub-project pre-feasibility evaluation form ("Hoja de Identificación de Proyectos de Riego, Visita Preliminar"). The present form does not adequately address beneficiary needs, nor indicate possible short-and long-term constraints that would prevent success. In turn, the use of this modified form will add consistency to the criteria OPOR uses in sub-project selection. Pre-and post-construction feedback and follow-up would be measurably enhanced.

2. Four additional staff also should be hired: (1) one deputy director to assist with general administration and reduce the manager's work-load; (2) one hydrologist, who would provide detailed information on stream flows, etc., therefore adding to information which at present is remarkably scanty; (3) one soil mapping specialist, whose work on the cooperative lands would ass'st in enabling cropping patterns to be adjusted so as to improve yields; (4) one surveying assistant, needed to reduce the work-load upon present staff members.

3. The passage of Presidential Decree 11 (July 28, 1984), the so-called austerity measure, mandates a freeze on new governmental hiring and a freeze on the filling of vacant positions. It is recommended that PL-480 funds be used to staff these nine positions. Fund-wise, it also is recommended that OPOR be given responsibility for those ORE/MAG monies currently administered by GDO that pay for certain sub-project materials as well as the

four construction monitoring and supervisory personnel that are hired for each sub-project. MAG supports this switch. It is recommended that, using whatever funding source is appropriate, the OPOR manager's salary be upgraded immediately to the appropriate level. Other staff salaries should be increased as funds become available, and a drag-scraper for land smoothing should be purchased when funds are available also.

Issue No. 2 -- Alternative Institutional Placements for OPOR

This issue revolves around the unanswered question of the best institutional setting for OPOR. At the present time MAG strongly favors placement in the newly proposed Directorate of Irrigation and Drainage. The other major alternative, strongly favored by the evaluation team, is continuation in CENTA. Important factors include the following:

- To date OPOR has experienced three major institutional (structural) shifts, all of which also necessitated changes in office location. Institutional stability, so critical to the establishment of long-term program viability, is far from being realized.

- If OPOR does not remain within CENTA, the positive linkages which are now emerging with agricultural extension and farmer-oriented technical assistance will be severely curtailed. An institutional base in CENTA will better enable the integrated farming systems-community development approach advocated throughout this study to be achieved.

[In a recent report prepared by AID, follow-up on small-farm projects like 519-0184 was referred to as "the missing element" (Central America: Small Farmer Cropping Systems, 1980). In El Salvador, follow up (including operation and maintenance) tends to be treated as an "add-on" activity rather than a basic requirement.]

- OPOR and the concept of small-scale irrigation development for El Salvador are receiving strong support from MAG. Plans are underway to expand DRD by initiating a Directorate of Irrigation and Drainage (DGRD), encompasing the present OPOR as a division. This would elevate OPOR institutionally and DRD as well. DGRD would become co-equal to CENTA (which is now a directorate). Other proposed divisions of DGRD would be Promotion and Regulation (including extension agents separate from those of CENTA and water rights specialists), Management of Irrigation Systems (primarily covering the irrigation districts of Zapotitán and Atiocoyo), and Project Formulation and Supervision. The new title for OPOR would be Division of Small-Scale Irrigation and Drainage. MAG states that operation and maintenance proceedures benefitting OPOR sub-projects would be handled through the Division of Management of Irrigation Systems, as would other types of follow-up. Specific details as to how this would work have not been formulated.

- Details on the current operations of CENTA are presented in Chapter III. As a "centralized dependent part" of MAG, its functions are critical to the success of El Salvadoran agriculture. Although the consultants did identify certain specific program deficiencies in CENTA, (such as insufficient funds for transport and educational materials), the overall management is good and increased emphasis is being placed upon the improvement of extension services. Active training programs are underway which will link with the OPOR program.

Recommendations:

1. The OPOR program should remain within CENTA. The process of institutional stabilization will be facilitated, and the overall emphasis of small-scale irrigation for cooperatives can be directed at farm-level human resources development rather than at sub-project construction as an end in itself. If OPOR joins DGRD the program probably will remain merely construction-oriented. The GOES should avoid a "monument building" orientation--even small subprojects can become "monuments" if beneficiary needs are neglected. Were OPOR to join DGRD, there would be the additional danger that functional linkages with the Division of Management of Irrigation Systems would place small-scale irrigation in a detrimental position compared to large-scale irrigation.

2. OPOR's institutional strength is not dependent upon equipment, but upon people. However, note should be made of the need for a medium-sized tractor and drag-scraper to aid the cooperatives in land preparation. Although the purchase of stereoscopic cartographic equipment is not required for OPOR, use of GOES equipment should be provided. The acquisition of LANDSAT and ERTS satellite photos indicating El Salvador's land resources would be useful for overall agricultural and irrigation planning.

Issue No. 3 -- Inter-Agency Communications

This issue centers upon inter-agency communications, i.e., relationships among OPOR and its parent organization (CENTA through MAG) and relationships with allied organizations (e.g., ISTA, FINATA). Were OPOR to join the proposed DGRD, the same concerns would apply; in some instances they would be magnified. The issue also involves communications and farmer outreach to the four agricultural region of the country.

- The evaluation team has proposed the establishment of a liaison section in OPOR. This primarily would address inter-agency (i.e., extra-OPOR) communications and outreach to farmers. It would address the other communications need, namely, inter-agency communications such as those between OPOR and ISTA. At present the OPOR-ISTA relationship is characterized by irregular communications and a lack of

systematic follow-through on ideas that would be mutually beneficial. The OPOR-ISTA relationship is stronger (of necessity) than the OPOR-FINATA relationship, but it should be noted that FINATA representatives have taken a more active role than ISTA rperesentatives in contracting OPOR with new ideas. It should be noted that the ISTA Region IV Manager has initiated active contact with the USAID/ES Project Manager.

° OPOR sub-project development recently has focused on the western parts of the country. The area extending from Chalatenango to Morazan remains problematic. However certain areas of the eastern region (especially near San Miguel) are conducive to expanded OPOR sub-project development. Security is a concern but not a major constraint. Letters of inquiry have been received by the regional MAG office there, and several well-organized cooperatives are now functioning to informally spread the concept of irrigation to other groups. The Department of San Miguel is in the driest area of El Salvador. Returns on sub-project investments could be very significat given the demonstrable need for irrigation.

Recommendations:

1. The consultants recommend that an inter-agency task force be established. The agencies and institutions to be represented would be OPOR, DRD, CENTA, MAG, ISTA, FINATA, DIDECO, BFA, and at least two representatives from the private and/or non-profit sector. The purpose would be to address general community development issues as these impact cooperative and small-farm agriculture Meetings would be held monthly. The four agricultural/CENTA regions would be represented. Meeting locations would be rotated by region, with farmers and co-op leaders given specific invitations to attend and present ideas. PL-480 monies could be used to fund a portion of the costs. This task force would not be a formal policy-making body.

2. It is also recommended that a branch office of OPOR be established in San Miguel. The MAG staff there are supportive; the present MAG facility easily could be used. Program functions could be accomplished in either of two ways: (1) A resident staff of four persons could be developed, representing the disciplines of irrigation engineering, socio-economics, extension liaison, and management; (2) the office could be established with provision for staff from the OPOR main office to stay for extended periods (one week or more). Funds would need to be set aside for travel and per-diem. AID representatives would be encouraged to visit as often as possible.

C. General Summary

Institutional stabilization for OPOR demands high priority. The current OPOR personnel should be retained, but with training funds provided for the upgrading of skills in program management, irrigation science, and socio-economic analysis. Communications need strengthening at both the intra-agency and inter-agency levels. Specific recommendations have been provided. OPOR is a viable institution to aid agricultural and human resource development.

CHAPTER VI

SOCIOLOGICAL ANALYSIS

A. Background Evaluation

1. Cooperatives: Institutional Support -- With Decrees 153 and 154 of March 1980, a new agrarian reform program was created, offering new hope to the landless farmers. ISTA, the Salvadorean Institute of Agrarian Transformation, is the implementing authority in El Salvador of the Phase I agrarian reform. It was established in 1975. In addition to land acquisition, land adjudication and coordination of inputs and technical assistance, ISTA is chargedwith the co-management of the co-ops until they become capable of self-management.

Under the co-management concept ISTA provides cogestores (co-managers), technicians usually trained in agronomy. Their duties include developing organizational and managerial skills among the cooperative members. Additionally, they provide production advise and coordinate access to extension, credit and marketing services (Agrarian Reform in El Salvador, 1983). Other technicians, called promotores (promotors), provide the co-op members with information on co-op system and socio-economic organization.

These support agents are the community development links between the co-op and the GOES institutions. In each of the co-ops visited by the evaluation team, at least one of the two agents was present and took an active role in explaining the condition of the co-op. In the large co-ops the team found the cogestores acting almost as managers, while they described their role as that of counselors. In general, the co-op members were pleased with these co-managers as long as they were present and working. One group of co-op directors expressed great disatisfaction with a former ISTA cogestor because he did not visit often enough and never seem to help them. He has since been replaced and the coop is very pleased with the new cogestor.

ISTA is one of several GOES institutions that work with the co-ops. Under the Ministry of Agriculture (MAG), the National Center for Agricultural Technology (CENTA), the Office of Small-Scale Irrigation (OPOR), and the Center for Agricultural Training (CENCAP) provide numerous services to the farm co-ops as well as to other small farmers. There are numerous other institutions both private and public that provide varying degrees of technical assistance. In the discussions with the numerous co-ops directors and members there was found to be little interaction or program integration among these organizations.

The evaluation team interviewed officials from all of the above-mentioned instituions in order to determine the extent to which the GOES has developed a comprehensive farming systems approach to agricultural development, and to determine the amount of support from them for small-scale irrigation. In general, there appears to be a substancial effort to support the co-op farm sector; however, no official spoke of a unified effort at coordinating the agricultural support units. There appears to be a large gap between the technical assistance methods being used and the actual abilities of the small farmers and former farm laborers. The ISTA agents are in the best position to utilize and coordinate the resources as they are the closest GOES agent to the co-ops.

Since OPOR also has been charged with developing irrigation systems for certain of the Phase III (Decree 207) farms, it should be noted that FINATA agents have taken a fairly active role in contacting OPOR with ideas for project promotion and development. However, ISTA is judged to be a stronger agency overall.

Information was not gathered on others of the agencies and institutions that might, at least indirectly, impact upon the co-ops. These include the Agriculture Sector Advisory Council (CCAS) and the Agricultural Entities Council (CEA).

2. Cooperatives: Structure and Management -- Currently there are approximately 220 co-ops organized under the Phase I process. The creation of the co-op units and their establishment on expropriated lands brought about numerous problems and challenges. The GOES support structure, as described previously, has good potential for meeting these problems of the co-ops The evaluation team, however, found that there is still a great deal to accomplish regarding the areas of management, membership benefits, economic growth and profit sharing.

Under the agrarian reform structure the land is owned by the GOES and the co-op until the debt is paid off by the co-op. In most cases, the membership of the co-op is made up of the former farm laborers employed by the former owner. Some co-ops that the evaluation team visited have accepted new members through an application and review process. Only two co-ops had pending membership applications. Most co-op members were found to be skilled in their farming duties but were not informed about agricultural alternatives. Very few co-op members are educated beyond the second grade.

The ISTA agency has developed a model co-op structure which serves as a base for most co-op organizational structure (see Appendix A). This model is adaptable to most situations in that there is a core group of governing committees, the general assembly, the directors, the supervisory committees and any needed production committees. The co-manager (cogestor) serves as the initial link in the co-management concept supported by ISTA. Once a co-op has developed a financial base sufficient to sustain a paid manager, the co-op enters a new administrative phase and is generally considered to be well on its way to self-sufficiency.

All the co-ops visited by the evaluatin team have a governing body referred to as a general assembly. In some co-ops the group meets semi-annually while in other it meets monthly or as the need arises. This body chooses the administrative (Consejo Directivo) and supervisory (Junta de Vigilancia) groups by election for periods of one to two years. Other committees also are chosen such as education (Educación), social welfare (Bienestar Social), machinery maintenance (Mantenimiento de Máquinas) and numerous others as needed by the co-op. A chart in Appendix A illustrates the committee structure for one co-op. Almost all of the co-ops have some type of production committee relating to the various crops produced such as corn, beans, okra, etc. None, however has an irrigation committee.

Management and leadership abilities are key elements in the success of the co-ops. In some of the co-ops visited the evaluation team found strong leaders with clear ideas about needed directions, problems and potentials. One isolated Decree 207 co-op exhibited little leadership and expressed frustration with their current situation. Where there are co-managers, the co-ops are functioning more effectively and various members are more readily taking on leadership roles. As expected, the style of interaction of the co-manager affects the attitudes and actions of the members. In the majority of the co-ops visited the evaluation team found positive interactions between ISTA personnel and co-op members. However, very few directors indicated that they had received training in co-op management. While most are positive in their attitudes, they are realistic as well as open in discussing their problems in producing a livelihood for their families and managing business.

In two of the co-ops, the evaluation team learned that no members of the former board of directors had been re-elected. The new directors were found to be enthusiastic about their duties but were obviously inexperienced and concerned that they conduct business properly. In one of these co-ops the former directors left permanently, in anger over their defeat. In

another, the member stated that their by-laws required election of an entirely new slate of directors. Apparently, the use of staggered terms of office is not a common practice among the co-ops. These examples illustrate that the co-op members are struggling to manage their organizations with limited to moderate success. It should be added that most co-ops indicated that there were some former members who had not been totally in favor of the organization.

As stated above, none of the co-ops had irrigation committees. Most co-ops had little experience with irrigation methods and were uncertain as to what needed to be done to maintain their systems.

In two of the co-ops, the consultant team found that the entire memberships had been relocated there from other parts of the country. In one case, the members had come from the eastern, conflictive area to a western hacienda that had been abandoned. In the other instance the farm had had very few workers and there was considerable room for the additional people. These cases illustrate the potential for reclaiming abandoned lands by organized groups. However, the evaluation team did not directly investigate the attitudes and reactions of the surrounding non co-op communities. Such attitutes can affect relocation efforts for displaced or immigrating groups. Overall, the spirit of unity among these two co-ops and the surrounding communities was estimated to be strong.

3. Cooperatives: Community Development Needs -- It is recognized that the cooperatives on the agrarian reform lands are new units designed as community development tools for a changing nation. As such the cooperative is a unique tool for bringing new ideas, new experiences and new organizational concepts to people heretofore cut off from these opportunities. It is also recognized by the consultants (having worked with cooperatives in two South American countries) that numerous constraints regularly are encountered in attempting to make cooperative movements succeed. Virtually no voluntary farming cooperatives have been able to establish solid footholds anywhere in the world. While to date the co-operatives in El Salvador have yet to prove themselves as successful, the people are still optimistic, industrious and eager to learn new concepts. The cooperative organization is currently providing this opportunity.

In some of the cooperatives the evaluation team found a relatively strong economic base as developed by the former owners. In some cases it was found to be linked to stronger

management knowledge as well. Cooperatives producing milk and meat products have better economic bases than the others, but usually have not been able to develop their irrigated crop lands effectively. Other felt needs of housing, sanitation, health, water supply, and education need addressing as well.

Other cooperatives without strong economic bases to start from are struggling to keep their members fed and employed. In some cases, people have left the cooperative because they percieved elsewhere better opportunities than what was then being offered.

Cooperative size (measured in terms of number of members and size of land holding) also plays a role in the present and future success of the enterprise. Smaller co-ops (with fifty or fewer members) are experiencing leadership and employement problems. Larger cooperatives tend to have problems of scale, i.e., problems related to size and organizational complexity that make conflicts more difficult to manage. On the other hand, larger co-ops usually have greater potential for production and the generation of regular income. Smaller co-ops may not be able to diversify crops and provide employment year-round.

The current civil war is also an obvious barrier to community and economic development. In two cooperatives, the evaluation team was told that the members would prefer to raise cattle but were unable to do so because the previous herd had been confiscated by insurgents. One co-op is still paying on the loan for those cattle. In another area nearer the coast co-op members reported that if they were to raise cotton (a good export crop) they would lose it to burning.

Nevertheless, the spirit exhibited by the cooperative members and the ISTA agents is proving to be a strong factor in the community development procces. At those sub-projects visited by the evaluation team this spirit seems to help maintain the members in their attempts at earning more consistent incomes. Even in the weaker cooperatives the people have already made at least some progress in spite of their difficulties. Some are experimenting with new crops based on new contracts with private firms such as Quality Foods. Others are laying plans for the planting of additional crops during the dry season. In general, an atmosphere of hope tempered by realism was found to prevail in most of the cooperatives visited.

In all of the cooperatives, the members discussed numerous other community felt needs. The evalution team made no attempt to prioritize these needs, but rather noted

them as "felt needs raised by the people themselves". Outside of agriculture better houses, clean water, improved sanitation facilities, and better roads and bridges were the most commonly mentioned felt needs. La Bolsona cooperative made a special plea to the evaluation team for assistance in acquiring a bridge to cross the Ceniza River. This river often flows excessively high during the rainy season, preventing trucks and other vehicles from passing, thereby isolating the co-op and other surrounding residents from nearby communities and markets. Children also are unable to reach school.

A large barrier exists in terms of the size of the agrarian reform debt that each co-op owes. For some of the cooperatives, the amount due the government for the land and infrastructure has not yet been determined. Questions have been raised by some AID officials regarding the ability of the majority of the co-ops to pay off their debts within any reasonable time period. If this proves to be true any hope for meeting the other community development needs may never be realized. However, it also should be noted that the GOES is solidly behind the cooperative concept. It can be speculated that, in the future, groups that are demonstrating some progress but having difficulties in meeting debt obligations will be encouraged -- rather than discouraged-- to continue their co-op efforts.

As indicated earlier in the section, there are numerous GOES agencies and institutions that are directed at helping the cooperatives meet their community and economic development needs. The coordination of these efforts lies primarily with the ISTA agents assigned to the cooperatives. A recent AID document indicates that coordination may not be as effective as desired (Agrarian Reform in El Salvador, 1983). The interviews conducted by the present evaluation team highlight numerous community needs that are unmet after 3/1/2 years. This admittedly is a short period and there are major barriers, such as the current conflict and the lack of economic growth by the co-ops. However, coordination has proven to be possible in areas where conflict is less and when agents of the various GOES agencies are permanently located. Furthermore and of great importance, there is eividence that a few agencies are beginning to realize that by measuring a program's results in terms of increases in human welfare and agricultural productivity rather than in units of canal built and hectares irrigated, a sense of the country's growth will be more accurately discovered.

4. OPOR and Community Development -- The OPOR sub-projects have been judged by virtually every person asked as excellent candidates for inclusion in the community development plan for the cooperatives. The consultants agree. Small-scale irrigation provides an additional tool the farmer can use in his movement toward a more stable and secure life style. Irrigation systems also aid the local, regional and national economics. However, the evaluation team did not find evidence that the OPOR irrigation projects are being developed in the context of a complete community development plan. Nor does there appear to be a comprehensive farming systems approach in place (see Chapter III), as most farms are following traditional patterns of farming with very little coordinated advice nor integrated socio-economic, technical, and agricultural planning. Rather, the individual OPOR sub-projects appear to be operating in an isolated context with no overall plan that coordinates with other irrigation plans nor with the community development goals of the government (including DIDECO).

Some coordination has taken place involving the OPOR office itself, USAID/ES, and the use of PL-480 funds of the Office of Special Resources (ORE). These monies have provided for the employement of numerous cooperative members during the construction phases of OPOR projects. In the seven projects reviewed in more depth by the evaluation team and reported in Appendix A as case studies, it is estimated that members 4,444 benefitted from employment generation. In each of the projects completed by OPOR to date similar benefits were received by members of the other cooperatives.

The Statement of Work presented to the consultants by the USAID/ES mission did not directly request evaluation of linkages between the OPOR and PL-480 programs. However, due to its importance to the GOES and the large number of comments received about it from AID, a brief commentary is provided here. Additional PL-480 monies could be utilized in concurrance with OPOR's director and the AID Project Officer for the construction on co-op lands of farm access roads and drainage ditches, and implementation of soil conservation (such as leveling, contouring, and the building of wind breaks) and reforestation schemes. Such projects appropriately can be made part of a complete farming systems - community development plan designed to modernize and maximize production. A major problem, for most cooperatives is the lack of capital funds to build structures, purchase machinery, or add other capital investments. Through creative project planning coordination, PL-480 funds could be directed toward broader cooperative development. A portion could be set aside for the development of a "capital investment/self-sufficiency fund" based on the number of days worked per co-op member on this project.

The stated GOES goal for the establishment of co-operatives is to provide a previously landless group of persons with a new sense of dignity through land ownership, while at the same time increasing their income and thereby their standard of living through intensified and diversified agricultural production. It would be assumed that these goals include a self-sufficiency concept evolving out of a realistic long-term time-table, so that government financial assistance could be terminated without incurring a massive debt. Reaching this goal of self-sufficiency can also be assumed to be attainable because few of the expropriated lands were failing to produce prior to the change-over in 1980. To reiterate, problems of debt, management, and improved use of farming methods face these cooperatives.

The new GOES appears to be taking a more comprehensive approach to community development than the previous administration. In conversations with officials and representatives of ORE, MAG, DIDECO, CENTA, ISTA, DGRD and OPOR, the evaluation team detected a real desire to better coordinate the activities of each service department. It is probable that the problems of resettling the displaced persons from the conflictive areas and integrating them into more creative labor generation programs will also be included on the regular agenda as these agencies seek to improve coordination. The consultants would note that any plans to resettle such persons on other than abandoned Phase I farms will be met with resistance by the local residents.

B. Issues

Issue No. 1 -- Interagency Coordination

In discussing interagency support with the various co-operative members, the evaluation team found that the farmers felt avoided and ingnored by most of the agricultural support institutions. In many of the cooperatives the ISTA cooestores were relatively self-assured in their knowledge of agriculture and the farming needs of the cooperative. None of the interviewees indicated that interagency or inter cooperative communication and/or meetings were of a regular nature. This issue raises the following problems:

- Lack of sharing of resources, technological information and community development techniques amoung agricultural support personnel.

- Isolation of cooperative members from the other cooperative

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- Dependence of cooperative members upon the guidance of the cogestor.
- Lack of an overall farming system development approach to the agrarian reform cooperatives.

Recommendations:

1. Regular monthly meetings be held between all the agricultural support agents in each Department or sub division of the Department. These meetings are to center upon community development techniques and plans. This should link with inter-agency task force activities (Chapter V).
2. Training programs should be included in the monthly meetings to teach the various agents to understand and put intc practive the techniques and methods of inter-agency cooperation. Specific case studies should be included, to be presented and analyzed by those attending.

Issue No. 2 -- Management and Training

The management abilities of the co-op members and directors appear to be limited by their past experience as laborers. Few, if any, have a total farm management concept, that is well developed and tested by experience. Cooperative philosophy was generally discussed positively by the members. However, in relating the experiences of dissatisfied members, complete replacement of boards of directors and members who withdrew from the co-op, there does not appear to be a unified aceptance of the cooperative style of living by all. The cooperative may be in a transition or shake down phase requiring experimetion with duties, leadership and membership benefits. Institutional support will have to be carefully determined and balancedin the type and amount of direct management and advise. The organizational structure of the cooperatives is based on a rather sound theorical foundation. Effective use of the committee struture usually takes several years of practice resulting in numerous trials and errors. This issue raises the following problems:

- Lack of adequate farm management experience.
- Lack of effective delegation of authority over task.
- Loss of cooperative spirit and unity.
- Loss of production due to poor understanding of or inadequate instructions.

Recommendations:

1. A comprehensive training program for co-op directors and other committee leaders in farm management methods and community development principles should be designed and implemented. The Comites de Vigilancia should take the lead.

2. Regular meetings, suggested to be once every two months, of co-op directors, farm managers and other co-op leaders, should be held to discuss co-op problems, share resources and exchange ideas regarding the growth and development of their individual co-ops. Such meetings should be organized by ISTA agents. Costs for such meetings should be paid by the co-ops if possible or by ISTA. Travel, per diem and an honoraria should be covered to ensure the participation of the leaders.

3. For co-ops with OPOR irrigation systems, special committee for the maintenance of the irrigation structure and its operation should be created. The members of this committee should be trained by OPOR and ISTA. The committees should also select specific workers to operate the system and consider paying these workers a higher wage for a specialized skill. Regular training should be obtained by the committee regarding irrigation methods and soil conservation techniques.

Issue No. 3 -- Community Development Needs

The cooperatives studied by the evaluation team represented a cross-section of the cooperatives that have OPOR sub-projects. As such they presented a reasonably good sample of cooperatives in varying stages of development. The OPOR project has not considered the felt needs of the co-ops, but rather built projects as they were presented. Results have been measured in terms of length of canals constructed, number of hectares irrigated, or number of projects constructed. No effort is made to consider a total farming systems community development plan or to even suggest that such be considered when projects are proposed. Problems raises by this issue are:

- Results are measured in terms of system built and hectares irrigated rather than in improvements to human resource capabilities.
- Little effort is made to determine the long run human welfare benefits
- Projects are built without consideration of any community development plan.

Recommendations:

1. OPOR should develop a selection criteria scale that allows it to chose cooperatives that are in the greatest need and can best benefit from an irrigation project. As indicated elsewhere (Chapter V), the proposed OPOR liaison section should help coordinate this effort. A co-op's need should be measured in terms of potential for significantly enhancing agricultural production for the co-op as a whole and for significantly complementing the co-op's other efforts at road and bridge improvement, school, and rural electrificacion. The factor of need must be balanced systematically against a co-op's "state of readiness" to manage an irrigation system. Formation of a co-op irrigation committee should be made mandatory.

2. Leaders of cooperatives that have proven successful with a farming systems approach and OPOR irrigation systems should be provided travel funds and honoraria so they can visit other co-ops to share their knowledge. These honoraria funds could be developed from PL-480 monies. They should be invited to talk with BFA representatives so that lending institutions can better understand their felt needs. All this is part of the practical, case-study approach to a better understanding of farmer needs.

3. It will be very difficult to integrate displaced persons and refugees into the construction programs of the co-ops.

Issue No. 4 -- Capital Development/Self-Sufficiency Fund

The agrarian reform cooperatives usually have very little if any capital development funds. One group had only accumulated ₡400. They are faced with a huge debt for the land and are barely able to obtain credit for their forthcoming crops. The present OPOR program of utilizing co-op members paid with PL-480 funds has proven to be effective in providing income as well as raising the hopes of the co-op members for future production. The cooperative remains without capital investment funds and gains slight advantage for increased credit via the irrigation system. Problem within this context are:

- Little or no ability to develop and maintain a viable and capital investment fund for future improvements.
- Continued employment is still dependent upon bank credit for future crops.

Recommendations:

1. OPOR should require each co-op to develop a comprehensive farm development plan which includes the use of the

irrigation system for crop diversification. This should be submitted to the newly proposed OPOR liaison section for critique and approval one month prior to completion of sub-project construction.

2. AID should develop a plan for utilizing additional PL-480 funds in soil conservation, reforestation, road and bridge-building projects. Additionally, a portion of these funds should be channeled into the capital development/self-sufficiency fund for use in capital improvements. The funding contribution would be calculated against one-half hour of each co-op member's daily work on the project.

C. General Summary Recommendations

1. The agrarian reform cooperatives must be approached within a broad scope of community development philosophy and withina complete farming development system. In this context OPOR's sub-projects should be designed to utilize PL-480 monies for land leveling, reforestation projects, soil conservation and road and bridge construction programs.

2. The OPOR design engineers should be required to meet regularly with the regional extention members of CENTA, CENCAP, ISTA, and other agricultural support agents in sub-regional, regional, and national coordinating groups to promote, educate and coordinate with said agencies in providing development services to the cooperatives and other small farms.

3. USAID and GOES should immediately implement a training program for all the cogestores of ISTA, extention agents of CENTA, trainers of CENCAP and CODIZO and the design engineers of OPOR in community and cooperative development methodologies, and technical application of agricultural irrigation systems. Through this coordinated training program the line level agricultural development agents will be able to assist the agrarian reform farmers to implement productive methods on their farm in order to reach self sufficiency in a timely fashion.

4. The OPOR socio-economic section should develop and implement a human welfare and resource scale that would provide a means to better assess beneficiary needs and measurably assess the state of readiness of a cooperative to manage an irrigation system. It will also enable them to better prioritize and rank prospective sub-projects, something not now being consistently done. This tool should consist of items that measure recent crop

production linked to knowledge of cropping patterns existance and quality of both short-and long-term cooperative development plans, participation in extension outreach and CENCAP training, management ability, and functional status of each cooperative sub-committee. Projected numbers of beneficiaries and numbers employed in two categories (age/sex and job type) also are necessary. Present socio-economic analyses are very weak, focusing primarily upon number of co-op members present and total number of persons employed.

5. OPOR's sub-project selection process should include a determination of an individual cooperative's "state of readiness", balanced against the cooperative's need for an irrigation system as calculated economically. With both sets of factors (categories) being weighed and prioritized, a co-op that rates high in one category can be included as a sub-project even if it rates low in the other category.

CHAPTER VII

ECONOMIC ANALYSIS

A. Background Evaluation

From 1980 to April 30, 1984, AID invested $ 2.3 million in small irrigation systems under project 519-0184, according to the Ministry of Agriculture office that coordinates MAG-AID projects. AID funded direct costs of the systems consisting mainly of construction materials and labor. Vehicles for OPOR and training for OPOR personnel were also funded by AID as part of project 519-0184. Most of the labor costs paid for by AID were from PL-480 funds.The Government of El Salvador contributed ₡ 5.0 million, mainly for indirect costs such as salaries of OPOR personnel. With only a few exceptions, OPOR staff member were working for the government prior to 1980. If project 519-0184 had not existed, staff members would have engaged in other duties but they would have received essentially the same salaries. GOES contributions to 519-0184 were, therefore, mainly funds that would have been spent with or without the project,not incremental costs.

The $ 2.3 million invested by AID in project 519-0184 was only 1% of all AID money for agricultural projects in El Salvador from 1980 to 1984, showing that irrigation was of minor importance, in terms of magnitude of expenditures in AID's overall program to foment agricultural development.

The cost data provided by the MAG-AID coordinating office were not disaggregated into costs per system. However, OPOR provided data on direct costs (construction materials and labor) of 32 small irrigation systems, as shown in table VII-1.

Average construction costs per irrigated hectare were ₡ 3,477 and ranged from ₡ 1,320 to ₡ 7,432 (₡ 1,408 per irrigated acre, ranging from ₡ 534 to ₡ 3,009).

Dollar investments by AID in El Salvador are converted to colones at the official rate of exchange of ₡ 2.50 per $ 1.00. For certain other costs, the unofficial rate of approximately ₡ 3.95 per dollar may be a better indicator of the present value of the colon in relation to the dollar, as it is a market-determined rate. 1/

1/ When the World Bank evaluates projects in countries where an official exchange rate appears to overvalue the currency, the Bank calculates an "economic rate of exchange" which is also called a "shadow price". It is an estimate of what the rate of exchange would be in a completely free market.

An investment in irrigation amounting, on the average, to ₡3,477 per hectare ($1,391 at the official rate of exchange) or ₡1,408 per acre ($563) represents a modest cost compared to average expenditures in the United States for private on-farm small irrigation systems, and a very low cost compared to expenditures per irrigated hectare for large-scale irrigation projects financed by the World Bank or regional development banks such as the IDB.

The cost per irrigated hectare of large-scale irrigation projects is often subject to different interpretations (i.e., conflicting opinions) when the projects include large dams and storage reservoirs, as is often the case. The reason for this is the large projects are normally multi-purpose projects (hypropower is nearly always one of the purposes, in addition to irrigation, and other possible purposes include municipal-industrial water supply, flood control, fish culture, and recreation). The costs of a dam and reservoirs for a multi-purpose project are, of course, joint costs and thus the cost for any single purpose among the multiple purposes (say, the cost of irrigation) is clearly a function of how the joint costs are allocated among project purposes. Whatever method is used in connection with large projects for allocating joint costs among project purposes, a cost per irrigated hectare amounting to more than twice as much per irrigated hectare as the OPOR projects is normal.

It should be noted that the cost of irrigation projects usually include some land costs (often a large item) for canal rights-of-way and other land. In the case of the OPOR sub-projects, the costs are favorably affected by the fact that land did not need to be purchased.

Total costs per sub-project as shown in table VII-1 can be disaggregated into the costs of labor and of materials and equipment. The average percentages for all OPOR sub-projects were approximately 70 per cent for labor and 30 per cent for materials and equipment, but for various individual sub-projects the percentage for materials and equipment was higher than 50 per cent. These latter sub-projects were primarily the relatively "high technology" systems as opposed to simple gravity-flow systems.

An annual return on an investment of 10% to 12% is usually considered to be a reasonable goal, and the prospect of a fairly reliable annual return in this percentage range is normally deemed to be adequate justification for making an investment. Based on the construction cost data in table VII-1 an average annual return of around ℓ 348 per hectare (as the net value of incremental agricultural output attributable to irrigation) achieved after some five or six years of project operation, would justify the investment of public funds in OPOR projects. CENTA studies in 1983 showed the annual net profits per hectare of various non-irrigated crops produced in the wet season. Comparable net returns could be expected in the dry season with irrigation. Net returns for various crops, based on the CENTA studies, are shown in tables VII-2 and VII-3. Farmers who use their OPOR systems for production of a dry season crop of rice, medium-technology corn, medium-technology corn and beans intercropped, or corn for seed production would equal or surpass the cited figure of about ℓ 348 of incremental net return needed to justify the average investment in OPOR systems per hectare. Use of an OPOR system for irrigating sugar cane should result in an incremental output averaging 34 metric tons per year per hectare, and it appears that this would be an economic use of a system. Use of irrigated land for producing a crop of medium-technology beans, on the other hand, would not be an economic use of the system, based on the CENTA data pertaining to net returns on bean production in 1983.

One of the first benefits accruing to members of a cooperative where OPOR builds an irrigation system is usually employment for some of the members in construction jobs. Another early benefit for many cooperatives is that an irrigation system helps them to obtain credit from the BFA. Many of the cooperatives started with meager resources other than land, and they often experienced considerable difficulty for the first year or two in obtaining any credit, even short-term crop production loans. For some cooperatives visited by the consultants, their first bank loans were obtained after an OPOR project had been completed.

The Inter-American Development Bank (IDB) has funds available for irrigation projects, including small projects on the land of a single cooperative or other single property, as well as for larger projects. The funds for small irrigation projects (or other on-farm improvements) are administered by the Banco de Fomento Agropecuario (BFA). The potential for irrigation in El Salvador is so large that there is no danger that the two sources of external funding for irrigation (AID and IDB) will lead to duplication of efforts or excessive investment in irrigation.

The standard measurement of the key benefit of an irrigatio project is the net value (i.e., the value after deducting prodution costs) of the incremental agricultural output attributable to irrigation 2/. Since OPOR projects usually introduce irrigati for the first time, farmers need time to acquire new skills. In past feasibility studies of irrigation projects, it was usually assumed that full potential incremental output could be reached in about the fifth or sixthyear of project operation, provided qualified extension agents helped the farmers to learn the necessary skills. Recent post-construction evaluations of irrigation projects have indicated that farmers may need more than five or six years to achieve expected levels of output, even with adquate technical assistance.

Some OPOR projects are still under construction; others were recently completed but have not yet been used; some have been in operation for a year or two; but none has been in operation for five or six years. Therefore, it is much too soon for the full potential incremental output at any OPOR project to have been reached. However, climatic conditions in El Salvador, with rainfall concentrated in half the year but with other conditions generally favorable for continuous crop production, create a good potential for irrigation to confer significant benefits based on more intensive land use. The OPOR systems, except when used to increase sugar cane yields, will make it possible to produce two crops per year instead of one; and at some systems used to irrigate crops such as rice or vegetables, more than two crops per year (i.e., 2.5 or 3) should be an attainable goal.

2/ This benefit is the primary economic benefit of irrigation. It is the key benefit for evaluating a project's feasibility. Additional economic benefits are secondary and include incremental profits of (a) suppliers of inputs to farmers and (b) various indiviudals and firms that store, process, transport or otherwise participate in the chain of transactions between the farmer and ultimate consumer. Secondary economic benefits are often difficult to quantify. Apart from economic benefits irrigation projects often have social-well being benefits such as better health and nutrition for farm families.

Internal Rates of Return (IRR)

An "internal rate of return" or IRR is a means of evaluating the economic feasibility of a project. It is the interest rate at which the present value of costs equals the present value of expected future benefits, usually within some period of time such as 30 years. Usually an IRR is calculated as part of a pre-construction feasibility study on the basis of estimated costs and estimated future benefits of a proposed project and it serves as a key element in the analysis of whether to build a project. Although existing OPOR sub-projects have already been built, several IRR's are here calculated as a guide to whether additional small irrigation systems of similar characteristics should be constructed in the future. These IRR's refer, first, to a specific OPOR sub-project; and then to several hypothetical sub-projects with costs and sizes that are based on average costs and average size of the 32 OPOR sub-projects listed in table VII-1. An IRR of around 10% to 12% is accepted by the World Bank as satisfactory economic justification for a project.

Case No. 1: "Las Bromas" sub-project cost ₡257,572 to build. It is designed to irrigate 54 hectares. Its average cost per irrigated hectare of ₡4,770 is higher than the average of ₡3,477 per irrigated hectare. The cooperative has decided to use its sub-project to produce okra for the firm Quality Foods de Centro América. Quality Foods will supply ample technical assistance to the cooperative in how to cultivate irrigated okra, so it is assumed that by the third year of experience in okra production the cooperative will achieve the full potential met profits of ₡929 per hectare (this figure is given in Cultivo de la Okra en El Salvador, second edition, published by Quality Foods). It is assumed that in the first year net profits would be ₡465; ₡698 in the second year; and the full ₡929 in the third year and each year thereafter. Cash flows are as follows:

Year	Cash Flow
1	- ₡257,572
2	25,110
3	37,692
4-30	50,166

The IRR of the sub-project is 17.3%.

Case No. 2 : Based on OPOR's data pertaining to 32 sub-projects, an IRR was computed for a "composite" sub-project which irrigates 49 hectares (the average for the 32 projects listed in Table VII-1) and which cost ₡3,477 per irrigated hectare (again, an average figure of the 32 sub-projects) or total cost of ₡170,373. It is assumed that the cooperative uses its system to produce irrigated rice in the dry season, which gives a net profit of ₡843 per hectare according to CENTA studies. Because irrigated farming is new for

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the cooperatives members, it is assumed that they will need 5 years of experience in order to attain full potential net profits with their profits per hectare per year growing as follows: first year, ₤422; second year ₤528; third year, ₤633; fourth year, ₤739; fifth year and subsequent years, ₤843.
Cash flows are as follows:

Year	Cash Flow
1	-₤170,373
2	20,678
3	25,872
4	31,017
5	36,211
6-30	41,307

The IRR of the sub-project is 19.9%

Case No. 3 : It is next assumed that directors of the cooperative where the "composite" OPOR sub-project is located wish to obtain higher profits than can be earned using their irrigated land for rice production. They decide to use only half (24.5 ha) for rice, and the other half for high-quality irrigated corn, which they can sell for seed with a net profit of ₤1,124 per hectare, according to CENTA data. Again, it is assumed that the farmers lacked prior experience with irrigated crop production, and that they need 5 years of experience in order to reach full potential net earnings per hectare. Their returns on rice production develop as indicated in case No. 2 and for seed corn as follows: First year, ₤562; second year, ₤703; third year, ₤843; fourth year, ₤984; fifth year and thereafter, ₤1,124. Cash flows are as follows:

	Net Returns		
Year	Rice	Seed Corn	Cash Flow
1	-.-	-.-	-₤170,373
2	₤ 10,339	₤ 13,769	24,108
3	12,963	17,224	30,160
4	15,509	20,654	36,163
5	18,106	24,108	42,214
6-30	20,653	27,538	48,191

The IRR is 22.8%

Case No. 4 : It is next assumed that an OPOR sub-project cost 50% more than the average cost per irrigated hectare (i.e., ₤3,477 x 1.5) or ₤5,216. It should be noted that only seven of the sub-projects in Table VII-1 cost more than this amount per hectare. This project is assumed to be designed to irrigate 49 hectares, the average for OPOR sub-projects. Costs of operating a diesel-powered

pump reduce net returns by 25%. The cooperative produces rice on its irrigated land. The usual 5 years of experience in irrigation is needed to reach full potential profits. The cash flows are as follows:

Year	Cash Flow
1	-₤255,584
2	15,509
3	19,404
4	23,263
5	27,158
6-30	30,980

The IRR is 10.1% (This hypothetical cooperative would therefore need help in selecting a more profitable crop for cultivation on some of its land. Incidentally, the OPOR sub-project with the lowest cost per irrigated hectare has an IRR of nearly 50%).

TABLE VII-1
PROJECT COSTS

SUB-PROJECT	MEMBERS	HECTARES	COSTS TOTAL	COSTS PER HA.	COSTS PER MEM
Achichilco	32	17	ℓ 114,000	ℓ 6,706	ℓ 3,56
Aldea Vieja	24	11	36,742	3,340	1,53
Amatal	15	56	299,642	5,351	19,97
La Bolsona	28	100	170,633	1,706	6,09
Las Bromas	22	54	257,572	4,770	11,70
California	53	35	211,636	6,047	3,99
La Canada	32	87	321,882	3,700	10,05
Cara Sucia	450	42	141,154	3,361	31
El Carmen	30	20	63,860	3,193	2,12
La Chapina	46	60	190,725	3,179	1,14
El Edén	138	50	197,624	3,952	1,43
Las Conchas	122	35	64,018	1,829	52
Llano Grande	29	15	37,550	2,503	1,29
Meanguera	6	6	20,939	3,490	3,4
Miramar	29	35	177,204	5,063	6,1
Nueva Guayapa	307	55	86,580	1,574	2
El Obrajuelo	38	86	113,513	1,320	2,9
Palo Combo	84	100	213,749	2,137	2,5
La Paz	28	35	260,117	7,432	9,29
Plan de Amayo	88	60	121,693	2,028	1,38
Primavera II	20	72	229,563	3,188	11,47
Rancho Grande	27	40	281,395	7,035	10,42
El Recuerdo	20	81	180,319	2,226	9,0
San Antonio	52	15	47,079	3,139	90
San Francisco Guajoyo	166	84	495,837	5,903	2,98
San Martín Larín	50	35	242,081	6,917	4,842
San Raymundo	72	42	119,071	2,835	1,654
Singaltique	109	100	222,157	2,222	2,0
El Tatuano	35	10	34,529	3,453	98
Taquillo	90	35	130,219	3,721	1,447
Las Victorias	100	55	181,706	3,304	3,304
El Zope	82	45	113,740	2,528	1,387
TOTAL	2,424	1,573	ℓ5,469,529	- . -	- . -

Average cost per hectare = ℓ 3,477 and per member = ℓ 2,256

Source: OPOR records. Membership in cooperatives is subject to a degree of change over time. Data pertaining to two systems (sub-projects) are omitted because their costs per hectare were special situations. The sub-proejcts are here listed alphabetically. It should be noted that the above-listed sub-projects do not comprise all OPOR projects (see Tables I-1, I-2, and I-3).

TABLE VII-2
Average Net Return-Grain Crops
(Computations)

High-Technology Rice

Yield = 80 QQ/Mz x 100 = 8,000lbs/Mz ÷ 2.204 =
3,630 Kg/Mz x 1.43 = 5,191 Kg/Ha = 5.2 Mt/Ha
Farmgate price = ℓ 33/QQ ÷ 45.37 = ℓ 0.727/Kg x 1,000 = ℓ727/Mt
Gross return = 5.2 x ℓ 727 = ℓ 3,780
Production costs = ℓ 2,062.14/Mz x 1.43 = ℓ 2,949/Ha
Net return = ℓ 3,780 - ℓ 2,949 = ℓ 831/Ha

Medium-Technology Rice

Yield = 65 QQ/Mz x 100 = 6,500 lbs/Mz ÷ 2.204 =
2,949 Kg/Mz x 1.43 = 4,217 Kg/Ha = 4.2 Mt/Ha
Farmgate price = ℓ 33/QQ ÷ 45.37 = ℓ 0.727/Kg x 1,000 = ℓ727/Mt
Gross return = 4.2 x ℓ 727 = ℓ 3,053/Ha
Production costs = ℓ 1,545.35/Mz x 1.43 = ℓ 2,210/Ha
Net return = ℓ 3,053 - ℓ 2,210 = ℓ 843/Ha

Medium-Technology Beans

Yield = 16 QQ/Mz x 100 = 1,600 lbs/Mz ÷ 2.204 =
726 Kg/Mz x 1.43 = 1,038 Kg/Ha = 1.04 Mt/Ha
Farmgate price = ℓ 75/QQ ÷ 45.37 = ℓ 1.653/Kg x 1,000 = ℓ1,653/Mt
Gross return = 1.04 x ℓ 1,653 = ℓ 1,719/Ha
Production costs = ℓ 1,037/Mz x 1.43 = ℓ 1,483/Ha
Net return = ℓ 1,719 - ℓ 1,483 = ℓ 236/Ha

Medium-Technology Corn

Yield = 55 QQ/Mz x 100 = 5,500 lbs/Mz ÷ 2.204 =
2,495 Kg/Mz x 1.43 = 3,568 Kg/Ha = 3.57 Mt/Ha
Farmgate price = ℓ 23/QQ ÷ 45.37 = ℓ 0.507/Kg x 1,000 = ℓ507/Mt
Gross return = 3.57 x ℓ 507 = ℓ 1,810
Production costs = ℓ 1,019.26 /Mz x 1.43 = ℓ 1,458/Ha
Net return = ℓ 1,810 - ℓ 1,458 = ℓ 352/Ha

Medium-Technology Corn and Beans (intercropped)

Yields = (a) 55QQ/Mz of corn = 3.57 Mt/Ha
(b) 25QQ/Mz of beans x 100 = 2,500 lbs/Mz ÷ 2.204 =
1,134 Kg/Mz x 1.43 - 1,621 Kg/Ha = 1.62 Mt/Ha
Farmgate prices = (a) ℓ 23 QQ ÷ 45.37 = ℓ 0.507 Kg x 1,000 =
ℓ 507/Mt.
(b) ℓ 75 QQ ÷ 45.37 = ℓ 1,653/Kg x 1,000 =
ℓ 1,653/Mt.
Gross return = (3.57 x ℓ 507 = ℓ 1,810) + (1.62 x 1,653 =
ℓ 2,678) = ℓ 4,488.

Production costs = ℓ 2,835.37/Mz x 1.43 = ℓ 2,625
Net return = ℓ 4,488 - ℓ 2,625 = ℓ 1,863

Corn for Seed Production

Net return = ℓ 786/Mz x 1.43 = ℓ 1,124/ha

Source: Data in quintales and manzanas from Costos de Producción de Granos Básicos - 1983, CENTA. Converted to metric tons and hectares by consultants, based on manzanas of 7,000 square meters.

TABLE VII - 3
AVERAGE NET RETURNS - GRAIN CROPS

CROP	NET RETURN PER HA.
High-technology rice	ℓ 831
Medium-technology rice	843
Medium-technology beans	236
Medium-technology corn	352
Medium-technology corn and beans (intercropped)	1,863
Corn for Seed Production	1,124

Source: Based on data in Table VII-2

B. Issues

Issue No. 1 -- Economic, Social and Technical Criteria for Selecting Sub-Projects

This issue is how to insure that future funding for new irrigation systems (or rehabilitation of old systems) will be allocated to the most appropriate systems. Criteria are needed to select among alternatives because there is more potentially irrigable land (and more cooperatives) than it will be possible to provide with irrigation systems.

- Construction costs per irrigated hectare ranged from ℓ 1,320 to ℓ 7,432 at 32 OPOR sub-projects listed in table VII-1, so the most costly was 5.6 times more expensive than the least costly.

- Social well-being at cooperatives visited by the consultants covered a wide range. A few cooperatives were relatively affluent in terms of livestock machinery still in operating condition, and housing for members. Some cooperatives were so poor that they had neither livestock nor machinery nor enough dwelling units to provide housing for all members; and the directors had at times been unable to pay members their wages.

- Many existing OPOR systems convey water entirely by gravity flow, but a fair number require pumping. Under existing arrangements for operation, the costs of diesel fuel or electricity to operate the pumps, as well as repairs and eventual replacement of the motors (about every eight years in the case of diesel motors), must be paid by the cooperatives. This will increase production costs of irrigated crops and reduce net profits.

Recommendations: Both economic and social well-being aspects must be considered in selecting sub-projects. The primary criterion should be cost effectiveness, meaning that the greatestweight should be given to estimated cost per irrigated hectare. Among possible sub-projects which all have relatively low costs per irrigated hectare, social well-being conditions can be taken into account by awarding an irrigation system to the poorest cooperative. However, a high-cost system should not be constructed at a cooperative solely because it members are notably poor. Finally, the consultants urge that OPOR should, with very few exceptions, build simple gravity-flow systems. It is especially important to avoid diesel-operated pumps because it is impossible to project long-term trends in the cost of petroleum products. Use of some irrigation systems in certain Asian countries has been discontinued because of the high cost and scarcity of diesel fuel.

An unresolved issue in connection with sub-project selection is the extent or degree to which costs per cooperative member (as opposed to costs per irrigated hectare) should be taken into account. Althougn members of most cooperatives are poor at present, their eligibility to share in future earnings of their cooperative makes them potentially better off than landless rural laborers for whom membership in a cooperative is unavailable. Generally, most cooperatives do not seem very anxious to admit new members, even when the members can not themselves supply all the man-days of labor that are needed; they hire outside labor to supplement their own work. Table VII-1 snows that some OPOR

systems have been quite costly on a per member basis. AID and GOES may wish to consider whether a cooperative that is quite small in terms of number of members, with a resulting high cost per member for a proposed irrigation systems, should be urged (or required) to admit some new members as a condition of obtaining an irrigation system.

Issue No. 2 -- Budgeting and Planning Irrigation Systems

This issue is whether funds allocated in the future for more irrigation sub-projects should (1) continue to cover only construction costs, or (2) include funding for training cooperative members in irrigation as well as any related on-farm improvements deemed essential for effective use of the system. Important points are as follows:

- An irrigation system will not, by itself, insure an increase in agricultural output and more income for members of cooperatives. Farmers without experience in production of irrigated crops always need training in how to irrigate. Further, the members of El Salvador's cooperatives lack experience as self-employed farmers, so they need guidance in what crops to produce and how to market them in order to maximize profits. Many cooperatives also may urgently need some on-farm improvement in order to make effective use of a new irrigation system, such as (1) land leveling, (2) a shed or other structure in which to store incremental output, or (3) an improved ox-cart trail or road.

- The loan agreement of August 30, 1978, between AID and GOES for small-scale irrigation projects took note of various needs related to irrigation systems, especially training and technical assistance. However, implementation of the agreement has, in practice, focused primarily on constructing irrigation systems The plans for systems usually have not dealt specifically with related training and other needs, with adequate funds specifically budgeted and responsibilities precisely assigned. Many systems were built and turned over to cooperatives without formulation of a plan for training the farmers in irrigation or providing for construction of other on-farm improvements urgently needed in order to make effective use of the system, nor were funds specifically budgeted for such training and related improvements.

Recommendations : The consultants recommend that future sub-project plans should be more comprehensive than in the past. Training needs should be identified and costed; when related facilities are urgently needed, provisions should be made for their construction concurrently with the system, and the necessary funds for implementing a comprehensive plan of this type should be allocated and budgeted. This type of planning and budgeting may result in fewer sub-projects than if most of the available funds continue to be spent primarily on construction of sub-projects. However, the benefits should be greater.

Issue No. 3 -- Possible Cost Sharing

This issue concerns whether cooperatives selected for sub-projects should be required to share the construction costs. In quite a few countries including the United States, the beneficiaries of an irrigation project are usually asked

to pay part of the costs. Key factors include the following:

• Within the United States, there has been increasing emphasis for at least eight years on requiring the beneficiaries of any new project for development of water resources to pay some of the costs. This requirement is in addition to the long-standing requirement that beneficiaries of an irrigation system (i.e, farmers who use the water) should pay all annual operation and maintenance costs.

• One argument in favor of shifting more project costs onto farmers is that it impresses upon them that water is not "free" and that it should be used prudently, just as is also the case with any other scarce resource. One member of the AID staff expressed this view.

• The consultants found that most of the cooperatives they visited have severely limited resources at the present time. Further, they have not yet even started to make land payments.

Recommendations : The consultants do not believe that cooperatives are in a financial position at this time to make it possible for them to share any of the construction costs of OPOR sub-projects. The consultants recommend that cooperatives continue to be responsible for maintenance of projects, as this primarily involves a contribution of labor rather than a cash expenditure.

Issue No. 4 -- Guidance In Farm Management

This issue concerns the need for cooperatives that acquire an irrigation system to better learn economic and financial aspects of its operation, in addition to the technical skills of how and when to apply water to the growing of crops. Important factors are as follows:

• To maximize benefits on OPOR sub-projects, the farmers will need to develop skill in selecting the most profitable crops. Decisions about how to use irrigated cropland will require annual review with the aid of the proposed OPOR liaison office, taking into account trends in commodity prices and the cost of inputs.

• Directors at some of the cooperatives visited by the consultants were not aware of the need to be innovative in the use of their irrigated land. In fact, cooperatives where members have a strong orientation toward cattle production (based on their past experience as workers on haciendas whose owners focused major attention on livestock) were little interested in crop production on either irrigated or non-irrigated land. Their general intention and preference was to use nearly all of their land as pasture in support of livestock operations.

• Most members, when they were farm laborers, presumably did not have any significant experience in making management decisions. A few cooperatives have found profitable uses of their irrigation systems in production of high-value speciality crops (such as okra and mellons) because of initiatives by private agrobusiness firms in contacting cooperatives and offering them contracts and technical assistance.

Recommendations : The consultants recommend that the Ministry of Agriculture should offer specific guidance to cooperatives in how to maximize profits derived from irrigation (see Chapter III); to be able to offer sound guidance MAG will need to make careful yet brief annual studies that compare net returns in alternative uses of irrigated land. Such systematic comparative data is not yet available in El Salvador. The consultants believe that once cooperatives start making payments toward their land indebtedness they will have a strong incentive to become concerned about maximizing profits.

Issue No. 5 -- Need for Further Study and Evaluation of Credit Situation

This issue concerns the need for a closer examination of the present situation of cooperatives with respect to their ability to obtain credit, in order to resolve the question of whether or not scarcity of credit is seriously retarding agricultural output at this time. Key points are as follows:

- Field work executed by the consulting team during this rapid investigation focused mainly on interviews with the directors and some of the members of 15 cooperatives (15 within OPOR's purview). With very few exceptions, directors stated that their principal problem resolved around obtaining credit. (Where the civil war was causing cooperative members to be strongly concerned about their personal safety and/or the safety of their possessions, the conflict clearly was a more basic problem than obtaining credit). For some groups the credit situation seems to be better than it was for the first year or two after establishment of the cooperative, but obtaining any credit is perceived by them as a difficult and time-consuming problem.

- Leading figures in Salvadoran banking have assured consultants that shortage of credit is not a major constraint on farm output.

- The sample of farmers (cooperative directors and members) interviewed by the consultants was small, but it is probable that their problems and concerns with regard to credit are representative of the problems and concerns of cooperatives in general.

Recommendations : The consultants conclude that scarcity of credit is indeed a problem for many cooperatives at this time, but the true dimensions and magnitude of the problem are difficult to evaluate. One possibility is that lack of credit may be significantly holding back agricultural output in 1984. Another possibility (perhaps less likely) is that its lack is not retarding output in 1984. The evaluation team recommends that a closer examination be taken of the credit problem than was possible to be made during this evaluation. The opinions of the OPOR manager and USAID/ES Project Officer should be specifically included regarding this matter.

Issue No. 6 -- Addition of GOES Expenditures to Project Costs

This issue relates to whether average costs to irrigate one hectare are understated unless certain GOES expenditures are added. Important points to consider include the following:

• MAG data show an investment by AID in OPOR projects of ₡5.75 million ($2.3 million) up to April 30, 1984, and a contribution by the GOES of ₡5 million. As discussed in the Background Evaluation, most of the GOES expenditures would have been incurred with or without Project 519-0184. They were not incremental costs incurred by the government as a result of the project.

• The average construction cost per hectare of ₡3,477 given in Table VII-1 is based on OPOR records pertaining to direct costs of construction materials and wages paid to construction workers (i.e., through AID funds).

• One point of view is that the AID contribution to OPOR projects was only 53.5% of total expenditures and that the real average cost per irrigated hectare for irrigation systems should be ₡6,499.

Recommendations : The consultants recommend that ₡3,477 be considered as the average cost per irrigated hectare, but they have no argument with anyone who wishes to cite the higher figure (as long as justification is provided). It should be noted that the consultants found that AID financial records are apparently maintained in a form that makes it difficult for AID to determine how much was spent on each OPOR sub-project; recognizing this AID therefore recommended to the consultants that they obtain cost data directly from OPOR.

C. Summary of Issues and Recommendations

Cost data provided to the consultants by OPOR indicate that the average construction costs of sub-projects have been on the order of ₡3,477 per irrigated hectare. Annual incremental output per irrigated hectare with a net value of around 10 to 12 percent of the construction costs would normally be accepted as satisfactory economic justification for AID's investment in small-scale irrigation systems. CENTA data concerning the average net profits in 1983 derived from the production of various crops indicate that, with adequate guidance, farmers should be able to use their irrigation systems in ways that will confer annual benefits adequate for justification of the AID investment.

In the proposed forthcoming "second phase" (1985-87) of AID's investment in small-scale irrigation, future sub-projects should be selected for construction based on the criteria of cost effectiveness (i.e., lowest cost per irrigated hectare), helping the relatively poorer cooperatives, and technical simplicity of the systems. This needs to occur within the broader context of improved project prioritization by OPOR, and of regional targeting and access to demonstration farms, as discussed in Chapters IV and V. Funds should be budgeted for a "package" consisting of an irrigation system, any urgently expressed felt needs related to improvements such as land leveling or a storage structure, and training for the farmers who will use the system. The present financial situation of cooperatives would make it impractical at this time to require cooperatives to share irrigation system construction costs. As noted above, the net value of incremental output attributable to OPOR systems will justify AID's investment, but farmers will need guidance in learning how to maximize their profits from irrigated crop production, and careful and

continuing monitoring will be necessary in order for MAG to give them sound guidance. It is not clear to the consultants to what degree credit problems are hurting cooperatives (and thus holding down output on both irrigated and non-irrigated land), but directors of cooperatives often cited scarcity of credit as their main problem.

Certain costs incurred by the GOES can, from one point of view, be considered as part of sub-project costs, and it is recognized that the GOES has indeed made significant contributions, mainly in the form of salary payments to government employees assigned to work on the sub-projects. Most of these employees were working for the government prior to Project 519-0184, so continued payment of their salaries was not an incremental (additional) cost for the government.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

A. Background

The following have been suggested as primary objectives for an irrigation project (Clyma et al., 1982).

1. Water control for supply of water to insure
   a. Dependability
   b. Equity
   c. Adequacy
2. Productivity of agriculture
3. Farmer involvement in systems management
4. Resource conservation to insure a productive future
5. Return on the investment in irrigated agriculture

While engineering, design, and construction play very significant roles (being primarily means to implementing water control which make achievement of the other objectives possible) it is important to note that they are not listed as objectives. The objectives for a successful irrigation system, large or small, focus on agricultural productivity and human resource development.

There are great benefits to be derived from undestanding not only the physical but socio-economic and institutional aspects of an irrigation project. This understanding will enable problems to be solved rather than treating the symptoms. It was with the above objectives in mind and the desire to undestand the system in which OPOR functions that the consultant team undertook the evaluation. The evaluation is based on the need for and direction that small-scale irrigation in El Salvador should take.

Methodology

The evaluation was conducted using three basic methods: (1) site visits, (2) interviews, and (3) review of documents. An interdisciplinary approach was used with the evaluation team composition being: agronomist, agricultural engineer, economist, rural sociologist, cooperative specialist, and short-term special consultant. The guiding principles/philosophy for the evaluation team were:

1. Effective programs move beyond project building orientation to human resource development/social outcome orientation. Water is a necessary but not sufficient condition for agricultural production (Clyma et al., 1982).
2. Upfront planning must include planning for long-term follow-through. Operation and maintenance cannot be viewed as an "add-on" either management-or economic-wise. By definition water management implies continual improvement. However, this improvement or change must be planned.

3. Recognized and consistently applied criteria for project selection, implementation, construction, and monitoring must be employed. These must be judged not only technically but against human resource and productivity bench-marks.

4. Planning, design and construction need to begin with inputs from the beneficiaries; opportunities for feedback from beneficiaries need to be built into the system. The needs of the institution should not overwhelm the needs of the beneficiaries.

5. Farming systems have inherent risk and uncertainty associated with them. How well is the mitigation of the risk and uncertainty being addressed given that it cannot be eliminated?

6. Recommendations based on practice are preferable to those based in theory or assumptions; however, the two are not mutually exclusive.

Using the above objectives and guiding principles as foundations, the evaluation team then analyzed the stated OPOR objectives. Before a presentation of the conclusions and recommendations an attempt is made to recapitulate the findings into a logical framework process of analysis. This is done to clarify project effectiveness and impact on USAID's general plan for El Salvador.

Logical Framework Analysis

The ability of OPOR to meet its objectives is a desirable starting point for presentations of the evaluation. The objectives of OPOR are presented in Plan Operativo: 1984, CENTA. They are briefly as follows:

1. Construction of small irrigation projects in the agrarian reform sector
2. To help small low-income farmers obtain and utilize available water resources

If OPOR as a single entity is judged based on these outputs then it is performing adequately. However, viewing OPOR within the overall system whose goal is to enhance the economic development of the country, then there is improvement needed.

The goal, purpose, and outputs of the modified small-scale irrigation project were not documented. Therefore, in order to evaluate the project the consultants gleaned the following from various sources. The initially stated goal was: to increase production, productivity, and income of the small farmers within the agrarian reform sector.

The project purpose was: To expand the capability of GOES to assist low income small farmers in the agrarian reform sector to obtain and utilize needed water resources.

The project outputs expected were: To increase irrigated lands, train water-use extensionists, and train project office personnel.

The conclusions and recommendations that follow are presented in the context of how the project outputs should be modified. This is done to enable OPOR to more adequately meet the project purpose in the future. Also presented is the way in which project inputs should be provided to achieve project outputs.

B. General Recommendations

The general recommendations developed from the evaluation are listed below; the more specific recommendations from each chapter are not repeated here.

- Small-scale irrigation is viable and should be implemented on a broad scale; it is an added tool for farmers to strengthen their economic situation and their cooperatives.

- Priority attention should be turned to the institutional stabilization of OPOR. It should be retained within CENTA to maximize extension and training opportunities, and to better address beneficiary needs. If it ismoved to the newly proposed DGRD, it should not be subsumed under programming which emphasizes large-scale irrigation projects. Close links to CENTA would still be needed. OPOR will be able to carry out its basic engineering functions in either location.

- OPOR has to make better use of the existing (or improved) extension service, without taking on extension as part of its function. A farming systems approach should be used to provide assistance to farmers through CENTA and ISTA.

- On-farm planning and design of irrigation systems must be given top priority within OPOR and USAID. A true "bottom-up" approach is needed in designing systems.

- Farmers need to be properly trained in the operation of their irrigation systems. The systems should be simple in design and operation.

- OPOR irrigation sub-projects should be related to the country-wide master water plan or at least a hydrologic basin plan.

- An AID-OPOR monitoring and evaluation procedure for all sub-projects should be established. This will enable much better sub-project follow-up and the meeting of beneficiary needs.

- Regional demonstration farms should be established to serve as models for other co-ops. These farms would also demonstrate (not

test) the viability of new technologies. They should be located first in the departments of San Miguel, Sonsonate, coastal La Paz, and Chalatenango (conflicts permitting).

- The OPOR staff minimally should be expanded by the addition of nine technical and professional personnel, five of whom would be based in a proposed OPOR liaison section. This section would be totally comprised of the following new staff: One socio-economist with expertise in beneficiary needs analysis and water right or water law; two extension liaison specialists to work with the 20 to 28 CENTA extension agents now being trained to assist with OPOR sub-projects; one documentation and bibliographical resource specialist; and one irrigation engineer to aid with sub-project follow-up and OPOR-DRD communications. The other new staff would be one deputy director, one hydrologist, one soil mapping specialist, and one surveying assistant.

- Irrigation development on the agrarian reform cooperatives must be approached within a community development and farming systems framework. In this context OPOR's sub-projects should be designed to creatively complement the use of PL-480 monies for land leveling, reforestation, soil conservation, road and bridge construction programs, and rural electrification.

- The OPOR design engineers should be required to meet regularly with the regional extension members of CENTA, ISTA, CENCAP, and other agricultural support aggents in sub-project, regional, and national coordinating groups, to promote, educate and coordinate with said agencies in providing development services to the cooperatives and the small farms. As proposed by the consultants, the new inter-agency task force would coordinate this overall effort.

- Extension in El Salvador needs to be strengthened in several areas, but progress is being made. One important need is for GOES and USAID to immediately implement a training program for all the cogestores of ISTA, extension agents of CENTA, trainers of CENCAP and CODIZO and the design engineers of OPOR in community and cooperative development methodologies, linking this directly to technical applications of agricultural i rigation systems.

- The OPOR socio-economic section should develop and implement a human welfare and resource scale that would provide a means to better assess beneficiary needs and measurably assess the "state of readiness" of a cooperative to manage an irrigation system. It will also enable OPOR to better prioritize and rank prospective sub-projects, a process not now being consistently done.

- OPOR's sub-project selection process should include a determination of an individual cooperative's "state of readiness", balanced against the cooperative's need for an irrigation system as calculated economically.

- Capital development/self-sufficiency funds should be developed for each of the cooperatives with the aid of the GOES. A modest start could be made now to put aside savings based upon hours worked on co-op projects by its members.

C. Interpretative Summary and Major Recommendations

Irrigation is relatively new to small farmers in El Salvador. The farmers are now enthusiastic and optimistic about the prospect of improving their income with irrigation. They will not only need much help and assistance in the proper physical application of water but also in making full utilization of the system. For all supporting services and institutions to make significant contributions to the farmers needs in the project area, a strong emphasis on proper coordination and liaison will be required.

Farmers generally have a good understanding of the cooperative philosophy; nevertheless there is some dissatisfaction among members. For those cooperatives with present economic strength and viability, this is generally the result of strengths prior to expropriation. The co-ops will operate under a co-management concept with ISTA until they reach self-sufficiency.

Since the opening of the OPOR office in 1979, it has been characterized by structural instability and functional success in some (but not all) areas. In 1981 program focus was changed and the program has become more manageable internally. In the opinion of the consultants those OPOR functions that currently are being executed well include intra-office coordination, delegation of authority, document processing, basic engineering and design, technical assistance as provided by STC, and budget management. Those functions that are being executed moderately well include general management, agronomic analysis, economic analysis, construction supervision, topographic surveying, and budget analysis. Those functions which are in need of substantial improvement include inter-agency liaison and communication, post-construction engineering follow-up, extension outreach (now definitely planned), hydrology, socio-economic analysis of beneficiary needs, and use of sub-project selection criteria.

Average construction costs per irrigated hectare at OPOR sub-projects have been on the order of ₡3,477. This covers direct costs incurred for materials and labor. The internal rates of return (IRR) for OPOR sub-projects, based on average costs per hectare and average number of hectares irrigated, are around 20 to 23 percent depending on what crops are produced.

The OPOR sub-projects are mainly open-channel operated delivery systems with some variations. The design and construction of the OPOR sub-projects delivery systems are, with minor exceptions, good. At present a strong engineering link between design and construction does not exist. The present systems are designed without much farmer participation. The major problem with the sub-projects is that the irrigation systems are not easily farmer-manageable. The delivery of a complete irrigation system which includes a water application subsystem is not now being done. The operation and maintenance procedures on the co-ops need to be improved regarding both the irrigation systems and farm equipment.

Demand for such sub-projects definitely exists through much of the reform sector. However, the analysis of demand is extremely complex. It affects the analysis of the maximal size of land to be irrigated per cooperative in a conceptual but not quantitative way. It is recommended that sub-projects not exceed 100 ha. in size in the immediate future. This limit, it is hoped, would cause emphasis on quality of projects rather than size. With farmers lacking training and technical support, an area larger than 100 ha. would not be manageable by farmers. When OPOR is able to deliver a complete system (i.e. one that includes a practical water application system) and CENTA can provide technical assistance in irrigated agriculture, then the sub-project limit can be increased. Only in cases of special conditions of flat terrain and easily available and dependable water supply should this limit be exceeded for the time being.

The construction of larger projects in El Salvador (larger than 500 ha.) should be approached with caution given past experiences in the country. The design of the on-farm systems, operation, maintenance and management of the overall systems apparently has been poor. Larger systems require management skills beyond the present capacity of most farmers, and beyond the economic support and training capacity of the government.

Major Recommendations

The evaluation team has found that small-scale irrigation is a useful tool for increasing the agricultural production of El Salvador. From the sociological and engineering viewpoints some significant successes are now being achieved through irrigation. However, the basic benchmark by which agro-economic success can be measured is the incremental agricultural output attributable to irrigation. Although constraints exist, the OPOR office (as modified during recent years) has proven to be a viable institution for developing irrigation systems on cooperative farms.

For the above reasons the evaluation team recommends the continuation of the small-scale irrigation project under the direc-

tion of OPOR. The major recommendations and premises upon which they are based are presented below, as extracted from the Executive Summary.

Alternatives One and Two are based on several premises. If the primary objective is to substantially increase the program size (i.e., taking on 25 percent more sub-projects), impact a greater number of cooperatives in a short period of time, expend available AID loan monies, and expand institutional visibility, then:

1. The OPOR staff should be substantially expanded in the engineering, design, socio-economic, administration, liaison and new sub-project monitoring areas. Salaries would need to be increased. Formalized linkages should be made with the Division of Irrigation and Drainage, with both units remaining in CENTA.

2. The OPOR staff should remain about the same size, but expand the number of sub-projects undertaken through substantial contracting to private El Salvadoran companies for design, survey, construction, monitoring, and technical assistance services. Skill upgrading for certain staff would be required, and salaries would need to be increased.

Alternative Three is based on the following premises: If the primary objective is to enhance program quality, improve consistency of effort, improve institutional stability, and improve sub-project monitoring and follow-through, then:

3. OPOR should be maintained at about the same staff size, and strengthened in the weaker areas of administrative support, socio-economics, liaison, and sub-project monitoring. Salaries would need to be increased. The number of sub-projects per year should be reduced by 25 percent. OPOR would remain a part of CENTA and work in a coordinated manner with the personnel in the Division of Irrigation and Drainage.

Whichever path is pursued, extremely careful attention must be paid to planning. This has two major components: (1) Program planning aimed at the attainment of realistic short-and long-term objectives; (2) financial planning aimed at putting the various sources of funding into a coordinated "package" well in advance. Given the likely continuing need for both GOES internal and PL-480 internal/external funds, formal agreement among all participating agencies will have to be reached in advance as to appropriate allocations and line-item placements in forthcoming annual budgets. Neither an 'add-on' nor ex post facto approach will work. Grant funds should be given greater attention, and programmed according to the technical assistance and evaluation needs of the project.

AID 1820-28 (7-79)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

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

Project Title & Number: 519-0184

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs: Program or Sector Goal (A-1) To increase production, productivity, and income of the farmers in agrarian reform sector.	**Implementation Target (Type and Quantity)** 1. Increases in crop yields over base year. 2. Crop diversification changes. 3. Changes in livestock held due to increased irrigated pasture area. 4. Increased income of cooperatives and farmers.	Using Ministry of Agriculture Survey as baseline-and post-project amendment survey- directly measure change in production, productivity and income of farms in agrarian reform sector.	**Assumptions for providing inputs:** 1. Small farmers and food production in the agrarian reform sector remain GOES priority. 2. No natural disaster occurs 3. Other GOES programs aimed at the agrarian reform farmers are successful. 4. Price structure of products remain favorable 5 Small farmers provided with access to markets

AID 1020-28 (3-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

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

Project Title & Number: 519-0184

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	Implementation Target (Type and Quantity)		Assumptions for providing inputs:
Project Purpose: (B-1) To expand the capability of GOES to assist low-income farmers in agrarian reform sector to obtain and utilize needed water resource.	1. Small-scale irrigation capability institutionally stabilized in OPDR/MAG. Evidenced by a functioning office, with continued budgetary support: a) Performing technical and socio-economic feasibility studies for selection of sub-projects; b) Designing, supervising construction and providing technical assistance to beneficiaries in maintenance and operation of irrigation systems; c) Providing beneficiaries with market information on basic grains, fruits, vegetables and specialty crops; d) Collecting information on "before" and "after" irrigation conditions in sub-projects. 2. CENTA extension agents providing agronomic and water use extension services to sub-project beneficiaries on regular basis. 3. Annual increases in the number of hectares served by small-scale irrigation projects.	Post-Project Amendment Survey Observation Project Records Project Evaluation	1. GOES continues to give priority to the development of small-scale irrigation systems serving the agrarian reform farmers 2. OPDR sub-projects become part of a national water plan

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AID 1020-28 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

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

Project Title & Number 519-0184

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs (C-1)	Implementation Target (Type and Quantity)		Assumptions for providing inputs:
1. Sub-projects irrigated.	1. Increase by 25 percent number of sub-projects over base year.	- Project Records - AID Records - Observation - Pre-project evaluation - Post project survey - Spot check survey by AID Project Manager.	1. Persons available to be trained in water use extension.
2. Water-use extensionist trained.	2. Approximately 25 extension agents trained in first year.		2. Extension agents correctly advise farmers on irrigated agriculture practices.
3. OPOR professional staff trained.	3. 12 professional staff trained in on-farm irrigation system design and management.		3. OPOR sub-projects correctly selected in terms of water availability.
4. Demonstration farms established.	4. Establish 3-4 regional demonstration farms.		4. Establishment of viable collaboration between OPOR and DRD or DGRD.
5. Establishment of irrigation committees on sub-projects co-ops and members trained in irrigation.	5. Irrigation committee members trained in operation, maintenance and management of irrigation systems.		
	6. Membership in co-ops with sub-project stable in members. Members remain enthused about future.		

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A number of other data sheets, charts, and government tables were studied in the course of this evaluation. They are not listed here.

APPENDIX A

SUB-PROJECT CASE STUDIES AND SYNOPSES

A total of 16 cooperatives were visited by various members of the team. This appendix is divided into two sections. The first section covers those seven cooperatives that were judged by the consultants to represent a wide range of variation in structure and function, and which were judged to represent a wide range of strengths and weaknesses. These are reported in more depth, as case studies. The second section covers those nine cooperatives that were judged to represent less variation, to be less striking in terms of factors of importance being assessed, or the analyses of which largely duplicated information presented in the first section. These are reported in less depth, as synopses.

Section One

These case studies are presented in alphabetical order (exclusive of the articles "la", "las", "el", and "los"). Noteworthy aspects of each study are as follows:

- La Bolsona -- was introduced to the consultants by OPOR personnel as a relatively strong cooperative with high promise of success. The opposite was found to be the case.

- Las Bromas -- started with negligible resources, but through dynamic use of the irrigation system and the procurement of an okra contract, has improved its prospects significantly.

- La Canada -- is highly visible owing to visits paid by U.S. Congressmen and MAG officials. Plans already underway for expansion to a second construction phase when first phase construction has yet to be tested under irrigation. Inputs disproportionate to number of beneficiaries.

- Cara Sucia -- was introduced to the consultants by OPOR personnel as a relatively weak cooperative with a non-functional irrigation system. The opposite was found to be the case.

- El Eden -- started under unusually fortunate circumstances, with a full complement of cattle, equipment, and operational experience left from the regime of the former patrón. Currently, quite strong socio-economically.

- Plan de Amayo -- also started under fortunate circumstances. Co-op has hired the services of a local consulting firm (cost ₡ 25,000) to assist with livestock, horticultural, and administrative upgrading.

- San Martín Larín -- design inadequacies are presented. Physical/engineering parts of the system are incompatible with the terrain.

La Bolsona (Dept. of Sosonate)

This cooperative has 194 ha. and 28 members. It impressed the consultants as one of the poorest and least-aided (by GOES agricultural agencies) of the co-ops visited. Surprinsingly, the directors said that (1) the former owner of the land actively helped them to obtain possession when land reform was implemented and (2) he turned over the land in an atmosphere of good will. They expressed friendly feelings about the former owner and said they would welcome a visit from him, although he has never returned.

Access to the co-cp is possible only by fording the Ceniza River at times of low flow. Rainfall in the upper basin causes the water level to rise and isolates the co-op until the volume of discharge decreases. Members say that lack of a bridge over the Ceniza River is their principal problem. They say they have not received technical assistance from CENTA or any other agency Until recently they were unable to obtain credit, but now they have a BFA loan to buy some cattle. Their experience when they were employees of the ex-owner was with livestock and they are not especially interested in crop production. In the future, they wish to use their irrigation system mainly to apply water to 100 hectares of pasture. Presently, most of these 100 ha. are included within about 140 ha. used for cultivation of crops, consisting half of corn, one-third rice, and the remainde miscellaneous crops.

Very few of the members can read or write and it appears that most of their children will also be illiterate. Few, if any, of the children are enrolled in school, mainly because the nearest school is on the other side of the river.

The OPOR irrigation project, designed to convey water to approximately 100 ha., had an estimated cost in 1981 of ₡170,928, consisting of 43 per cent for materials and 57 per cent for labor (Sub-Proyecto de Riego La Bolsona, dated March 1981). Official OPOR records show that the amount spent on the project was ₡ 170,633.

The diversion structure for this project is a concrete masonry clam. Flow through the dam is controlled by the use of flashboards. The flow of available water is 260l/sec which is quite adequate for the area they irrigate. The conveyance canal is rock masonry construction. The cross-section is trapezoidal. The construction methods used by OPOR are good, as they are in most of the projects. The distribution canals are lined brick masonry with plaster. The cross-sections are generally rectangular. Some earthen distribution canals were installed. However, due to cattle traffic and poor maintenance these canals no longer function for distribution. Apparently, the lining of the distribution canals was not completed because of budget overruns.

The topography of the farm is hilly. The way the system is laid out makes it difficult for farmers to irrigate all their land. Most of the land is in pasture with some areas planted to rice and corn. The irrigation method appears to be mainly border ditch wild-flooding. There appears to be very little on-farm water control. The distribution canals are placed too far apart. This co-op has aluminum irrigation pipe available but no pump. Farmers use the pipe to help distribute water from the canals to the fields.

The surface drainage on some areas is poor and needs to be improved by the installation of ditches linked to natural drainages.

La Bolsona is presently irrigating 82 of the 100 ha. mentioned above. The crops now grown and areas follows, with ha. in parentheses: Corn (18), rice (26), and pasture (73); 16 ha. is in native pasture. Some of the irrigated pasture has been planted to improved species. One pasture had a legume that was well established along with the grasses. One member thought the pasture should be sprayed to removed the legume not being aware of its value in the pasture mix.

The co-op also has 84 ha. of land that is allocated to members. They grow corn, rice, fruits and vegetables on these lands.

The soil examined was uniform heavy, sticky and plastic clay to 90 cm. with no cemented layers. It was dark colored to almost 80 cm. changing to a brownish color to 90 cm. The soils and topography of their irrigated area would lend themselves to intensive cropping but the coop members are in great need of help an assisstance in soil and water management.

Las Bromas (Dept. of Ahuachapan)

This co-op has 106 ha. of cropland. The 22 members (socios) are mainly from elsewhere. They are not ex-employees of the former owner. In the difficult first two or three years, some members became discouraged and left, mainly to return to their home area. Problems included (1) inability to obtain bank credit, not even short-term crop production loans; (2) lack of any machinery, equipment or tools; and (3) overcrowding in the ten dwelling units owned by the co-op each of which had to accomodate two to three families.

One of the co-op's main assets is a conscientious young agronomist assigned by ISTA as an advisor. He has substantially helped the co-op since it was established. There has been little assistance from other governmental agencies.

The OPOR irrigation project is designed to convey water to 54 ha. Estimated project costs, according to the planning document entitled Proyecto de Riego-Hacienda Las Bromas dated June 1981, were ₡ 188,038. This consisted of ₡ 89,760 for materials and ₡ 98,278 for labor. OPOR records show that costs incurred for construction were ₡257,572.

The co-op now has a contract covering okra with Quality Foods de Centro America, a firm which operates a plant to process and freeze vegetables for export to the United States. Okra will be grown on much of their irrigated land, starting this year. The firm will furnish okra seed and technical assistance. Members are enthusiastic about their contract for okra production. They believe that better economic conditions are now within reach.

The conveyance canal was rehabilitated to supply water to the co-op instead of using a pump. The team did not have time to see the diversion structure.

The irrigation project has not been completed because the co-op has not been able to afford a pump to lift water to higher areas of the farm. After checking the soils and slopes on this area, it is probably not desireable to irrigate on the area until farmers gain more experience or training in water control. The soils are generally shallow and the terrain is steep. Some fo the areas cultivated during the rainy season are eroding due to poor soil conservation practices.

The conveyance system includes a siphon under a stream. This siphon is presently plugged. No clean-out was installed in the siphon. The co-op will try to install a clean-out to alleviate the plugging problem in the future.

In general the construction methods and layout of the conveyance system are good. More turnouts need to be installed and farmers given help on distributing the water on the fields. The drainage system appears adequate and was at the time of site visit removing excess rainwater.

The farm road system laid out in conjunction with the canal system has given better access by farmers to fields. The transportation of produce is easier with the road system (which overpasses the canals with small bridges) since trucks can move directly to cropped areas.

This co-op could also benefit from some land smoothing to enhance water application uniformity. The benefits from land smoothing could increase production enough to relieve the pressure to expand the irrigation system into the hilly areas. Farmers recognize that both high and low spots in the fields decrease production.

This co-op has been the site of irrigation experiments by personnel from CENTA. Surface, sprinklers and drip irrigation methods were compared on vegetable crops. Farmer say the surface and drip methods gave good results. The sprinkling seems to have caused most of the vegetable crop to rot.

The co-op has no machinery except an irrigation pump and corn sheller. The pump was taken by a government agency for repairs and has not been returned. The members are anxious to have the pump returned.

The co-op has no grain storage facilities. Individual members keep grain in their homes in small quantities.

The irrigation systems is designed to irrigate 54 ha., however, only 37 ha. are under actual irrigation. The co-op would like to increase the irrigated land to 100 ha. Currently the co-op raises corn, rice, sorghum and okra. They double crop the sorghum after the corn crop. Additionally, they plan to irrigate pasture land and a small plot for citrus. The okra is irrigated every eight days by the furrow method. The soil examination on the hilly land showed dark to heavy clay to 30 cm. Below this level the soil was dark brown clay with one or two shallow compact clay layers. The co-op members stated the soil depth as 125 cm.

La Canada (Dept. of Sonsonate)

This co-op has 302 ha. of land, mostly unimproved pasture. There are presently about 38 members, nearly all of whom are from elsewhere. They are not ex-employees of the former owner. Twenty to 25 per cent of the land is used for improved pasture and crops such as corn. A principal cause of this low degree of land utilization was unavailability of credit until 1983 when the BFA granted a loan for purchase of about 65 dairy cattle and more than 100 calves to be raised for meat. Livestock will now be the major activity and source of income. An OPOR irrigation project now under construction will convey water to 87 ha. Somewhat more than half of the irrigated land will be used for improved pasture and miscellaneous crops. On 40 to 50 per cent of the irrigated land the co-op will grow mellons, pursuant to a contract with a U.S. firm which will provide technical assitance. The co-op is taking a broad look at U.S. and El Salvadorean private-sector marketing opportunities.

Lack of credit was the co-op's main problem from 1980 to 1983. At one time members thought that an agricultural credit program funded by UNICEF to provide low-cost loans would help them. However, requirements imposed by ISTA, which administers the program for UNICEF, proved to be insurmountable. ISTA wanted voluminous documentation in support of a loan application, as well as maintenance of very detailed records covering expenditures, according to the directors of the co-op. Thus they resumed efforts to get funds from the BFA and in this they were eventually successful.

ISTA provides the co-op a full-time advisor. The directors say they are pleased with the high quality of his advice. Occasional visits have also been made by a CENTA extension agent. The directors say they are less impressed with the quality of his advice; they sometimes ignore it.

An OPOR document entitled Proyecto de Riego - Hacienda Canada, dated August 1983, gave estimated project costs as follows:

Materials	₡ 161,562
Labor	105,276
Sub-total	266,838
Indirect costs	6,667
Administration	6,669
Total	₡ 280,174

OPOR records show costs incurred for construction were ¢ 321,882.

With regard to the irrigation system, it was found to have good construction in general. The project is not yet completed. Farmers are worried that training will not be provided in the use of the system.

The water supply to the project is from a river. The water will be lifted from the river to the conveyance system by electric powered pump. The pump is yet to be installed. Judging from the present lift of about 4 meters (in the rainy seson and therefore high flows in river) the pump may be difficult to prime during the irrigation season.

The conveyance canals of the system are constructed as most OPOR projects with brick lining which is plastered with concrete. The cross-section is rectangular. Basins and bridges over the canals are provided for vehicle traffic. Part of the irrigation system layout included farm roads which make farm access good.

The unlined sections of the canal systems were originally trapezoidal in cross-section. Livestock have broken down the earth canals. These canals will have to be reformed before the next irrigation season. Some thought should be given to reforming the canals with a ditcher since the co-op is presently acquiring a tractor.

The drainage system appears to be well designed. However, during the time of on-site visit the fields to be irrigated were ponded with rain water in some areas. Probably some consideration should be given to land smoothing not only to help water distribution but also drainage.

The design team considers that siphon tubes may be used to irrigate part of the fields. However, the tubes are not yet available and farmers will probably have to irrigate using secondary field ditches.

Water control on this co-op will be very important since they are contracting to grow melons for export. The quality of the melons will be greatly enhanced with good water control.

The co-op would like to expand its irrigated area but consideration must be given to the availability of water in the river. Also, the co-op does not appear to be selecting their best land for melon production which could potentially be their best income crop. This co-op needs technical assistance in both water management and agronomic practices.

The storage facilities for grains for this co-op are good. Small sheet metal silos are used for storage. The co-op is in the process of buying a tractor and owns a disk harrow. There are no tools on the co-op for even minor repair and maintenance. The co-op owns very little agricultural machinery.

This co-op has signed a contract to grow melons (cantaloupe and honey dew) for a firm in Texas. They will be planting in November and haversting January to March. This will put their produce in the USA ahead of the usual winter production from Mexico. They will only have two to two and one-half month period where their produce would have a demand in the USA. The timing of their planting, growing to maturity and shipping will have to meet this limited period of time in order for them to take advantage of the good demand and favorable price in the US.

The Texas firm will build a plant to clean and chill the produce before it is shipped. This plant will be about 4 km from the co-op thus minimizing the transport problem for the co-op. The firm will also provide advisors in the production of the melons and at least one of the co-op members has visited Texas to observe production practices there. They have already been advised as to row spacing and bed preparation for planting.

The co-op will start with 28 ha. of melons, with plans to increase this to as much as 70 ha. if the enterprises proves successful. The topography and soils were examined in the proposed melon growing area.

This examination shows that the soil is not the best quality they have avilable. However, not all of the best land is irrigable due to its height. Additionally, the irrigated land had water standing in it when the team visited and therefore probably has a drainage problem. In order to successfully utilize the irrigated lands, the co-op will need a great deal of agronomic assitance and water management advise to meet the standards for exportation.

La Canada has received a great deal of attention when compared with other Phase I cooperatives. U.S. Congressmen have visited, as have high-ranking Ministry of Agriculture officials. A number of positive developments can be attributed to this situation; some of this visibility likely will benefit other cooperatives as well. However, plans already are underway for expansion of the irrigation system, yet the first portion of the system awaits a pump and has never been fully tested. Investment is disproportionate to the number of beneficiaries.

Cara Sucia (Dept. de Ahuachapan)

This co-op has 350 members of which 325 are considered active. It has had more success economically than most of the other co-ops the consultants visited, and currently employes eight persons including a manager. Co-op members stated that they felt life was better now than under the ownership of the patrón. Their pay averages ₡ 8.00 per day for actual days worked. Skilled workers such as tractor drivers and mechanics earn more (₡ 17.50/day and ₡ 10.00/day, respectively. This is more than under the former owner. Each worker contributes a fixed amount to a health fund which provides medicine and maintenance costs of the health clinic. The co-op is paying the nurse's salary.

"Working together for progress" was stated by a member as one of the definitive aspects of the co-op. Most members are very positive toward their involvement in the co-op. They indicated that there are some members of the co-op who have not totally grasped the spirit of the co-op, and sometimes did not participate as fully as desired. The members have recently reorganized the co-op's structure with the help of the ISTA personnel. Their new structure is based on the general ISTA organizational structure and helps them to control the assignment of tasks according to production needs.

Economically, the co-op has experienced some success. They have built several new drying facilities and have paid off some of the debt on them. The directors still are not certain as to how much they must pay for the land, as the exact cost of the farm has not been determined. They have had some losses due to flooding in one year, and excessive dryness the next. They are expecting a better year and have a contract with Griffin Brand Company of McAllen, Texas, USA, to produce a large crop of melons.

The extention agents have been somewhat helpful to the coop, but the directors seemed more inclined to follow their own intentions when it comes to agricultural matters. A promotor from ISTA was assigned to their co-op but he was not influencial with the coop members.

The canal system built in 1981, was considered abandoned by OPOR and AID personnel. The visit by the evaluation team disclosed that the system was still in use. The co-op is irrigating 28 ha. out of their total of 1,960 ha. The co-op utilizes the low lands and gives each member one manzana (0.7 ha.) for his own use in the hilly regions of the co-op. It was noted that a section of conveyance canal which overpassed a river was destroyed by flooding. This section has been re-

placed by a siphon under the river. Farmers say the siphon functions well in the dry (irrigation) season.

The diversion is from the Rio Palma. A concrete masonry weir is used to divert water into the conveyance system. The conveyance canals are rectangular in cross-section. The turn-outs on the canal are rectangular openings which are slotted. The slots accommodate the insertion of flashboards to control discharge through the turnouts.

There are no canals or structures below the turnouts for delivering water to the individual fields. Farmers say that they dig small channels to deliver water to individual fields and into furrows. Most of the fields appear to be wild flooded with no means of controlling water on the fields. At the time of the site visit most of canals needed cleaning. Farmers state that during the irrigation season the canals are cleaned. Without maintenance there is a danger of deterioration of the canals due to weed root growth during the rainy season. Some bricks of the canal lining have been removed by people neighboring the hacienda, to be used for other purposes. Generally, this brick removal has infringed only on the canal freeboard and does not appear to have hindered operation.

Some land smoothing appears to be feasible and desirable. Generally, the fields are level but not level enough to achieve uniform application of water.

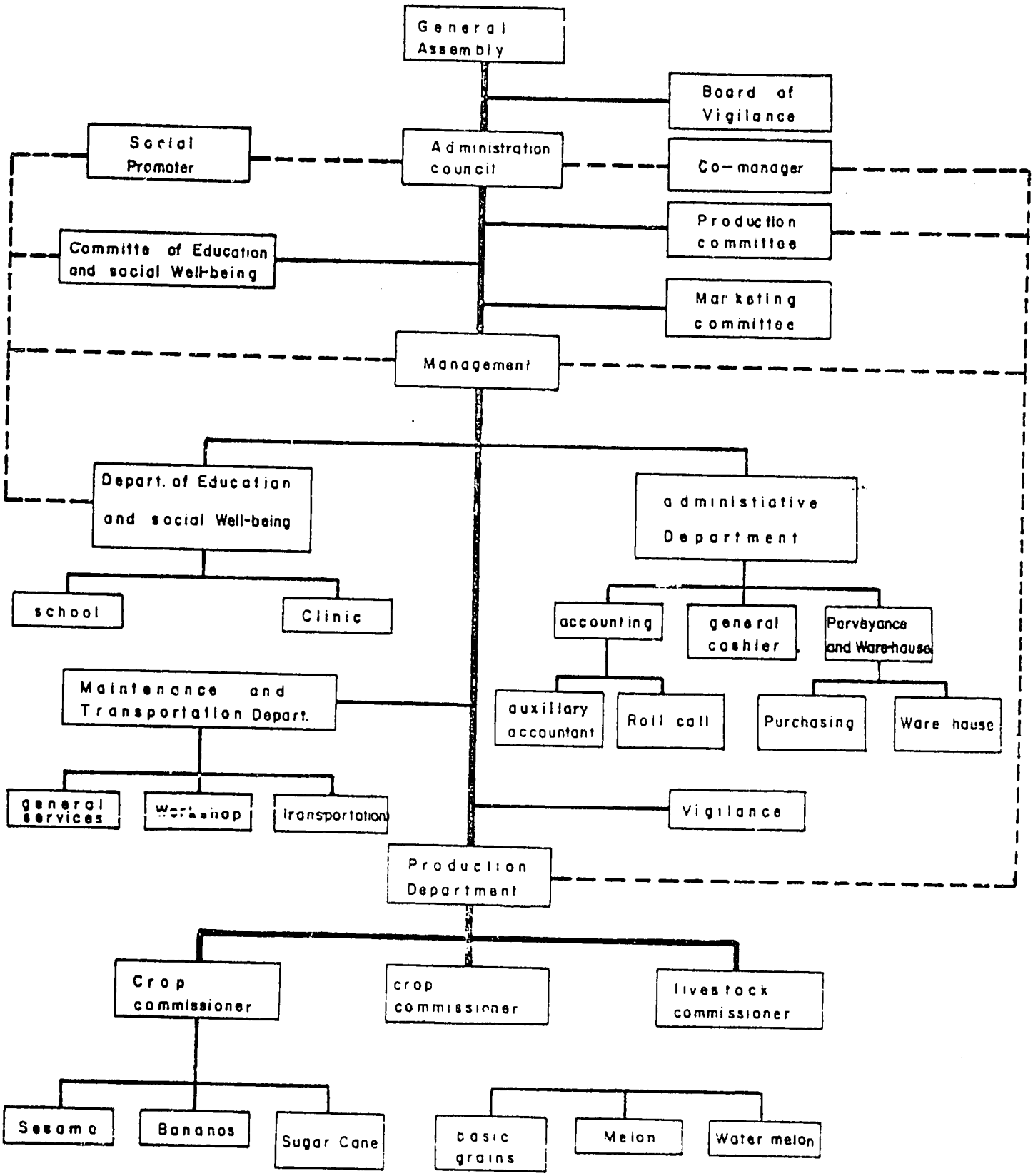
The equipment maintenance on the co-op is poor. They have seven tractors and two disks, plus a number of wagons. While the mechaninc seems competent he is hampered by lack of tools and availability of repair parts. The building and storage facilities (some relatively new) are in poor condition. Cara Sucia needs advise on a preventative maintenance program for equipment and facilities.

The main crops of the co-op are sugar cane, bananas and hybrid seed corn (H5 and H3). They are also experimenting, under the guidance of CENTA, with the growing of chili and cabbage. They have tried to grow rice but have not had good results. Soils do not serve as constraints; most are excellent deep loams.

Because the management structure of Cara Sucia is well-developed, under the direction of a full-time, paid general manager, a complete organizational chart is provided here. Other of the co-ops visited by the consultants utilize similar (although in most cases less complicated) structures. At Cara Sucia all committees are staffed and functioning.

Figure A-1

ORGANIZATIONAL CHART OF COOPERATIVE CARA SUCIA



OPOR's estimate of project cost, contained in a document dated August 1983 , was ₡ 266,383. Records indicate that the costs incurred for construction were ₡ 321,882.

El Eden (Dept. of Sonsonate)

This co-op has 655 ha. and 138 members. It is a prosperous livestock co-op. Somewhat more than half of the total area is pasture. Cropland compromises about 154 ha or 24 per cent of the total area. Sugar cane and corn account for nearly all the cropland, with about the same area allocated to each. The OPOR project irrigates 40 ha.

Obtaining credit has not been a serious problem for this co-op. It regularly purchases veterinary services and employs a staff to provide managerial, accounting and clerical services. It is undoubtedly the most successful of the co-ops visited by the consultants.

OPOR's estimate of project cost, given in a document entitled Sub-Proyecto de Riego-Hacienda El Eden dated September 1982, was ₡ 195,551, of which 40 per cent was estimated as the labor cost and 60 per cen the materials cost. OPOR records show that the costs incurred for construction were ₡ 197,624.

This co-op has large areas of irrigated pasture. The OPOR irrigation project was added onto the existing system. The OPOR project is located on a more hilly area of the co-op. The soils with the most potential appear to be irrigated by the existing system. It may have been more cost effective for OPOR to rehabilate the existing system than to expand into the hilly area.

The conveyance system uses good construction methods. However, consideration of how farmers can control water once out of the conveyance canal is lacking. More work needs to be done on helping farmers adequately distribute the water on the fields. The original idea was to use siphons to irrigate - however farmers were never advised of this and siphon tubes were not supplied to the co-op.

Generally, the maintenance is poor. Farmers say they clean canals at the start of each irrigation season. Weed growth is vigorous on several sections of sediment filled conveyance canals.

The conveyance system includes a siphon. The siphon does have an air valve and a clean out.

The drainage system follows the natural drainage channels. No control structures have been installed. To date no obvious erosion has taken place along the drains.

The sugar cane which is presently on the OPOR irrigation project area is planted along contours. This has greatly helped to reduce erosion. However, the water application distribution systems could be improved by installing more turnouts and check structures along the conveyance canal. At present the water from a turnout flows into field then into the sugar cane with no control on the distribution.

At present, they claim to be irrigating 400 ha of pasture. Pastures are on deep heavy clay soils. Proposed OPOR irrigated area is shallow hilly area. Surface loam soil is good but only 20 - 25 cm deep with heavy clay sub soil of low fertility below. They plan to grow some okra here but should be considering better soil areas that are now in pasture. Pastures are not receiving any husbandry with regards to weed and brush control and proper fertilization. They claim to have planted improved species in recent pasture plantings.

Cattle and milk production is the important feature of this coop. The okra planting project area would be a deviation from past farming experience and methods. They would require help. They said they had extension help when they started but have not had it since.

They have 450 cows and sell all co-op milk. They did remark, however, that over 1/2 of members had their own cows.

The members indicated that they felt that life had improved for them since becoming owners of the land. They were now able to make decisions themselves through their own organization. The co-op assits with medical needs and transportation. The co-op pays each worker every two weeks whereas under the former owner they were paid twice a year. The co-op employed armed guards because of fear that the previous owner would attempt to retake the farm. The farm is a profitable enterprise.

Plan de Amayo (Dept. of Sonsonate)

The Plan de Amayo co-op is one of the most well-organized of any of those visited by the evaluation team. It is also one

of the largest visited, with a total holding of 675 ha. The OPOR sub-project file lists the names of 88 socios, but the actual membership now stands at 92. As with several of the other co-ops studied, a waiting list of potential new members has been established.

The original owner no longer lives in the area. All of the farm machinery was left behind, and has been maintained relatively well by the co-op. Through the "reserve right" clause the former owner claimed a portion of his land and cattle back after expropriation. This portion of land is now rented out. The dairy, which continues to provide financial strength to the co-op overall, has been in operation 14 years. It began with 60 dairy cows.

The dairy operation now appears to be well-managed. Most of the current socios worked for the former owner, and therefore gained expertise in this field. Currently 112 cows are milked daily, producing an average 2.4 gallons per cow. The dividends the dairy produces are distributed to co-op children in the form of grains or milk. Dairy jobs are rotated among members. They harvest daily requirements for their cattle by cutting and green-chopping king grass (sudan grass). It is cut every 35 days, and is well flood-irrigated throughout the dry season. Stall feeding is supplemented with molasses, soybean cake, rice bran, and bone meal.

The present cropping as given to us is as follows, with numbers of ha. in parentheses: Rice (35), pasture (96), sugar cane (150), and tomatoes (4). It was not stated what portion of these cropped areas were irrigated and it was noted they did not include their "green chop", unless it was assumed to be part of the pasture. The evaluation team was presented with a plan for crops to be grown next season (1984-85) which included the above with increases for some crops such as rice, corn and smaller areas of tomatoes, cassava, onions, sweet chili, guisquil, oranges and plantain.

Rice fields visited were planted quite late and were very weedy. The explanation was that the tractor for land preparation had not been available soon enough. The soils examined were black loams to 30 cm. with gradually changing dark brown color at first to heavy, cemented clay at 75-90 cms.

With its irrigated pastures, the co-op is mainly devoting its efforts to dairy and beef cattle. The pastures are irrigated by a system installed by the old owner of the hacienda. The OPOR project simply delivers water to a potentially irrigable area. The OPOR project mainly consists of a long conveyance canal an siphon. The construction of both the canal and siphon are adequate.

This project lacks even the most rudimentary water application system. The fields are fairly level and with land smoothing (the co-op has equipment available to do this) could be effectively irrigated.

Members stated they needed more canals within the system; the OPOR project has not been completed. They were advised to petition to get this done. A salient feature of this hacienda is the good water supply produced by a hillside spring. With no other users tapping this water supply, it ensures that investments in irrigation facilities will be fully utilized (and likely, fully paid for).

ISTA put Plan de Amayo in contact with a consulting service, Technoserve Inc., which has drawn up both short- and long-term plans for livestock, horticultural, and administrative development. They pay the consultants on a monthly basis and are making extensive use of the services. The total cost is ₡ 25,000.

Working as a team, the co-op's 5-person board of directors and Technoserve's consultants identified six major problem areas for Plan de Amayo. Each is broad, but each is being addressed systematically. Goals for 1984 also have been established focusing on milk production and sales, and livestock program administration. The membership believes such goals can best be achieved by maximizing co-op participation; therefore, no outside laborers or migrants are employed.

The estimate of project costs provided by OPOR (document dated March 1981) was ₡ 161,122.

San Martin Larin (Dept. of Ahuachapan)

This co-op has 52 members and an area of 337 ha. Until now, the members have been unable to enage in livestock production, which was the business of the former owner, due to lack of credit, but the BFA recently granted them a loan of ₡75,000 to buy livestock. Their irrigation project, designed to convey water to 35 ha, has thus far been used mainly for corn and pasture.

The members say that they are relatively satisfied with the technical assistance they receive. Extension agents sometimes visit them; an ISTA advisor comes often (but not every day) and one member participated in a two-week course in cattle production which he considered very beneficial and helpful to him.

OPOR records show project costs for the irrigation system of ₡ 242,081.

The project is on a very hilly area. The system is very difficult to operate without causing extensive soil erosion. The construction methods and materials are good. The concept of the layout of the system is not good in the sense of irrigating very steep slopes. The canals and siphons can effectively deliver water to specific areas. When the water is turened out of the canals there is no method for spreading the water over the land. This is critical especially in the hilly areas of this project.

Farmers have removed bricks from the canal lining to increase the number of turnouts available for use. When questioned about this farmers admitted they should have worked more closely with the construction engineer so that more turnouts would have been available.

The farmers are not using the system to irrigate very intensively because of the potential for serious soil erosion. The project was designed for 35 ha. but only irrigates about 18 ha.at present. If this system is to be fully utilized the on-farm application system must be designed to complement the delivery system. Also, farmers need to be trained to irrigate these hilly areas.

They are double-cropping on much of their corn area (both irrigated and rainfed) with sorghum thus intensifying their production per ha. They reported good corn yields of up to 4.0 t/ha. where they irrigate. The dry season irrigation of corn has been an individual effort, not a co-op effort which is not true with the irrigated pastures. They have tried growing their own beans but with little success. They must purchase this commodity to meet their needs. They have enough corn, chickens, eggs and pork for their own use but buy fruits and vegetables. The co-op hopes to become self sufficient in the latter crops as they are several kms from a paved road and markets.

The co-op plans to plant 5.6 ha of plantain for a perennial crop and to try vegetable crops (tomatoes, cucumbers, etc) on 7.7 ha. during the dry season. The rest of their irrigable area will be in corn or pasture (as presently formed).

The ISTA worker has advised them on planting pastures on the rainfed hilly areas. They bought improved grass seed, planted a nursery, and are field planting the grass stems from the nursery on an extensive area. Even though they are in an isolated location and could use additional technical advise, they are well organized and exhibit enthusiasm in the planning and operation of their cropping practices.

The soil on the hilly lands have a shallow top soil of about 30 cm. of sandy clay loam. This is underlain with a heavy clay-brownish red in color. Some alluvial soils occur in a narrow band along the stream. There are dark loams on the surface to 30 cm. changing color and texture to a greyish clay beginning at 60 cm. and continuing to 90 cm. These alluvial areas would be good locations for their planned plantain and vegetable cropping.

Trucks do come in to the co-op over their rough roads to deliver fertilizer and pick up produce but the co-op said their greatest need was for a better road out of the area.

Section Two

These synopses are presented in alphabetical order (exclusive of the articles "la", "las", "el", and "los). The fact that less information is presented on each should in no way be construed to mean that these cooperatives were judged to be less important to the success of the cooperative movement, or that the problems that some of them are facing are less important to solve.

Maquigüe (Dept. of La Union)

This co-op is located near the coast, not far from the Gulf of Fonseca. The climate here is drier than the western part of El Salvador.

The water supply for this farm is a spring which originates nearby. According to farmers on the co-op the spring flow is constant year round. A rock masonry dam will be built to control the spring flow. A diesel operated pump will supply water to the irrigated fields. Construction will start soon and be completed before Febraury, 1985.

The farmers are anxious to have the project. They are more interested in the employment potential of the constructions phase than in the benefit of the completed system. This co-op has had very little contact with extension agents and has been disappointed with the little information they have received. They hope that contacts will be improved. The high flow rate to be supplied to the irrigated area is 60 lps. for 20 ha.

Miramar (Dept. of San Vicente)

This co-op has about 500 ha. Of this total 210 are cultivable. It once had 37 members, but now only 25 are considered to be active. It has been severly and adversely affected by the rebels who are active in the immediate vicinity. They robbed the co-op's cattle, leaving members with a debt to the BFA which they are unable to pay. Cultivation of some of the 210 ha. of cropland has been discontinued because of its proximity to the rebels. Further, many members who once lived at the co-op have moved for reasons of safety to the town of San Vicente, from where they travel daily to and from the co-op.

Each socio who works in the field is paid ℓ 7.70 per day. This is seen as an improvement over the previous wage of ℓ6.00. Non-socios employed by the co-op are paid the same amount. The vice-president reported that the biggest economic problem is paying off the debt owed the bank.

The directors would like to hire a manager but they can not afford the cost, even though most of this salary would be paid by AID under the program administered by BFA.

The OPOR project will irrigate 70 ha., of which about 30 ha. will be rice, about 18 will be sugar cane, and the remainder sesame and miscellaneous crops. They want to eventually irrigate 100 ha. of land. AID and OPOR records show project costs of ℓ 177,204.

Engineering-wise, this project is under construction. The construction methods are generally good. The dips (basins) constructed in the canals to allow vehicles to cross are too shallow. When the canals operate at full capacity these basins will overflow. Turnouts along the canal need to be installed to closer intervals. The above-grade construction of the canal will allow greater flexibility in operation of the system.

From an agricultural viewpoint sugar cane is preferred crop; yields are above the national average. They would like to expand the area from 17 ha to 70 with as much of it as possible irrigated. The farmers do not, however, have a good concept of the actual increases they could realize from proper irrigation of sugar cane. Some socios state that 2-3 crops of rice can be obtained anually. It should be noted that they will be trying horticultural crops during the dry season. The rice yields reported by workers in the field were low (1.3t/ha) but the regional extension director overestimated considerably when he said they had attained 5.2 t/ha. A weedy grass (sprangletop) is the main problem in the rice fields. It is not controlled by propanil.

The top soil is a dark sandy clay loam reaching to only 22 cm in the higher portions of the landscape, but extending much deeper at lower elevations. A greyish sticky clay lies below the top soil. The ph is low at 5.2

Until such time as conditions of law and order prevail in the area, it is unlikely that this co-op can prosper.

Mosquitia (Dept. of Sonsonate)

This co-op does not have an OPOR project. Each member has his own plot of land. The co-op's activities comprise crop marketing, purchases of production inputs, and negotiating with the BFA for credits. Obtaining credit is regarded by the directors as one of their principal problems. Some technical assistance is provided by CENTA but the directors want more. The consultants visited this co-op as part of a program of activities arranged by CENTA to show AID consultants some of the research and extension services under AID-GOES project 519-0265.

The co-op has 75 members, with about 46 as active. It was formed under the Decree 207 as a small landholder co-op. The land area is 93ha. They grow sugar cane, corn, sorghum and horticultural crops. They need technical assistance in order to increase their yields per ha. and to introduce higher paying crops such as vegetables.

Primavera II [1/] (Dept. of San Vicente)

This co-op has 34 members (socios) and 88 ha of cropland. All members are said to be active, with those who were not having been asked to resign. Although located near the Miramar coop, Primavera II does not seem to be as adversely affected by the rebel activity in the area. The directors say they sell their crops as quickly as possible after harvest and retain minimun amounts for family consumption, in order to reduce the risk that the rebels will rob them.

The co-op has experienced most of the same problems as other co-ops plus a few additional problems that are less common. One of the latter is that their ISTA advisor seldom visits them. The directors want to make it known to the advisor's supervisor that they are receiving little help, but they have been unable to arrange an appointment with the supervisor.

This OPOR irrigation project is designed to irrigate 82 ha. OPOR records show it cost ℓ 299,563.

The directors would like to hire a manager under an AID-financed program administered by the BFA. AID would pay three-fourth of a manager's monthly salary of approximately

1/ With engineering information on Primavera I included

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ℓ 1,700 and the co-op would have to pay one-fourth or about ℓ 425 per month. (During the second year the ratio is 50/50, during the third year 25/75). They have interviewed a prospective manager who is a graduate agronomist but are unable to hire him as they cannot afford ℓ 425 per month. The co-op currently has one employee, an accountant.

From an engineering viewpoint, it should be noted that Primavera I and Primavera II are part of the same canal system. (Primavera I was examined only from an engineering point of view.) These two projects have recently been completed. As usual, construction methods and materials are good. Operationally, however, the system is not well conceived. Some fields cannot be irrigated without extensive field channels being installed by farmers. Some turnouts are in locations and at elevations that make the irrigation of adjacent land impossible. The farm is broken up into blocks or fields which are fairly level and could be efficiently irrigated with some land smoothing and a well laid-out system.

Their present rice yields are low (1.7t/ha.) but the farmers believe they can double it under irrigation. (The evaluation team believes even more intensification is possible). They have 35 ha. of sugar cane and report a lower yield (32 t/ha.) than neighboring Miramar (45 t/ha.) but they expect good increases in sugar cane under irrigation. Corn is grown and sold as ear corn in the dry season. Another dry season crop grown is sesame. The gross return for this crop is $ 605/ha. ($ 245/Ac). They cannot grow beans here because the stream water contains effluent from a nearby processing plant.

The soil is a dark clay loam. It is uniform in texture to 90 cms. It has good internal drainage so is an excellent soil for horticultural crops (vegetable crops). They have planted radish, tomatoes, onions and cabbage. In 1983, 1.4 ha of tomatoes were harvested. The cost of production was about $ 253 and with a return of $ 1,266. Their net return was $ 1,013 ($ 723/ha - $ 293/Ac.) These two cooperatives have a great potential for producting high incomes per unit area with their irrigation projects.

Rancho Grande (Dept. of San Miguel)

This co-op has 28 members and 240 ha. of land. The members want to raise livestock, a goal they share with the members of quite a few other co-ops visited by the consultants. Until now, the members have been unable to engage in cattle production because of unavailability of credit. Now BFA has granted

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them a loan of ℓ 290,000, repayable over 8 years at 15 per cent interest, and they plan to engage in a livestock operation. This is one of the largest amounts of credit which a co-op visited by the consultants has obtained from BFA.

The OPOR irrigation project is designed to convey water to 40 ha. Members want to use their irrigated land for improved pasture. OPOR records indicate the project cost ℓ 231,395.

The turnouts are very few and some canals are too low to irrigate the fields they supply. There is very little flexibility in operating the system under the current design.

The diesel powered pump on the river has an 8" outlet that delivers 80 l/sec. If they are going to irrigate only 40 ha as they say - this is a very generous supply of water and would need to be managed properly to avoid over-irrigation and/or drainage problems. However, the high flow rate for the pump was selected to allow for expansion of the irrigated area.

They produce two crops of rice per season in their irrigated area. This was assumed to be 7 ha. since they stated 33 ha. of the 40 ha. irrigated area was pasture. They report a high yield of 6.5 t/ha. the highest rice yield reported. If this yield level is correct, they should conduct an economic analysis of the returns of this crop compared to the more extensive pasture land.

Examination of the soil showed it to be a heavy clay vertisol to 90 cm. and suitable for rice and pasture.

San Rafael (Dept. of La Paz)

This project is a rehabilitation effort by OPOR, of an existing system that is approximately 30 years old. The rehabilitation effort will be in conjunction with the physical rehabilitation include training of farmers and some land smoothing. This project will supply water to small farmers who received their land under Decree 207 of the Agrarian Reform.

The irrigation method presently employed is simple wild flooding from turnouts located at high corners of the fields. The water control is very poor. The farmers complain of difficulty in irrigating high and low spots in their fields.

Productivity could be significantly improved in this area with proper water control and land smoothing. Land smoothing should be done with care as the productive soils in some areas are shallow and the water table is about 60 cms. in some areas.

Farmers in this area have experienced difficulty in irrigating during the dry season due to lack of water in the river. Apparently, upstream users are diverting more water than they should. A detailed study of this area would probably indicate that farmers are greatly overirrigating in order to wet high spots in their fields.

There is a great desire by farmers to have their system improved. Farmers are aware of the benefits of a good irrigation system.

Cotton was grown previously in this irrigated area. Due to the slopes, they had too much erosion with this crop so now they grow rice, corn and sorghum and somewhat follow the contour in planting. Some farmers still have pasture and cattle but it is more of a "crop" area. In the dry season, they have traditionally grown corn and chili. The farmers told the evaluation team that tomatoes and bananas have had serious disease problems. About seven farmers tried rice last dry season with good results. When the irrigation system is rehabilitated, they will grow more dry season rice. Even now they plant their rice crops late so it will mature in the dry season. This gives them a better harvest and drying weather compared to the normal earlier planting and is something they can do with irrigation. Rice yields are relatively low at 2.5 t/ha.

The hacienda owner is asking $ 1,880 per ha. for the land. Farmers say "this is 100 times the value of the land just one generation ago". They are now paying ₡ 100 ($25.32) per harvest against the purchase of the land. Cost of land is supposed to be repaid in 30 years. They have provisional title to the land but the debt is quite worrisome to them.

They will have more water available after the project is completed and can use a system of rotation irrigation. More water will certainly increase the drainage problem unless corrective measures can be taken.

They cannot get credit for horticultural crops. They have no oxen so they hire tractors for land prepartion.The soils in this area are marine alluvials with good texture but in many places they have coarse sand lens at 60-90 cm. This would contribute to the excess water problems of the lower portions of the fields.

Singaltique (Dept. of San Miguel)

The consultants met with the directors of this co-op, in the town of San Antonio Silva to discuss their problems and needs, but were unable to visit the co-op site because of unsafe conditions caused by rebel activity in the vicinity. This is a large co-op with approximately 1,100 ha of land and 109 members (socios). Principal sources of income for the co-op, in order of importance, are production and sale of (1) cattle for meat, (2) rice, and (3) milk. Crops are discussed in more detail below.

The irrigation project is designed to convey water to a service area of 196 ha which was previously pasture land, but with irrigation will be allocated half to rice and half to improved pasture. OPOR records show project costs were ₡ 222,157.

A problem with the project is that there is not enough water to irrigate the design service area, due to heavy demands for water and withdrawals upstream from Singaltique. This co-op has trouble with obtaining water during the dry season due to a water dispute with an upstream user. They want to supply their irrigation system by building a dam on a nearby river to avoid water disputes. They would like to irrigate more rice and sugar cane.

Singaltique now has 3.5 km of canals. The stream flow can produce 300 l/sec. at the upper end and 200 l/sec. at the lower end of the canals; 200 ha can be irrigated. Farmers apply 10 cm irrigation water every 8 days to pasture (this equals 12.5 mm/day, a fairly high rate of water application). A "minidry season" of 15-22 days in length is experienced almost every year during the wet season. There is usually very little rain after October. Conditions are considerably drier than in the central and western parts of the country.

Two Singaltique members involved with the crop production were interviewed. Irrigated rice is grown for market sale, not local consumption. The yield is viewed as good at 5.2 t/ha. Cattle-raising is still their main enterprise, but with irrigation members are moving more into crop production. Sugar cane is recognized as a profitable crop and plans are underway to increase plantings up to 70 ha. irrigated. The dam on the nearby river will be needed to do this and to be able to irrigate the cane during the dry season.

Each member is alloted 0.7 ha. (1 mz) for growing crops for family food. Some sesame for sale is grown on these plots also. To meet basic bean food requirements, purchases must be made. The co-op has one tractor used mostly for transport.

Overall, Singaltique is viewed by regional CENTA staff as a solid success, having achieved considerable gains in only two years. The evaluation team found the directors to be extremely well-organized. Members themselves state that conditions are "definitley better" than two years ago, and "far better" than under the patrón of the pre-agrarian reform era.

El Tatuano (Dept. of La Libertad)

This co-op has a small sprinkler system for about 9 ha. OPOR supplied the sprinkler pipe and sprinklers. The water supply is six shallow point wells of 2" diameter and 30 feet deep.

The system is operated with a 15 hp diesel-powered centrifugal pump. According to comments by the farmers the wells do not supply enough water to operate the system properly. They say they have no problem with priming the pump. The sprinklers used are the Rain Bird brand. There are at least two model numbers used. There is also a variation among the sprinklers as to nozzle size. The application uniformity of a single lateral would not appear to be good.

They can actually only irrigate 7 ha. instead of the 9 ha. for which the system is designed. The sudan grass for green chop is irrigated by sprinkler in the dry season until it gets above their risers. The risers appeared to be 3 to 3.5' high. The sorghum is then irrigated by the furrow method with the sprinklers. They set 7 lines for each irrigation. The total area is irrigated every 14 days with furrows, each setting of six furrows reaches the end of the run in 2 to 3 hours. The total area is covered every 15 days.

The crop being harvested for green chop is sudan grass SS41, apparently a sweet sudan and probably a hybrid. They cut enough each day to furnish green chop for 80 dairy cows plus some for fattening. They cut regrowth every 40 days. One planting will last for 10 cuttings. They encounter few pest problems with the sudan grass. The exception is migration of insects from cotton after control is terminated.

The soil is a marine alluvial sandy clay loam with lenses of loamy sand sometimes near the surface. Areas of poorer growth in the crop were where soil became sandy from 30 cm on down to 90 cm but with sandy clay loam top soil.

APPENDIX B

ECONOMIC TRENDS

National Trends in Agricultural Output

Total output of six major agricultural commodities -- coffe cotton, sugar cane, beans, corn, and rice -- was generally on an upward trend in El Salvador during the period 1962-1982, according to data published by the Economic and Social Data Services Division of AID. For most of the six commodities output in any given year was about as likely to decrease from the previous year as to increase, but the general trend was definitely upward.

Cotton was the single exception to the upward trend. Average annual output in the five years of 1978-1982 was 75 percent of average annual output during the five years of 1982-1966.

Sugar cane was the commodity with the sharpest upward trend. During the five years of 1975-1979, annual sugar cane output averaged 273 percent higher than average annual output in the years 1962-1966. Production of sugar cane was down in 1980 and 1981 but increased significantly in 1982.

Rice tended to have larger and sharper fluctuations in output from one year to another than other commodities. The highest annual output of rice occurred in the two years of 1967 and 1968, when production jumped to approximately three times the average output in the first few years of the period of record, but it then dropped very sharply in 1969 and never subsequently returned to the high levels of output of 1967 and 1968. At the end of the period of record, rice production declined sharply in 1981 and 1982, and output in 1982 was a modest 23 percent higher than in 1962.

Beans and Corn: Fluctuations from one year to another in the generally upward trend in annual output of beans and corn tended to be more moderate than the sharper fluctuations in rice output, and especially for beans the upward trend in annual output was quite consistent.

A cause for concern is that output of the three important food crops of beans, corn, and rice declined quite sharply in 1982 compared to 1981, which might have been due, at least in part, to unsettling effects associated with agrarian reform. The AID data do not yet show commodity production in 1983, so the consultants do not know whether or not output continued downward in 1983.

These data from AID's Economic and Social Data Services Division refer to total national output. They do not necessar-

ily indicate trends in yields per hectare because changes from year to year in total output are a function of changes in number of hectares harvested as well as of changes in yield per hectare.

Data pertaining to output of meat (beef and pork), milk, and eggs show steady growth from 1962 to 1982 in output of eggs, beef and milk, with eggs and beef increasing at a faster rate than milk. Pork production, on the other hand, declined during the years 1962 to 1982 with output in all years after 1963 lower than it had been in 1962 and 1963.

The attached two graphs show the production trends discussed above. In both graphs, production in 1962 equals the index number of 100 and the index numbers for subsequent years compare the magnitude of output with 1962.

Food Production Per Capita

There was a slight improvement in food production per capita in El Salvador between 1969 and 1981, according to a World Bank index published by AID's Economic and Social Data Services Division. Based on an index in which the three years of 1969 through 1971 equal 100, food production per capita was 106 in 1981, which is the most recent year for which this index is available to the consultants. Since the improvement in food output per capita was so modest, it is evident that most of the increased output in agricultural commodities and certain other food products in recent years, which was discussed in a previous section, was offset by El Salvador's rapid population growth. If the rate of population growth had been only moderately lower, the same growth that was achieved in total output of agricultural commodities and other foods would have caused a more significant increase in output per capita. As production of five out of six principal agricultural commodities declined in 1982 in comparison with 1981, it is quite likely that in 1982 food production per capita was, at best, no higher than in the years 1969 through 1971 (the base years for the World Bank index) and possibly lower.

Population in El Salvador during most of the past 20 to 25 years has been growing at the high rate of approximately 3% annually. If this population growth rate continues to prevail in the future, food output will need to grow at an equal rate to avoid a decline in average nutrition. Improved nutrition is more desirable than merely avoiding a decline: AID data indicate that per capita food consumption in El Salvador presently provides somewhat fewer calories than are deemed appropriate for adequate nutrition.

FIGURE B - 1

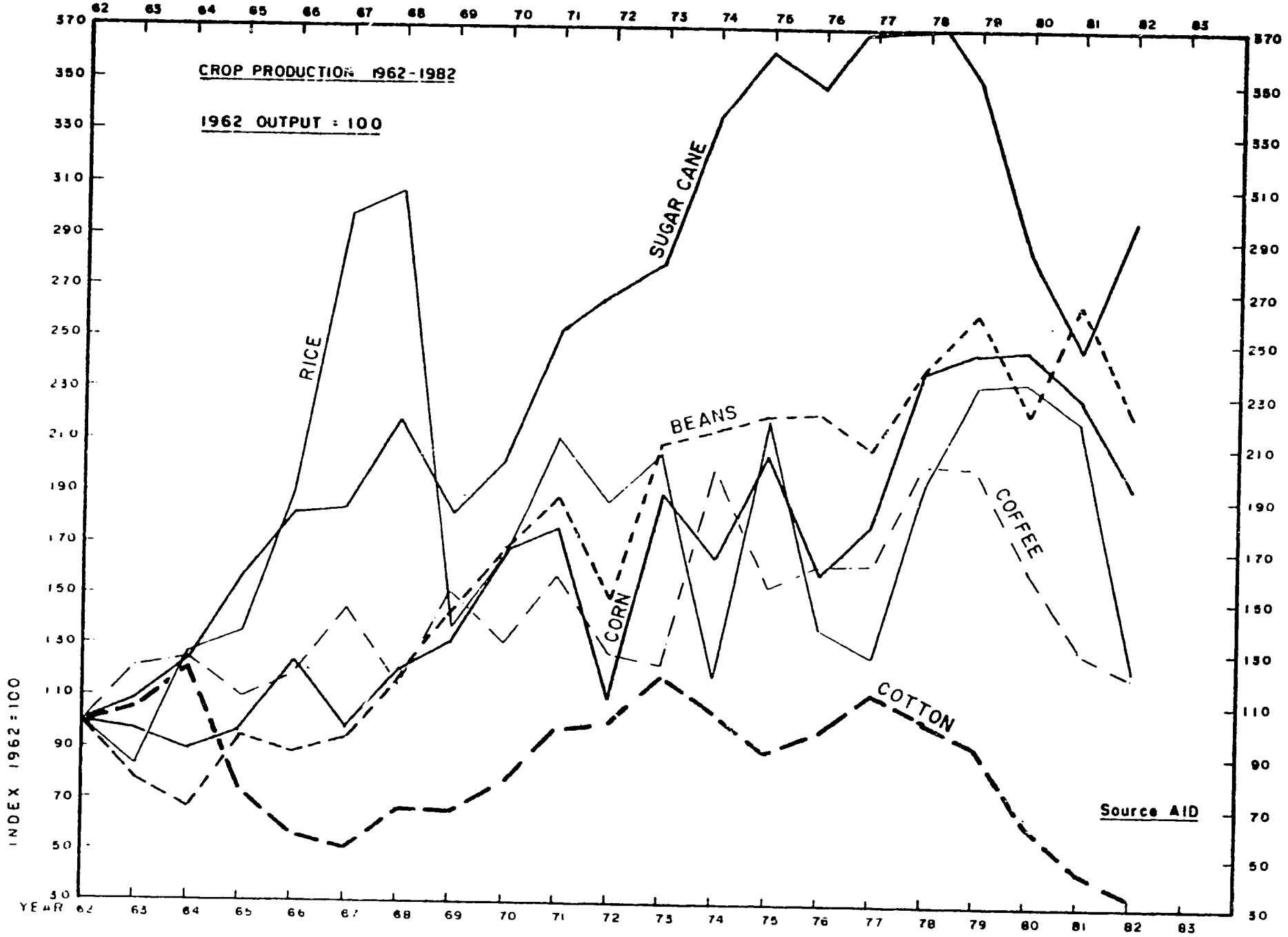
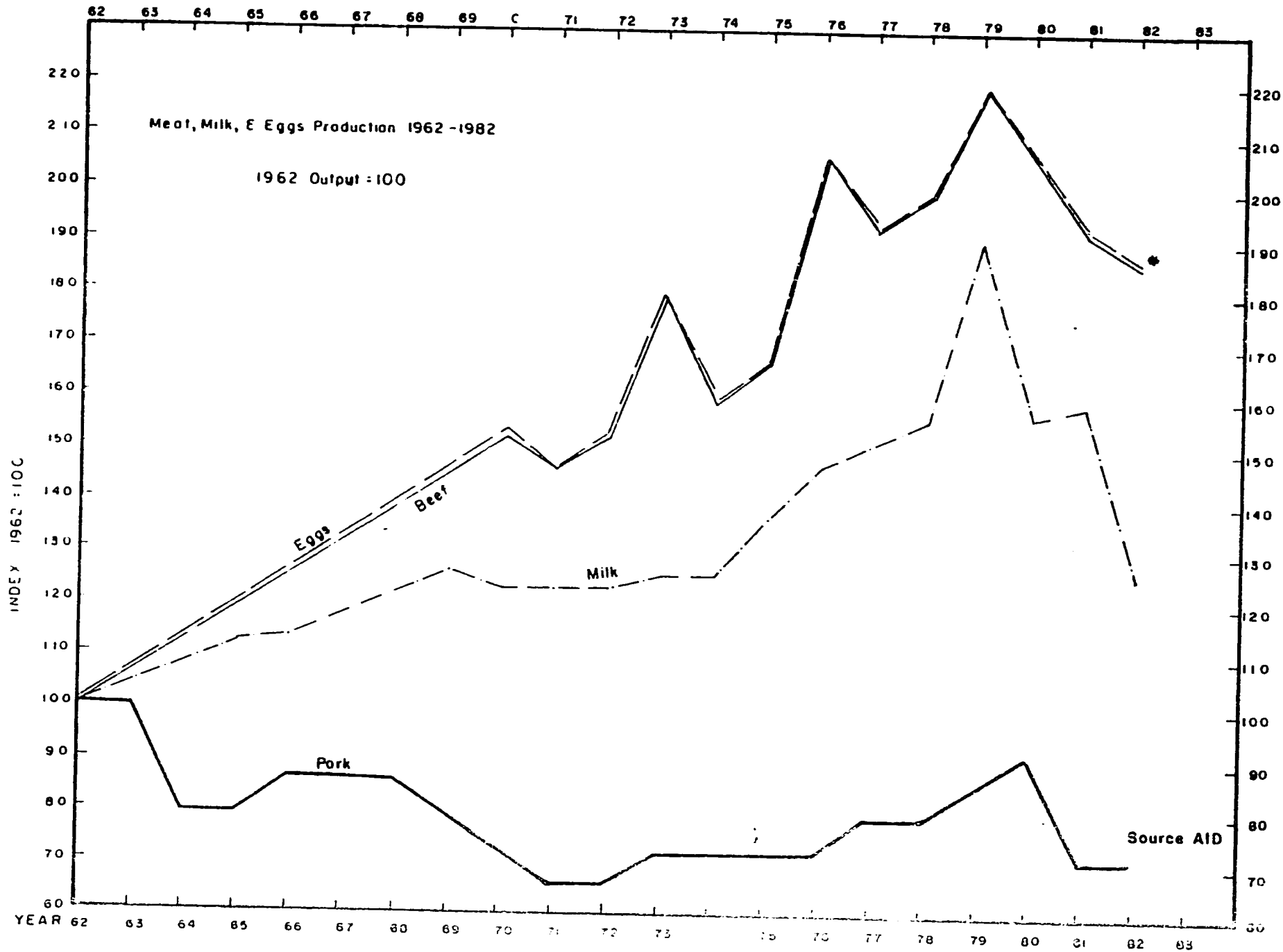

CROP PRODUCTION 1962-1982
1962 OUTPUT = 100
SUGAR CANE
RICE
BEANS
CORN
COFFEE
COTTON
Source AID
INDEX 1962=100
YEAR
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83
370 350 330 310 290 270 250 230 210 190 170 150 130 110 90 70 50 30

FIGURE B - 2


Meat, Milk, & Eggs Production 1962 -1982
1962 Output = 100
INDEX 1962 = 100
YEAR
Eggs
Beef
Milk
Pork
Source AID

APPENDIX C

ITINERARY AND ACCOUNT OF ACTIVITIES

The itinerary and activities of the evaluation team covered, *inter-alia*, contacts, interviews, meetings, and conferences participated in by one or all team members. Therefore the team members will not be listed by name in the following accounts.

In order to efficiently utilize the time of the team at each cooperative visited, the members divided into two subgroups: 1. agriculture-engineering and 2. economic-sociological-institutional. A total of sixteen cooperatives were visited or contacted by at least one or more members of the team during the course of the evaluation.

July 1 to July 31	Gathering and review of reference documents and other information re: El Salvador and Central American farming practices (in Denver).
July 17 -	Initial three team members arrive in San Salvador, Peter Van Arsdale, Richard Butler, and Robert Mohammed.
July 18 -	Orientation by USAID staff members, Luis Palomo, Stephen L. Haynes, Thomas H. King, Nelson Olaf Gonzalez. Review first sub-projects documents.
July 19 -	Initial meeting with OPOR acting director (manager) Elmer Guerrero and staff. Extensive overview of administration and technical operations; met Joaquin Flores, chief of Division of Irrigation and Drainage.
July 20 -	Presentation by cooperative La Canada to staff from MAG, OPOR, CENTA, USAID and the evaluation team.
July 22 -	Arrival of team member Ronald Baskett.
July 23 -	Visit to cooperative Cara Sucia for interviews and field investigation.
July 24 -	Arrival of team member David Mann; visit to OPOR for interview with acting director and staff; visit with CENTA director, Manuel Ponce and Max Montano regarding functions; brief visit with CENCAP director German Melgar; visit with Pedro Urquilla Schonenberg, owner and manager of Quality Foods, a contractor with several co-ops with OPOR irrigation systems for okra products.
July 25 -	Visit to Las Bromas cooperative for interviews and field investigation.

July 26	-	Attended review meeting at Sonsonate for USAID regarding extension program of CENTA, presented by Regional Director Fausto Candel and staff; visit to Mosquitia cooperative, a non-OPOR proje regarding it's management and functions; team meeting; conference with AID staff Cam Wickman and Peter Lapera on project paper amendment link to evaluation report.
July 27	-	Visit to cooperative El Eden for interviews and field investigation.
July 28	-	Meeting with extension director Carlos Cruz Vent ra of CENTA regarding organizational strengths ar weakness; reviewed training materials for extensi agents in irrigation and water management with Nelson Olaf Gonzalez of STC assigned to OPOR.
July 30	-	Trip to San Miguel to meet with Juan Ramon Flores OPOR acting regional director; visit to Rancho Grande cooperative; meeting with directors of Singalteque cooperative.
July 31	-	Visit to La Canada and La Bolsona cooperatives fo interviews and field investigation.
August 1	-	Meeting with Julian Velez, STC Consultant to dis- cuss the status of cooperative movement, general agricultural situation, status of research and extension and socio-economic problems of co-ops.
August 2	-	Trip to San Vicente area cooperatives Miramar, Primavera I and Primavera II and discussions with extension agent German Raul Henriquez.
August 3	-	Visit to San Martin Larin cooperative; meeting wi President of COFAPI, Freddy Quintanilla Morales.
August 4	-	Visit to Plan de Amayo cooperative.
August 6	-	Visit to San Rafael and El Tatuano cooperatives; arrival of special advisor, Tom Walz.
August 7	-	Interview with David Thompson, USAID, HRHA project unit re: displaced persons program and their re- setlement; visit to OPOR office for additional interviews.
August 8	-	Visit to San Marcos displaced persons camp; trip to San Miguel for training meeting of cooperative farmers; visit to Maquique cooperative.

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August 9 - Attended training meeting in San Miguel of ISTA agents; meeting with regional manager Luis Landaverde; meeting with Roberto Mitchell, director of ORE and OPOR; meeting with Plan de Padrinos director, Larry Wolfe on displaced persons activities; interview with Thomas King and Stephen Haynes of USAID; visit to Santa Tecla displaced persons camp; team meeting.

August 10 - Interviews with Joaquin Guevara Moran, president of BFA, and Arnoldo Beltran, chief of agricultural projects, IBD; interviews with agricultural researchers of CENTA regarding their work with horticultural corps, beans, corn, rice and their cultivation, Messrs. Carlos Arturo Tobar Palomo, Bernardo Patiño, Rutilio Mendez, Jose Mauricio Manzano, Ricardo Antonio Ortiz; interview with Jaime Antonio Cea Velasco, participant in the Utah State University "On Farm Water Management Research Project"; meeting with Francisco Antonio Avalos, director of GONADES on work with displaced persons; meeting with Heriberto Gallegos, educational director of Caritas; interview with Oscar Eduardo Sandoval, director of DIDECO, sub-director, Carlos Jose Utado and Jose Benevite re: interaction with OPOR; meeting with Pedro Garcia Roger, STC consultant with ISTA re: interaction with OPOR.

August 13 - Mid-term evaluation briefing with USAID staff; meeting Alfonso Escobar Chevez of MAG; interviews with CENTA staff: Edmidlia Guzman M., Department of Soils; Carlos Deras Figueroa, Research with sugar cane; Oscar Mauricio Coto Amaya, cultivation of spice crops; departure to Tom Walz.

August 14 - Visit to OPOR for needed documents; visit to CENTA for interviews with Angel Maria Paz, sub-chief of extension, Violeta Lino and Juan Gilberto Gomez, Planning department; interview with Joaquin Flores, chief of DRD re: the national water plan.

August 16 - Interview with Jorge Ruiz Camacho, vice-minister of agriculture and members of his staff, acoompanied by USAID staff.

August 15 to 29 - Preparation, writing and submission of final report.

August 24 - Interview with Klaus Klawitter of World Food Program re: interactions with various government agencies.

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August 29 - Final briefing conference with USAID staff.

August 30 - Team departs El Salvador.