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FINAL REPORT

PATTERN ANALYSIS OF SMALL- AND
MEDIUM-SCALE IRRIGATION PROJECTS

VOLUME II
(Narrative)

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VOLUME II Part 1 - IRRIGATION

A. INTRODUCTION - PURPOSE OF THE STUDY

The Program and Policy Coordination Bureau of AID has undertaken a series of "pattern analyses" of infrastructural projects to test this concept as a secondary evaluative tool and to develop, design and program recommendations for future project preparation and evaluation. In its initial study, Checchi and Company performed a pattern analysis of AID-funded small- and medium-scale irrigation projects to determine whether specific inputs showed a causal relationship with achievement of stated project purposes and goals. The study was a desk research effort using evaluation reports and, in some cases, progress reports and project design documents made available by AID/Washington. A set of hypotheses about linkages between social, institutional, economic, technical and environmental "inputs" to projects and achievement of project purposes or wider sectoral goals was formulated and tested against fifteen AID-funded irrigation projects on which adequate data were available.

Because the scope and content of evaluation documentation for a study of this type was below the expectations of the Bureau and the contractor, an ancillary study was devoted to a discussion of weaknesses in evaluation reporting and recommendations for improvement, also as part of the initial Checchi effort.

In response to the findings that AID evaluation material was less consistent and less comparable than anticipated, testing hypotheses against a second body of information became desirable. Because the World Bank evaluation system has yielded a more consistent and comparable set of evaluation

material, a second phase of the study was initiated to test the hypotheses against ten World Bank-funded irrigation projects. Concurrently the contractor undertook to determine whether characteristics of the Bank's evaluation system might be usefully reviewed by AID.

The cooperation of the Bank's Operations Evaluation Department was essential to the performance of the second stage of the study. Its permission is gratefully acknowledged, but this in no way implies Bank endorsement or support of study findings. Further, confidentiality requirements have necessitated deletion of project titles from appended descriptions.

B. DEVELOPMENT OF IRRIGATION PROJECTS

1. Background

This section of the report provides a context in which irrigation projects discussed in the following sections may be perceived. Of an estimated 1.5 billion hectares of cultivated land on earth, about 230 million hectares (15 percent) were subject to irrigation in 1976.^{1/} Another 5 million hectares is deemed potentially productive as forest, meadow or cropland.

Approximately 180 million hectares of irrigated land is situated in the developing world, including China. Large irrigation systems such as those of the Indus River Basin, Jordan Valley, Helmand Valley and Aswan Dam in the Near East and Asia account for almost 90 percent of this irrigated area.

The modern history of irrigation projects in the Third World under both colonial and post-colonial regimes has been one of large dams and centrally-controlled systems. In projects such as the Aswan Dam and others, multilateral and bilateral assistance agencies planned to fund only construction of dams, reservoirs and main canals leaving secondary, tertiary and quaternary canals, and drainage facilities to be funded from other sources.^{2/} Contrary to expectations, in many cases governments did not fund tertiary networks and local organizations did not exist to carry out their construction.

^{1/} Framji and Mahajan, p. Cii.
Berry, Ford and Hosier, p. 11.
Figures for irrigated land area change periodically as new systems are constructed and as old systems deteriorate.

^{2/} John P. McInerney, p. 14.

In some cases informal field-to-field flood irrigation enabled the spread of irrigation water to wider areas adjacent to secondary canals. In most cases low standards of water control led to salinization and drainage problems, poor water conveyance and inefficient field application.

A series of follow-up projects have provided for construction of secondary canals and irrigation works building on earlier investments. The projects in the sample show a consistent trend away from dam construction towards development of on-farm irrigation works. These include tertiary and quaternary canals, drainage canals and wells of various types.

The shift from capital-intensive to "small-scale" works projects began in the early 1970's and coincided with findings that poor crop yields on irrigated land, low application efficiencies and soil deterioration could be reversed by increased attention to management of water on-the-farm. Attention was also directed at correcting system inequities which permitted larger farms or farms located upstream or near main canals to use greater quantities of water at the expense of farms near tailworks.

As a group, evaluated Bank irrigation projects are more likely to reflect "older-style" concerns, including limited dam construction, because they began earlier than AID projects and took longer to complete. All projects in the sample, however, include discussion of on-farm development, rehabilitation of small "hand-made" canal systems, control of water on-the-farm through precision land-leveling and other techniques, or of potential for local rather than central management. The latter concerns are more prevalent in AID projects of the 1970's.

2. Purposes and Assumptions of Irrigation Projects

Irrigation and drainage projects are designed to satisfy obvious physical purposes such as flood prevention and increased agricultural production as well as indirect goals such as import substitution. Irrigation is a means to an end rather than an end in itself. The following list provides a summary of direct and indirect purposes and goals of irrigation projects as they appear in the general literature and in specific project documents. The technical goal or physical change is shown first with the complementary wider socio-economic goals following.

- Opening new lands to agriculture
 - decrease population pressure
 - increase food production
 - increase farm size
 - diversify crop production
 - substitute domestic for imported raw and processed foodstuffs
 - improve nutrition levels

- Preventing flooding
 - stabilize crop production
 - prevent erosion

- Permitting cropping during dry seasons (increasing crop intensity)
 - increase crop/food production
 - diversify crop production
 - create jobs

- Providing dependable water supply during wet season, or
- Rehabilitating local systems
 - upgrade agricultural inputs
 - increase crop production
 - increase value-added in agriculture
 - support related processing businesses
 - increase rural incomes
 - create jobs
- Improving water control
 - reduce inequities in distribution
 - conserve water
 - enlarge cultivable on-farm area
 - upgrade agricultural inputs
 - increase crop production

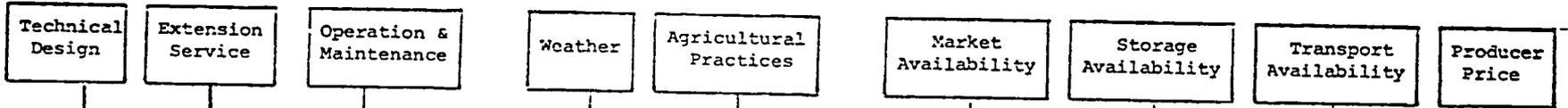
By providing reliable minimum quantities of food, or improving and increasing cultivable land, most projects will serve wider goals such as stabilizing food prices. In project documents, these latter goals are more often implied than directly stated.

In most contemporary irrigation project documents, there is a stated or assumed linkage between the supply of irrigation water, improved crop yields, and regular or increased farm incomes. The diagram on the following page illustrates this assumption (Figure 1). Success of the project in achieving anticipated economic returns depends on the suitability of the technical design and on a number of project and non-project-related inputs (critical variables in the diagram). Impacts,

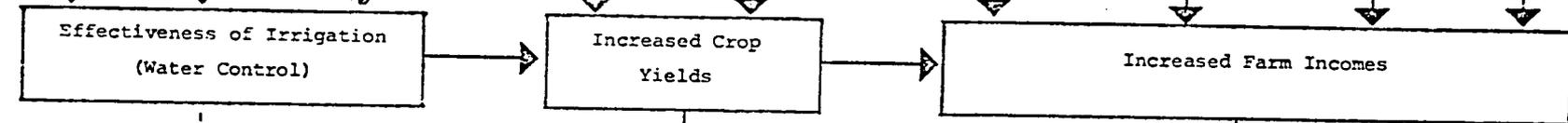
FIGURE 1

IRRIGATION PROJECT
CONCEPTUAL MODEL

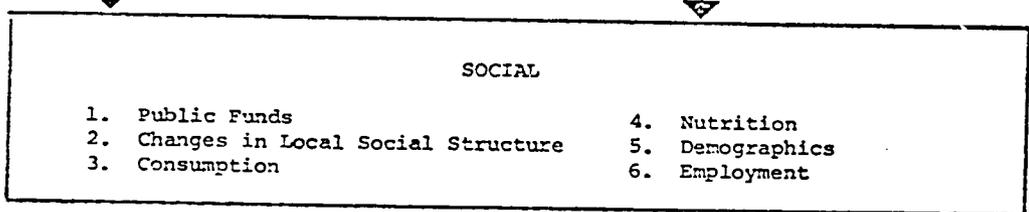
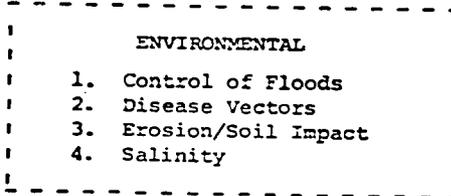
CRITICAL
VARIABLES
(INPUTS)



ASSUMED
PROCESS
OUTPUTS &
PURPOSES)



IMPACTS
(OBJECTIVES
& GOALS)



shown on the third line of the diagram, are the environmental ramifications and socio-economic effects of the project, planned or otherwise.

The projects selected for this study were reviewed principally for evidence of their impact. Of particular interest were net income changes, income redistribution, employment effects, and changes in social structure.

C. PROJECT SELECTION AND FINAL SAMPLE

1. Criteria for Project Selection

Irrigation projects were selected from AID and IBRD archives for review according to four basic criteria. These are:

a. Quality of Documentation Available

Because this was a desk research effort, the documentation which could be collected on a project was a critical variable for determining inclusion. A full or special evaluation or several PAR's or PES's were required for AID projects. Audit Reports (PPAR's) which usually included Completion Reports (PCR's) were used for World Bank projects. Projects for which feasibility reports, appraisals or project papers were obtainable were favored over projects lacking design documents. IBRD design documents and appraisal reports were dated, difficult to locate and were frequently summarized in the evaluations.

b. Extent to Which Socio-economic Impact is Addressed in the Project Documentation

As much as possible, the projects selected were those begun during the trend towards non-capital intensive rural development in the 1970's. For purposes of this paper we are calling this trend "New Directions" in reference to legislation passed at the time. Irrigation projects which began in the 1970's were most likely to have been designed to fulfill the needs of small or subsistence farmers. Evaluations performed in the 1970's are more likely to discuss project success or failure in terms of the socio-economic impact on these groups.

Information regarding anticipated socio-economic impact was provided in AID project design documents and in IBRD evaluation documents.

c. Geographic Distribution

Projects undertaken in four developing areas of the world--Asia, the Near East, Latin America, and Africa--were selected. The sample selected for review includes 25 irrigation projects. Twelve of these are in Asia. Topography and other geographical and environmental factors, as well as rice production, water availability, and adequate labor have resulted in most of AID's work in irrigation being undertaken in Asia. The largest share of Asian small- and medium-scale irrigation efforts, including on-farm water management and small farmer target projects, has been undertaken in Pakistan, Bangladesh, the Philippines, India, and Indonesia.

Substantial work in irrigation has been undertaken in the Near East and North Africa. Much of it takes the form of large projects. Although some of these have reached the stage where on-farm water management and small farmer target groups are subjects of concern, proportionately fewer met our criteria. Lack of documentation, as well as lack of projects of appropriate scale, left only three projects in the Near East and North Africa for inclusion in this study sample.

There have been relatively few irrigation projects administered by AID in Latin America. Small-scale projects have been funded in some cases from general program grants and mission-discretionary funds. These are not well documented. The three Latin American projects in the sample include one which was directed at providing the foundation of a national

irrigation policy in Nicaragua, and two small grants administered by a Private Voluntary Organization (PVO). In one of the PVO-administered grants, irrigation was only a single component of a rural development project having multiple objectives. More irrigation projects have been administered by the World Bank in Latin America than by AID. Seven in the region were considered in the sample.

Several AID irrigation projects undertaken in the Africa Bureau have had evaluations forestalled by unforeseen events. The single AID-supported example from the region (like several of the Latin America sample projects) was funded in part by a grant to a PVO. There was also only one example of an irrigation project funded by IBRD in Africa. Figure 2 shows the distribution of AID and IBRD sample projects.

d. Size and Nature of Project

The study was initially limited to "small- and medium-scale" irrigation projects. The term was defined by parameters which excluded only major dam projects. Any of the following conditions sufficed for inclusion:

- project area small relative to the total area of cultivable land in the country
- major purpose of the project is water management on-the-farm
- principal beneficiaries are small or subsistence farmers

GEOGRAPHIC DISTRIBUTION OF SAMPLE PROJECTS

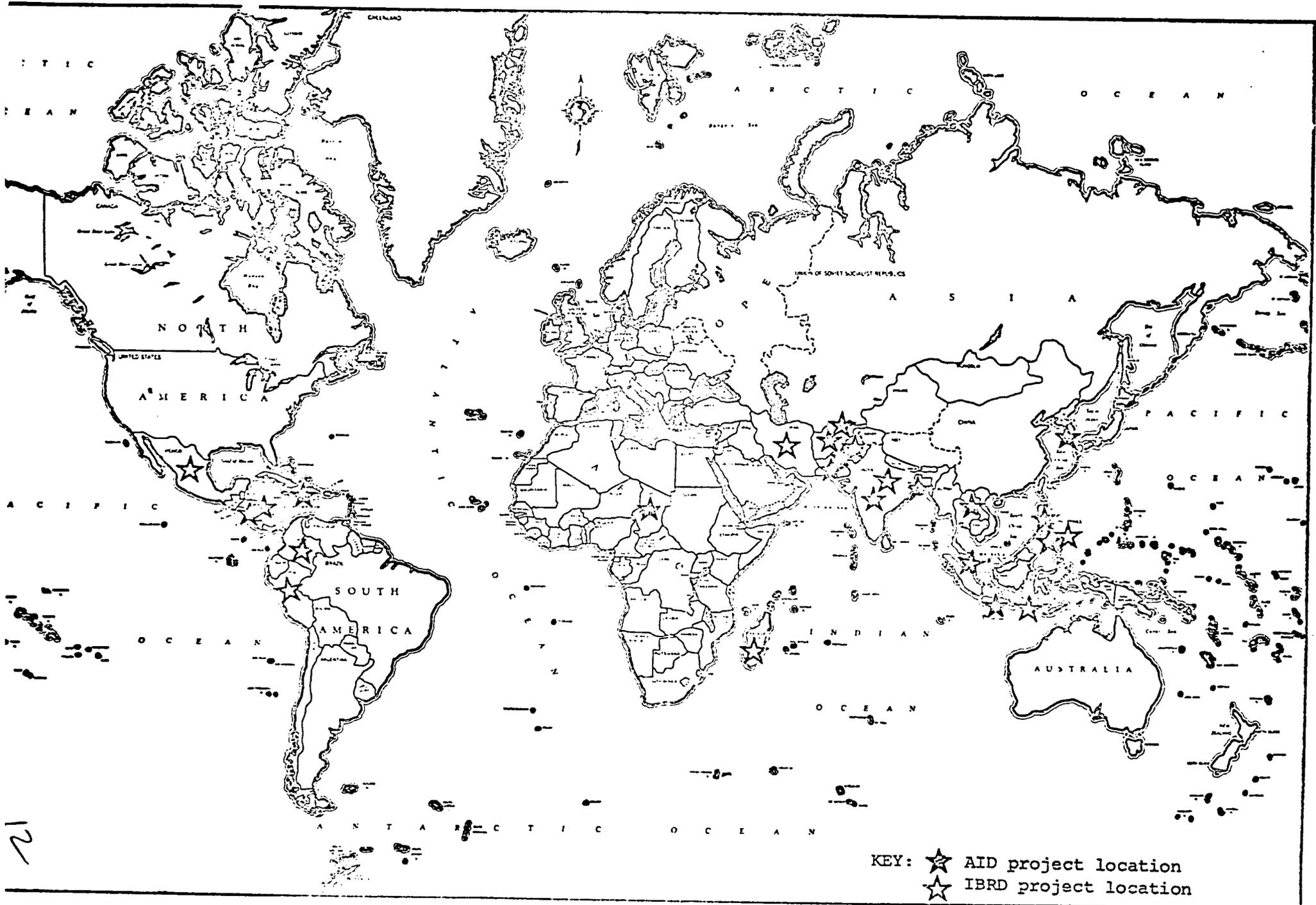


Table 1

PROJECT AREA AND PERIOD: SAMPLE OF SMALL- AND MEDIUM-SCALE IRRIGATION PROJECTS

<u>Project</u>	<u>Country</u>	(Planned) <u>Project Area</u> (hectares)	Average (Target) <u>Farm Size</u> (hectares)	<u>Disbursement</u> <u>Period</u>
(Sample) Afghan Rural Works	Afghanistan	12,140	n.a.	FY 1974-80
CARE Pilot Irrigation	Nicaragua	462	3.2	FY 1975-77
HACHO	Haiti	296	2.55	FY 1977-79
Irrigation Development	Nicaragua	56	Demonstration	FY 1969-72
Libmanan-Cabusao I (Bicol)	Philippines	4,000	Under 24 ha.	FY 1975-80
MONA-SCARP IIB	Pakistan	543,000	n.a.	FY 1966-74
Nam Tan Irrigation	Laos	2,200	3.0	FY 1968-75
On-Farm Water Management	Pakistan	171,995	75% under 16 ha.	FY 1976-78
Precision Land-Leveling	Pakistan	n.a.	n.a.	FY 1974-78
Regional Soil and Water Management Projects	India	n.a.	n.a.	FY 1966-71
SAWS I	Chad	150	0.25	FY 1976- ?
Sederhana I	Indonesia	60,000	1.0	FY 1975-77
Small-Scale Irrigation	Bangladesh	n.a.	1.0	FY 1976-79
Small-Medium-Scale Irrigation	Korea	66,000	0.92	FY 1974-77
Small-Scale Irrigation	Philippines	40,000	2.2	FY 1975-79
(Sample) Lagunera/San Juan	Mexico	80,000	3.8	1966-73
San Lorenzo Irrigation	Peru	45,000	10.0	1965-76
Ghazvin Development	Iran	37,000	2.5	1968-72
First Irrigation Rehabilitation	Indonesia	200,000	0.9	1969-77
Afghanistan Rural Credit	Afghanistan	Multiple areas of 1,000 ha.	60.0	1970-75
Atlantico	Colombia	9,000	½ 8-16; ½ under 50	1967-75
Lake Alaotra	Madagascar	12,000	4.0	1970-75
Second Rural Credit	Philippines		50.0	1969-74
Muda & Kemubu Irrigation	Malaysia	120,000	1.6	1966-74
Gujarat Agricultural Credit	India	193,000	7.0	1970-75

n.a. = not available.

The AID sample projects largely fit within these parameters. Many of the IBRD projects meet the conditions identified as pertaining to small- and medium-scale projects. As previously mentioned, Bank projects are larger in scope, in size of funds committed, and are more likely to include dam and major infrastructure construction. Because virtually all IBRD evaluations include discussion of the impact of the project on local employment and on small farmer incomes, the IBRD projects do permit identification of elements whose presence supports achievement of "New Directions" goals. Discussion of impacts occurs in IBRD evaluations even for projects which were designed prior to the "New Directions" era. Table 1 shows project area, average farm size and disbursement dates of sample projects.

Projects that were not considered included studies of irrigation in LDC's by U.S. universities and old projects with unlikely relation to "New Directions" concerns. The projects were excluded because we were looking for projects which made a direct investment in irrigation infrastructure and offered some minimal discussion of socio-economic goals.

2. Project Sample

The project sample is not definitive for small- and medium-scale irrigation projects undertaken in the 1970's by AID and IBRD because not all projects fit the criteria, and some which appeared to provide useful information were researched and found irrelevant. Several useful projects had to be omitted because relevant evaluation material could not be obtained.

For a comprehensive list of AID irrigation and related projects, see Appendix D, Volume III.

TWENTY-FIVE PROJECT SAMPLE

Donor	Project	Country	Evaluation Documents
<u>ASIA REGION</u>			
AID	On-Farm Water Management	Pakistan	PES, Trip Report, End of Assignment Report
AID (2)	MONA/SCARP IIB	Pakistan	Audit Reports, Site Inspection
AID	Precision Land-Leveling	Pakistan	Evaluation, End-of-Tour Report
AID	Small-Scale Irrigation I	Philippines	Progress Reports, Environmental, PES
AID	Bikol River Basin: Libmanan-Cabusao I	Philippines	Progress Reports, PES
IBRD	Second Rural Credit	Philippines	PPAR
AID	Sederhana Irrigation and Land Development	Indonesia	Social Soundness, Evaluation
IBRD (2)	First Irrigation Rehabilitation	Indonesia	PPAR, PCR
AID (2)	Nam Tan Irrigation	Laos	Evaluation (2 volumes)
AID	Small-Scale Irrigation I	Bangladesh	PES
AID	Regional Soil and Water Management Project	India	6 PAR's
IBRD (1) (2)	Gujarat Agricultural Credit	India	PPAR, PCR
AID	Small and Medium-Scale Irrigation	Korea	Interim Evaluation
IBRD (2)	Muda and Kemubu Irrigation	Malaysia	PPAR, PCR
<u>NEAR EAST REGION</u>			
AID (1) (2)	Rural Works Project	Afghanistan	Evaluation
IBRD (1) (2)	First Agricultural Credit	Afghanistan	PPAR, PCR
IBRD (1) (2)	Ghazvin Development	Iran	PPAR
<u>LATIN AMERICA REGION</u>			
AID (2)	CARE Pilot Irrigation	Nicaragua	PAR, Completion Report
AID (2)	Irrigation Development	Nicaragua	3 PAR's
AID (1) (2)	HACHO Project	Haiti	2 Evaluations, PES
IBRD (1) (2)	San Lorenzo Irrigation and Land Settlement	Peru	PPAR
IBRD (2)	Third Irrigation	Mexico	Impact Report, PPAR
IBRD (2)	Atlantico Irrigation	Colombia	PPAR, PCR
<u>AFRICA REGION</u>			
AID (2)	Chad SAWS I	Chad	Progress Report, Evaluation
IBRD (2)	Lake Alaotra Irrigation	Madagascar	PPAR, PCR

(1) These projects have several components, only one of which is irrigation.

(2) These are projects for which there was no project paper available.

KEY:	PES	Project Evaluation Summary (AID)
	Evaluation	Full or special evaluation (AID)
	Progress Report	Self-explanatory (AID)
	PAR	Project Appraisal Report (AID)
	Others	Social soundness, environmental (AID)
	PPAR	Project Performance Audit Report (IBRD)
	PCR	Project Completion Report (IBRD)
	Impact Report	Post-Project Impact Study (social soundness) (IBRD)

D. METHODOLOGY FOR STUDY OF IRRIGATION PROJECTS

1. Pattern Analysis Methodology

The use of pattern analysis as an evaluative tool is premised on ability to identify particular inputs that coincide with successful (or unsuccessful) projects in an appropriate number of project cases. The pattern which emerges supports program approaches which include these inputs. Conversely, unsuccessful projects may coincide with certain project inputs repeatedly, to form a pattern of failure.

Our task was to attempt to isolate these elements. We were asked to develop a methodology for assessing patterns among projects possibly using a matrix. The framework developed is a simple coincidence model, where apparent links between inputs and purpose and goal achievement are hypothesized. It relies on narrative to explain a group of hypotheses formulated from irrigation literature, interviews with experts, and from project results.

The variety of evaluation approaches and types of impact measurement used led to the determination that regardless of the statistical tables developed, extensive narrative would be necessary. Development of a computer model to test for correlations between inputs and impacts would have been a time-consuming, highly dubious method because hard statistical evidence supporting conclusions about employment-generation, income change, shifts in social structure is often absent from evaluation reports.

We formulated hypotheses about the coincidence between inputs to and achievement of project purposes in small- and

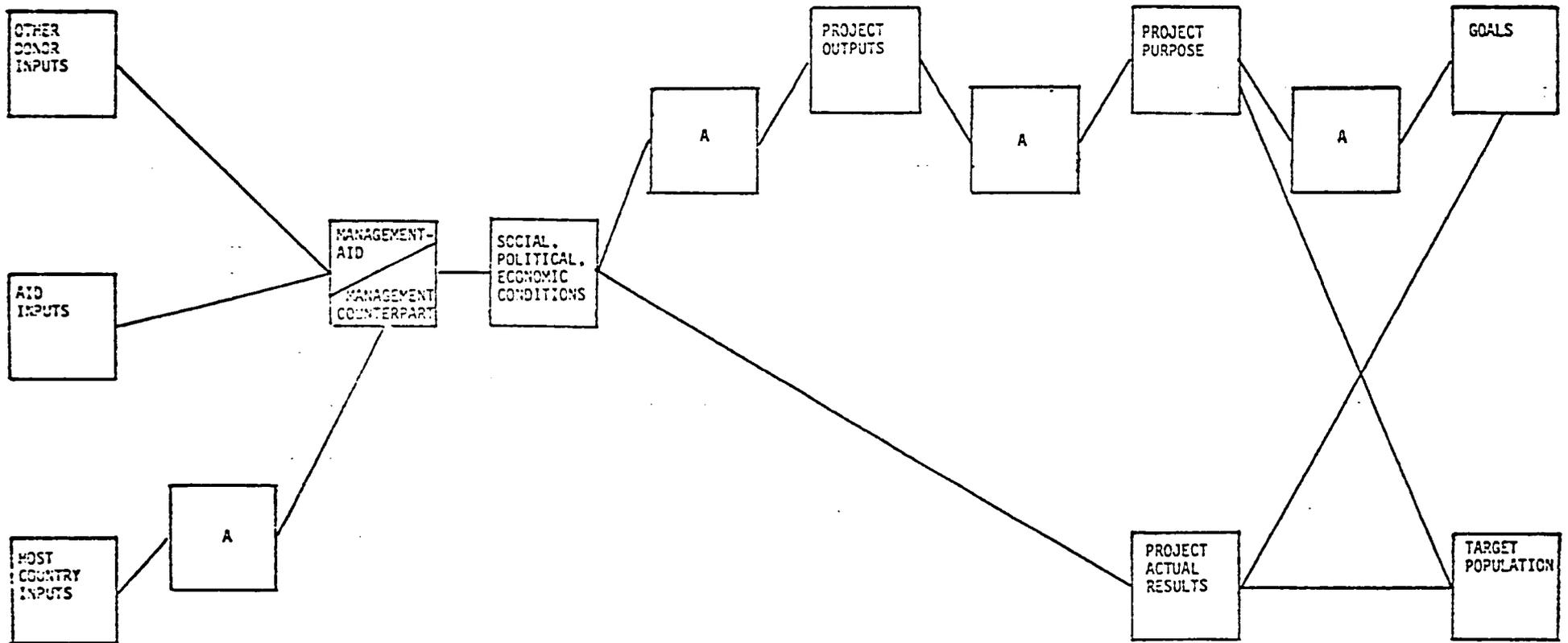
medium-scale irrigation projects. Several of the hypotheses discuss the relationship between outputs and purpose attainment. Several hypotheses pertain directly to host government, rather than AID inputs.

Hypotheses pertained to inputs or conditions of six types: sociocultural, economic/financial, technical, institutional, agricultural, and environmental. These classifications are broad. Inputs, such as land-leveling, are clearly technical. However, other inputs such as legalization of ad hoc water-user associations are less easily classified as institutional or sociocultural because they pertain to both areas.

We did not require an equal number of hypotheses in all of the above areas and therefore selected what appeared to be the most critical links between inputs and achievement of project purposes and goals. For example, we have very few hypotheses about environmental effects of small- and medium-scale irrigation projects. Evaluation findings in this area are rare.

2. AID-IBRD Methodological Tools

For evaluation and project design, AID uses the Logical Framework Matrix, illustrated in Figure 3 on the following page. The initial Logical Framework Matrix is a simple model of presumed linkages between project inputs, outputs, purposes, and goals and impact on the target group. Independent variables, such as the socio-economic conditions of the host country and management features of the project, are pictured in a central block. The Framework clearly distinguishes between the Project Purpose and actual results.



KEY:



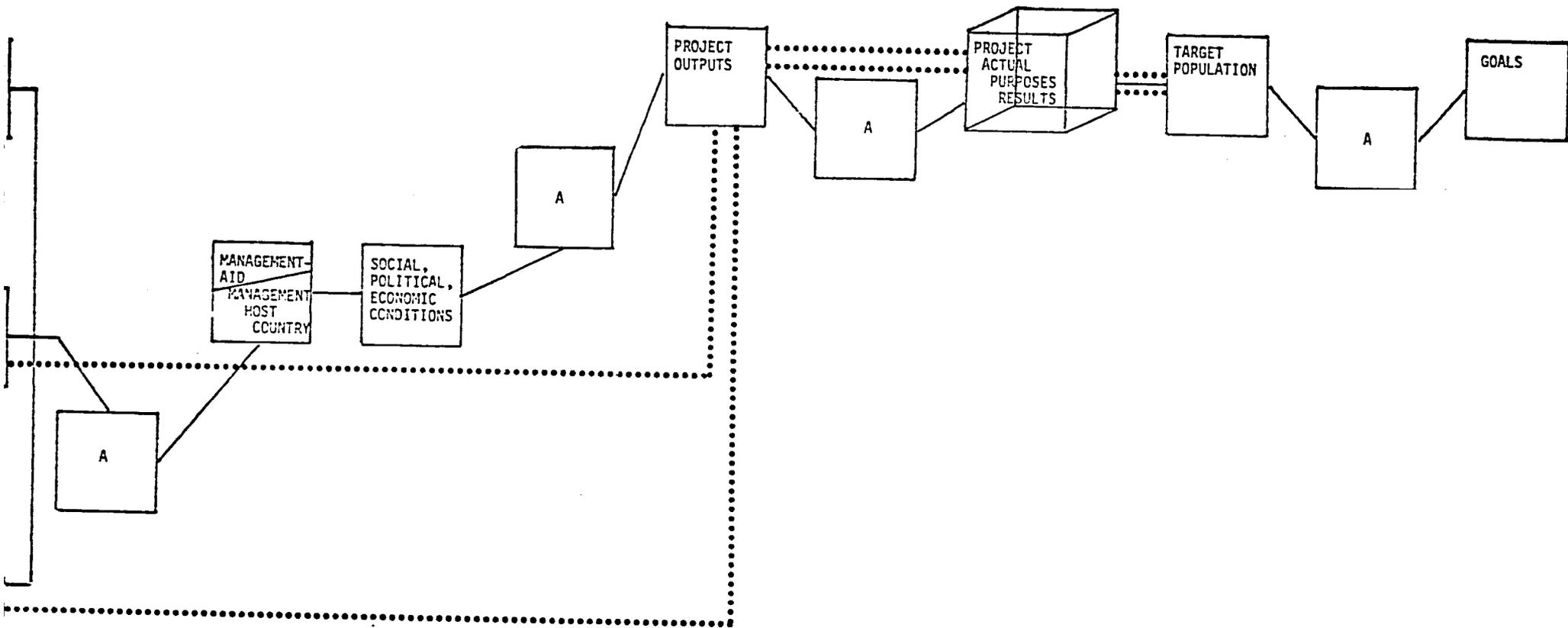
= Assumptions

FIGURE 3
LOGICAL FRAMEWORK
CONCEPTUAL MODEL I

The "log frame" specifies three levels of achievement which may be expected at completion of a project. These are: (1) outputs, which are identified by type and magnitude, including physical outputs such as canals, and institutional outputs such as creation of a water users' association; (2) purposes, such as increasing crop yields or increasing farmer incomes. Achievement of purposes is predicated on achievement of outputs. A relationship, including a deliberate program strategy, is hypothesized between output achievement and purpose fulfillment. The final stage--(3) goals--are broad sectoral changes such as decreased rural-urban migration, the achievement of which depends on achievement of project purpose(s).

The three levels of results of project inputs are difficult to link. Connections between achievement of project outputs, such as improved canals, and achievement of project purposes, such as higher crop yields, may be verifiable. However, direct causal connections between achievement of project purposes (for example, increased crop yields) and attainment of higher order goals (such as decreased rural-urban migration) are difficult to draw. Numerous intervening variables such as political, economic and climatic conditions have a direct impact on purpose and goal achievement.

The second Framework Matrix (Figure 4) is similar to the first, but shows a hypothesized relationship between inputs or program approaches and project purpose attainment. In this case, selected inputs are hypothesized to lead to attainment of actual results which, in turn, reflect attainment of project purposes.



▪ Hypothetical Relationship

FIGURE 4

LOGICAL FRAMEWORK
CONCEPTUAL MODEL II

▪ Assumptions

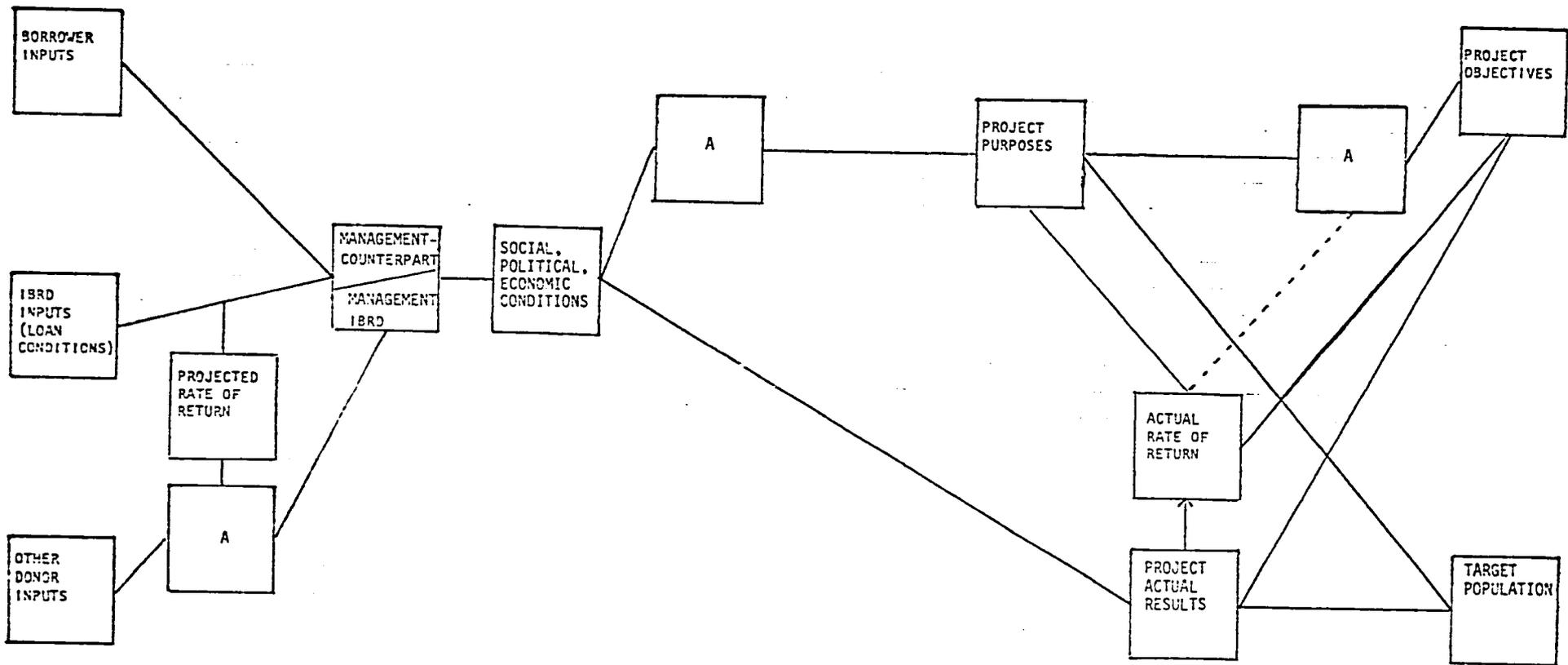
20

Like AID projects, IBRD projects identify goals of a sectoral nature. Objectives identified by IBRD such as improved farm incomes might be said to correspond to the purpose level of AID's logical framework. Physical or institutional outputs are frequently identified as the purpose of a project even though these may in fact be a means to an end.

A major difference between the Bank and AID in project conceptualization is the Bank's use of rate of return figures to justify a project initially and to evaluate it following disbursement. The reliance on this figure may stem from the Bank's mandate as an income-generating lending institution. Although financial rates of return for project participants are occasionally provided, frequently projects with favorable income or employment impacts are classified as "failures" because of poor or below-projected rates of return. This approach to project design and evaluation is quite different from AID's logical framework. For comparative purposes, the study team developed an illustration of IBRD project conceptualization, Figure 5 on the following page. (This has not been endorsed by the Bank.)

3. Success and Failure Determinants

Where possible, emphasis was placed on discerning the socio-economic impact of projects in this pattern analysis. For this reason, selecting one socio-economic indicator such as changes in farmer incomes as a criterion by which to judge all projects was considered. However, using one measure of success appeared arbitrary given the number of ways projects may influence a region, and this idea was discarded.



KEY:
 A = Assumptions

FIGURE 5
 IBRD PROJECT CONCEPTION
 (Developed by Checchi and Company)

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Many projects are successful in supplying certain outputs or partially meeting purposes and goals. For example, a project may be successful in raising farmer incomes to some extent but not in increasing cropping intensity. Because success and failure are ambiguous terms, there is no attempt here to label sample projects as a success or a failure. Given this caveat, project success or failure can be judged by achievement or lack of achievement of the project's own purposes or objectives, which is a function hypothetically, of timely and effective delivery of physical, institutional and other outputs.^{3/} Information regarding these achievements is provided in the project sheet for each project (Vol. III). This was the only fair method of judgment because our sample included projects dating from different eras in development theory and because many different types of project purposes are set out in various types of irrigation projects.

To determine whether project purposes were met, we necessarily relied on the data supplied in the evaluation. Our attempt was not to allow implied or imagined results to affect classification of successful goal or purpose achievement or lack thereof, but to take evaluator's comments literally. We held interviews concerning several projects where data were missing, and took the liberty of incorporating this information into our "evaluative materials" in only one project. (Evaluative material used is specified for each project in the data base (see Appendix B)).

4. Lack of Impacts

As Figure 1 illustrates, individual projects may affect political structure, demographic patterns, cultural

^{3/} For an example of the use of regression analysis to link particular outcomes to specific project innovations, see Deepak Lal, Wells and Welfare: An Exploratory Cost-Benefit Study..., 1972.

traditions, patterns of communication and patterns in employment and the distribution of wealth. Project impact includes changes of these types which occur in the immediate area of a project as well as net regional or national change.

Before discussing the impacts of projects in more depth, a humbling note is in order. While some projects have enormous impacts on physical landscape and economic and social structure, others have very little influence on ancient social systems. Other projects support economic or social changes whose evolution is a result of complex factors coming together beyond the scope of a single development project. The assumption that major change in social orders may come from a 2 - 5 year project is sometimes questionable. One interviewee pointed out that some projects have more impact on donor or administrative agencies than on target populations.

E. INTRODUCTION OF HYPOTHESES

The hypotheses presented below support program approaches to irrigation projects which merit further field testing. They are classified as sociocultural, economic or financial, institutional, agricultural, technical or environmental. The classification process was slightly arbitrary. Where a specific project input was favorably depicted, such as earthen canals, the hypothesis was classified according to the nature of the input. Where effects were under consideration and inputs are external to the project, the hypothesis was classified according to the nature of the effect. This is particularly true for sociocultural hypotheses.

Several hypotheses were added to the original group as a result of further study of the literature on social impacts and findings of IBRD projects.

1. Sociocultural Impacts

The dividing line between sociocultural impacts or effects and economic/financial impacts was drawn so that questions of water management by local cooperative organization, land tenure, equity, and changes in local political structure are included in this section. Employment and income effects per se are discussed as economic and financial effects and farmer willingness to take risk as an agricultural factor although the factors clearly have a sociocultural content.

2. SOCIOCULTURAL HYPOTHESES

Hypothesis #1

Project areas where villages are governed by a council, either elected or appointed, show greater potential for equitable decision-making about water use than areas where villages are dominated by a small number of large landlords.

Hypothesis #2

In areas of the world where sharecropping continues, land registration (where survey teams record leases) offers temporary security for tenants on irrigated land.

Hypothesis #3

Rotation systems of water distribution are more likely to lead to equitable water supply for farmers at tailworks of irrigation systems whose location often identifies them as relatively lower-income farmers.

Hypothesis #4

Successful irrigation projects located near urban areas generate urban out-migration which can be controlled through closed water users associations.

Hypothesis #5

The shift from volunteer to paid labor for construction of irrigation works and in responsibility for construction

from local groups to official regional or national bodies increases local awareness of nationhood at the cost of weakening local social structure.

Hypothesis #6

Technical assistance to farmer-builders, with no payment for construction labor, is more likely to instill a sense of ownership and incentives for system maintenance than does payment in cash or kind.

Hypothesis #7

The capacity of communities to open up land for irrigation and to construct delivery systems is likely to be higher in those locations where rudimentary systems exist than in locations attempting irrigation for the first time.

Hypothesis #8

Irrigation water serves fields from which male family members receive greatest remuneration, while potable water projects are more likely to serve market gardens from which women benefit.

3. ECONOMIC/FINANCIAL HYPOTHESES

Hypothesis #9

The most effective method to augment the income of the poorest rural population, the landless, is through increased employment opportunities on and off the farm, brought about by increased agricultural production.^{4/}

^{4/} "For ... the landless, near-landless, and marginal farmers - only increasing employment opportunities in rural areas provide any source of hope." "The available evidence suggests

Hypothesis #10

Where irrigation projects are carried out in conjunction with land reform programs, positive income distribution effects of irrigation projects are more likely than where income impacts are blunted by customary rates of sharing between landlords and sharecropper farmers.

Hypothesis #11

Irrigation investments predicated on farmers' willingness to change from single to double or multiple cropping systems are successful for selected crops and in areas where farmers have strong incentives, such as good producer prices and where consumer goods are available for purchase.

Hypothesis #12

Projects introducing one factor of production at a time generate a faster return to small farmers than those introducing several factors simultaneously such as resettlement programs introducing land, water, and institutions simultaneously or hydroelectric facilities jointly introducing power and water.

Hypothesis #13

Recovery of construction and/or operation and maintenance costs of irrigation systems through taxes or water charges inhibits water waste, and strengthens farmer responsibility for the system.

Hypothesis #14

Canal rehabilitation projects generate a faster financial return for farmer participants and a faster economic return overall than do projects which provide for major construction or sophisticated systems like drip or sprinkler irrigation systems.

Hypothesis #15

Demonstration farms are effective as research stations but have minimal spread effect unless farmers perceive that the inputs (seeds, fertilizers, pesticides, tools) of similar quality and quantity are available to them.

Hypothesis #16

In societies where village membership (rather than ownership of land) confers water usage rights, lenders for irrigation improvements who accept joint liability of farmers proving local residence and previous production ability, rather than requiring land as collateral, will encourage small farmers to borrow.

4. INSTITUTIONAL HYPOTHESES

Hypothesis #17

Locally-managed irrigation systems are generally better maintained and more efficient in water control than state-operated systems and can more effectively time water application to coincide with crop requirements.

Hypothesis #18

Benefits, such as increased crop production and more effective water usage from irrigation systems, are enhanced when continuing extension services explaining on-farm water management principles and proper cropping techniques are available.

Hypothesis #19

Irrigation technologies and water-users' associations are more successfully introduced in areas where extension work carries prestige and provides a better than average existence for the extension worker, than they are in areas where extension personnel turnover is high or where extension services are not provided.

Hypothesis #20

Formally-structured water users associations (as defined by a constitution, procedures, regulations, and memberships) are an essential prerequisite to efficient operation and maintenance of an irrigation system.

Hypothesis #21

Where irrigation projects include a new technical package (seeds, equipment, fertilizer, pesticides) as part of the inputs to the farm, local infrastructure (including transportation, storage, and credit facilities) should be sufficient to insure that the package can be delivered at the appropriate time in the cropping cycle.

Hypothesis #22

Organization of user groups around distinct subcomponents of canal networks or other physical components of irrigation systems, rather than on a community-wide basis, improves the performance of routine maintenance and operation.

Hypothesis #23

Because of extreme variations in supply of water caused by rain, closure of canals for maintenance, and imperfections in canal design and location, legislation governing water distribution and water rights must be flexible enough to provide for sale and trade of water by local water user associations.

5. AGRICULTURAL HYPOTHESES

Hypothesis #24

Agricultural innovations, such as precision land-leveling and canal construction which rely on available farmer labor or fallow fields, or willingness to incur debt, should be introduced over several seasons with an expectation of modest improvements in yields and incomes, as subsistence farmers often cannot afford to remove land from production, contribute their time or assume debt at project commencement.

6. ENVIRONMENTAL HYPOTHESES

Hypothesis #25

Control of snails which are vectors for schistosomiasis is promoted by clearing of weeds from canal banks.

Hypothesis #26

Management of surface and groundwater resources as parts of a closed system prevents depletion of water resources in one area at the expense of another.

6. TECHNICAL HYPOTHESES^{5/}

Hypothesis #27

Without land-leveling, poor drainage of irrigation water lowers water application efficiencies and, in some areas, takes land out of production.

Hypothesis #28

Earthen lateral canals are more cost-beneficial than concrete-lined laterals when correctly compacted and can be constructed and maintained by farmers.

Hypothesis #29

In conjunction with adequate disease vector control, fabrication of canal turnouts in concrete allows for use of turnouts for human bathing and for watering of cattle, while preventing destruction of canals and impaired delivery of water to fields.

Hypothesis #30

Detailed pre-study of classes of soils in the project area is critical to determine water requirements and appropriate crops.

^{5/} Hypotheses concerning technical aspects of irrigation were derived from review of projects and current research in the field. Emphasis was placed on selecting technical hypotheses at a level understandable to the layman, and upon selecting hypotheses which reflect substantially the current "state of

F. TEST OF HYPOTHESES AGAINST EVALUATION FINDINGS

1. Comments

In both the case of AID and IBRD, only a few hypotheses (five and four respectively) have applicability in a third to half the projects in that sample. The hypotheses that apply in each case substantially reflect the different orientation the organizations have had toward irrigation projects.

AID lending in support of irrigation projects has placed more stress on development of local water user organizations while the Bank is more concerned with development of project administrative capability in government agencies, and frequently supports ministerial-level training and development. Recently, AID has placed greater technical emphasis on water management on the farm, whereas Bank concerns continue to focus on wider regional hydrologic and soil planning activities.

Bank projects provide more information on the economic effects of sharecropping and land reform on project results. Hypotheses on these issues are more likely to be relevant to Bank projects. AID irrigation projects in the sample placed greater weight on extension services as a factor in the operation and maintenance of canals than did Bank audits. Hypotheses in the area of extension pertain more directly to AID cases.

Hypotheses are presented below in three categories: principal hypotheses supported by 3-5 cases from either the IBRD or AID samples, relevant hypotheses which had support from 2-3 AID and/or IBRD cases but were refuted as often as

they were supported, and hypotheses requiring further testing supported by one case or by none. Several hypotheses were developed during the second stage of this study as a result of findings in the literature and results of IBRD projects. Several of these could not be tested against AID project results because documentation was no longer available.

2. Principal Hypotheses

HYPOTHESIS #17

Locally-managed irrigation systems are generally better maintained and more efficient in water control than regional or state-operated systems and can more effectively time water application to coincide with crop requirements.

AID: 6 Cases

Many active and planned small- and medium-scale irrigation projects place heavy emphasis on either introducing irrigation technologies through existing water-user associations or strengthening or organizing associations. The organizations vary in size and formal structure. They include Irrigators' Associations in the Philippines, the Farm Land Improvement Associations (FLIA) in Korea, Water-User Associations in Indonesia in Pakistan and Farmer Groups (Left and Right Bank) in Laos. Communities in Haiti and Nicaragua relied on government agencies for operation and maintenance of irrigation systems. In Chad, continuing operation and maintenance following official completion of the project was a chief concern of the evaluator. For reasons of topography, the Bangladesh project involved installation of tubewells on the theory that operation and maintenance of wells would be provided by individual owners.

Projects operated by local organizations were generally those AID evaluators noted as having been best-maintained.

IBRD: 3 Cases

The IBRD has placed greater emphasis on institution-building at the level of the central government. In only one case did loan conditions provide that foundations for water users associations be laid. In two additional projects in Indonesia and Malaysia, farmers' organizations were formed through government initiative outside of the project.

HYPOTHESIS #19

Irrigation technologies and water-user associations are more successfully introduced in areas where extension work carries prestige and provides a better than average existence for the extension worker than they are in areas where extension personnel turnover is high or where extension services are not provided.

AID: 5 Cases

It appeared that in a number of projects, extension agents or provincial agricultural officers play a crucial role in introduction of precision land-leveling, reconstruction of canals, organization of water-user associations and management of demonstration farms. In several projects the lack of sufficient "change agents," or presence of under-skilled or ineffective extension agents, was a crucial element in the slow start and/or unsatisfactory results of the project. Projects in Nicaragua and Pakistan suffered the most from lack of reliable extension service. However, effective extension agents were one of the most impressive aspects of the two Philippine projects.

Where a lack of sufficient effort by "change agents" is given as a cause of failure to attain project purposes in the time allotted, several other causal factors are also identified. These include low pay and irrelevant recruitment standards. Requiring college degrees unrealistically restricts the available labor pool. Conversely, recruitment standards may be so low that extension agents are no help. Job insecurity for extension agents working on projects of short duration cause qualified personnel to abruptly leave the project. Some of these problems may be found in several combinations in a number of projects. In some developing countries, extension work is viewed as "low-status" employment, and therefore extension workers do not enjoy sufficient prestige to be effective in the farm community.

IBRD: 5 Cases

In the Madagascar project, agricultural support services were not budgeted separately. The regional development agency lacked funds, expertise in water management, and competent extension agents. In a Colombian project, the regional development agency lost personnel because of low salary scales. In the first case, poor water management resulted; in the second, where sprinkler irrigation was used, new crops were not satisfactorily introduced.

A lack of technical assistance in irrigation was faulted in a Philippines case, while in two other projects in Peru and Malaysia extension services were considered inadequate. In the Peru project, one consequence was overwatering as farmers believed that the more water plants received the better their production would be. Shortages of extension agents in the Malaysia project meant too few farmers received advice on multiple-cropping, new seed varieties, and land preparation.

A number of AID and IBRD projects included training components for extension or provincial agriculture support personnel. Such training ranged from on-the-job training to organized classroom education courses. However, it appears from the design and evaluation reports that training components are frequently underbudgeted or underplanned, and often do not succeed in accomplishing the results envisioned in the irrigation project papers. Regardless of training efforts, several AID evaluations pointed to the conclusion that direct assistance to the development of extension services may be essential to achievement of project purposes in irrigation projects.

HYPOTHESIS #24

Agricultural innovations, such as precision land-leveling and canal construction, which rely on available farmer labor, fallow fields or willingness to incur debt should be introduced over several seasons, with an expectation of modest improvements in yields and incomes as subsistence farmers are often unable to afford to remove land from production, contribute their time or assume debt at project commencement.

AID: 4 Cases

This hypothesis focuses on the difficulty the "poorest of the poor" may have rapidly accepting concepts of deferred incomes and investment. Four case studies were projects where inputs from small farmers were expected but failed to materialize. The inputs anticipated or assumed included land, financial involvement, management and labor. In cases involving land, fine-tuning of irrigation technology through precision land-leveling was planned. Small farmer fields were to

be leveled, but evaluators explained that many small farmers found they could not take land out of production for long enough periods to make this improvement. In several projects eight percent interest rates on repayment of irrigation system construction were planned, but even these rates had to be cut in half to enable water-user organizations to carry the loans and avoid having members deprived of their livelihoods. One project was predicated on supplies of materials for handpumps to be purchased for irrigation by small farmers. In the interim, prices of materials caused the pump price to rise beyond what the small farmer could afford. Finally, two rural development projects were critiqued by evaluators because local leaderships, rather than community organizations of small farmers, were requesting improvements in irrigation systems. "If HACHO's (a Haitian project) supporters are willing to make a long-term commitment to the prospect of moderate gains achieved on a gradual basis, HACHO should proceed to formulate and carry out a Type 2 (non-capital intensive) strategy. But there should be no illusion about the extent of progress which is possible or the long-term nature of the project." (HACHO evaluation.) It is apparent that although the emphasis has shifted from serving the entrepreneurial to serving the poorest farmer, the difficulties which had precluded serving the poorest of the poor remain. In view of this fact, it may be suggested that project designers not set unrealistic quantitative targets in project outputs and purposes which "build-in" failure. Modest goals for an effort of this enormity might enable more favorable evaluations for a number of projects. Those who use the Logical Framework are, however, inhibited from calling the project a success by unrealistic targets set in the project design phase. (For several projects in the case study, evaluators formulated revised log frames, or revised targets for this reason.)

IBRD: 3 Cases

Three IBRD projects supported this hypothesis. Stringent collateral requirements in two agricultural credit projects precluded small farmer borrowing. In both cases, small farmers constituted the target group. Investment in minor irrigation, implemented where possible, proved the most profitable in terms of both project returns and returns to farmers, but most loan funds were soaked up by traditional large-holder borrowers. In the second agricultural project an account of the effects of the drought explained that the drop-off in production was such that farmers who had borrowed were left without resources for repayment. They were deemed worse off than if they had never borrowed. Evaluators postulated that after a series of good years, these farmers' situations will improve over pre-project conditions.

In the third project, planned land-leveling efforts were curtailed because lands could be leveled only in the four-month inter-crop period instead of during the entire year as planned and because farmers were reluctant to disturb top soil. This project also involved an indirect farmer input. Canal lining was scheduled in such a manner that project farmers would have been deprived of water at critical times. This finding resulted in rescheduling so that the lining could be done over a much longer period than originally planned.

HYPOTHESIS #27

Without land-leveling, poor drainage of irrigation water lowers water application efficiencies and, in some areas, takes land out of production.

AID: 4 Cases

This is the single technical hypothesis for which we could find substantial support in our limited and somewhat uneven data base. This hypothesis considered with the previous hypothesis, highlights the complexity involved in making changes in irrigation systems. On the one hand, uncontested technical evidence is given in project papers for the usefulness of the technology of land-leveling to enable effective use of water. On the other hand, small farmer subsistence needs make it prohibitive for them to take land out of production to be leveled so that they may reap the benefits of improved crop yields. In four AID projects we reviewed, land-leveling had successfully increased yields. Two of the cases involved demonstration farms. The others involved farmers' fields; in one case leveling was cited as causal in increasing yields, in the other, lack of leveling allowed pooling of water and salinization and was cited as causal in holding crop yields below average. The study team is not technically-equipped to discuss irrigation technology in greater depth. However, it would appear that in projects where small farmer concerns are not limiting factors and land-leveling is not planned, it could be explored as a technique for improving yields.

IBRD: 1 Case

Although drainage problems are discussed in a number of projects, land-leveling was planned in only one. A second project audit stipulated that land-leveling represented a needed next step.

HYPOTHESIS #30

Detailed pre-study of classes of soils in the project area is critical to determine water requirements and appropriate crops.

IBRD: 5 Cases

AID: 0 Cases

Most Bank and AID projects provide soil and water data at the design phase. In the IBRD cases the soil studies were apparently not adequate. Several cases where Bank audit reports found significantly lower than projected rates of return revolved around soils that could not be developed as appraised because they were too saline, too alkaline, too coarse, or because of unfamiliarity of all concerned with an unusual soil such as peat. Shortages of both river and groundwater also appeared. The explanation for these shortfalls in the Bank cases which did not appear in the AID cases may be that the IBRD sample included larger project areas or more projects where irrigation investment is being undertaken for the first time than did the AID sample. The AID projects were in some cases follow-up projects designed to address problems such as soil salinity, discovered earlier.

The finding of project management that areas planned for inclusion in the irrigation system had to be deleted meant that farmers had to be resettled a second time. These farmers suffered a significant loss of enthusiasm for participation in the project.

HYPOTHESIS #12

Projects introducing one factor of production at a time generate a faster return to small farmers than those introducing several factors

simultaneously such as resettlement programs introducing land, water, and institutions simultaneously, or hydroelectric facilities jointly introducing power and water.

IBRD: 4 Cases

Projects which were directed at irrigation investment without major shifts of population or heavy infrastructure requirements showed greater overall returns and faster returns to small farmers. The single rehabilitation project in Indonesia is a case in point. A second project in Mexico had positive income and redistributive effects after regular water supplies were made available.

Alternatively, the third case in Colombia was a project which combined resettlement with irrigation investment and was extremely unprofitable. In a fourth case in Madagascar, infrastructure for resettlement and for irrigation could not be provided for at the same time because of shortages of funds within the project development agency and farmer disinterest in relocation.

AID: 1 Case

Only one project in the AID sample was multi-faceted. This project suffered from coordination problems but the possible negative effect on ultimate project success was not measurable at the time of the evaluation.

HYPOTHESIS #10

Positive income distribution effects are more likely where irrigation projects are carried out in conjunction with land reform programs than where income impacts are blunted by customary rates of sharing between landlords and sharecropper farmers.

IBRD: 4 Cases

Splitting his harvest or harvest income with the landlord was a significant deterrent to increased farmer participation in two projects in Afghanistan and Malaysia. Land reform through assertion of squatter claims markedly improved redistribution effects in a Peruvian project. In the fourth project in Colombia, income increased when tenants received farms of their own.

A positive national income redistribution effect was registered for IBRD projects in Colombia and Malaysia because the project represented investment in a relatively poor area of the country. Redistribution of income within a small region appears to be both more difficult to effect and even more difficult to verify. In the Mexican project, evaluators noted that more farmers were receiving a larger proportion of the income generated in the area (88% instead of 82%) than they had before the project began. Another project in Colombia reaches tentative conclusions about positive redistribution effects as a result of successful land reform in the project area.

Five projects recorded no positive effects and three provide no information.

AID: Insufficient evidence

This hypothesis was tested in the first stage against AID projects. Project design documents specified whether beneficiaries were tenants, sharecroppers or owners but evaluations were not conclusive on the subject of distribution of benefits.

HYPOTHESIS #9

The most effective method to improve incomes of the poorest rural population, the landless, is through increased employment opportunities on and off the farm, brought about by increased agricultural production.

IBRD: 4 Cases

Discussion in relevant literature and the consistent concern of the Bank evaluators with employment impacts of projects generated this hypothesis. Only one sample Bank project in Mexico specified employment generation as a direct objective. However, the audit and completion reports for this project and three others provided indications of either wage increases in the project area or job creation. The first Mexican project where employment generation was an objective relied on measures of increases in area wages as a percentage of national wages to show the objective had been met. This project and two others relied on either local reports of increased labor demand or measurement of rising wages to imply positive employment impacts. The fourth project, in Peru, shows creation of 5,000 jobs directly by the project and about 1,500 indirectly. These are hypothesized to have gone to low-income groups. In all four projects, the jobs or increased wages may be linked to production increases and/or increases in small farmer income.

AID: 1 Case

One AID project, Libmanan/Cabusao in the Philippines, showed increased on-farm employment as a major goal. The employment effects of the project exceeded expectations but it is unclear whether jobs were generated by increased agricultural production on-the-farm or off-the-farm in irrigation construction.

3. Relevant Hypotheses

HYPOTHESIS #11

Irrigation investments predicated on farmer willingness to change from single to double or multiple cropping systems are successful for selected crops and in areas where farmers have strong incentives, e.g., good producer prices and consumer goods available for purchase.

AID: 2 Cases

This hypothesis developed from discussion with AID irrigation project designers. Increased crop yields in several projects were predicated on farmer willingness to plant crops during the dry season. In many cases, the assumption was borne out. In two AID projects (Philippines and Chad), farmers had ready markets for crops for which prices were not controlled. It was the assumption of project designers that a change in cropping intensity would not occur in areas where farmers could find off-farm employment more lucrative. The hypothesis was disproven for AID projects in that we found no instances where some change in cropping intensity was not registered.

IBRD: 4 Cases

Four of the Bank projects were designed to increase cropping intensity. In three cases, no change was registered but the cause could not be related to lack of farmer incentives because of poor prices or non-availability of retail goods as the hypothesis suggests. The highest crop intensity recorded in IBRD samples was 191 percent in a Malaysian project. This case does not support the hypothesis as the project area appears depressed and remote from commercial areas. (This compares with an average high of 150 percent for other sample projects in rice production.)

The hypothesis is refuted.

HYPOTHESIS #7

The capacity of communities to open up land for irrigation and to construct delivery systems is (likely to be) higher in those locations where rudimentary systems exist than in locations attempting irrigation for the first time.

AID: 3 Cases

The Sederhana (Indonesia), Afghan Rural Works and Small-Scale Irrigation (Bangladesh) projects were designed to enlarge irrigated areas where farmers had some previous experience or opportunity to observe irrigation systems, either wells or canal systems. Technical problems in installation and resistance to the system were not recorded in these projects as they were in two South American projects.

IBRD: 2 Cases

The Indian project and a Peruvian project were designed to increase irrigated areas where farmers had prior experience. Neither project recorded resistance to the innovation nor did they reflect technical difficulties arising out of farmer ignorance relative to use of the system.

HYPOTHESIS #18

Benefits, such as increased crop production and improved water usage in systems, are enhanced when continuing extension services explaining on-farm water management principles and proper cropping techniques are available.

AID: 2 Cases

This hypothesis was developed upon review of the work of Colorado State University in Pakistan, where it was determined that improvements in existing irrigation systems at the farm level could greatly increase water application efficiency and increase the returns from irrigation of crops. Two AID projects, both in Pakistan, provided on-farm water management-type

services. Both were hampered in the number of farms they could reach by insufficient numbers of extension agents. (A third project provided information about poor management of water on the farm but the nature of extension services was not discussed.) Projects which implemented on-farm water management plans and showed improved yields generally included improved extension efforts.

IBRD: 3 Cases

Bank projects discussed "on-farm development" or "on-farm development works." The difference between the use of this term and the term "on-farm water management" is that the former appears to include any inputs from wells to houses which are provided within farm boundaries while the latter is limited to irrigation systems.

On-farm development was discussed in many evaluations but was not one of the purposes of most projects. Discussion of excessive use of water on the farm in project reports for Peru and Malaysia indicates problem recognition. However, there was little emphasis on on-farm water management in either project. Both project reports recorded insufficient extension support.

The project which registered the greatest increase in crop yields was the Indonesian irrigation rehabilitation project, where paddy rice yields went from 2.0 metric tons/hectare to 4.0 metric tons/hectare. (FAO averages for paddy rice production in Asia are 2.5 metric tons/hectare). A portion of the increase was directly attributed by auditors to the canal rehabilitation, another portion was attributed to provision of a new technical package by the government. However, extension services in all subproject areas were reported to be good.

HYPOTHESIS #20

Formally-structured water-users associations (as defined by a constitution, procedures, regulations, and memberships) are an essential prerequisite to efficient operation and maintenance of an irrigation system.

AID: 3 Cases

This hypothesis was supported by AID project findings. However, the Sederhana program in Indonesia which encouraged "legitimization" of water-users associations through official registration, also recognized the efficacy of informal organizations in performing routine operation and maintenance of systems. Incorporation of water-users associations is a primary goal in irrigation projects in the Philippines. Without official registration, the ability of the organization to obtain credit and support for irrigation construction is imperiled. Legalization of ad hoc water-users associations in Pakistan is equated with "permanentization" (sic) and is ranked "very important" by the evaluation team.

Legalization of a water users association in and of itself does nothing to increase production in a particular project. However, there is evidence that giving the association a sound legal foundation tends to improve maintenance and operation of the system and to open up channels of financial and technical assistance. These elements may well lead to greater production. In some areas, water users associations are viewed, however, as conduits for additional agricultural information, and indeed, as associations through which villagers can be integrated into the political structure. One evaluator at least questions whether water-users associations without water are

viable, and suggested that the need for water, rather than the need to organize, was at the center of the organizations and that use of them for purposes beyond irrigation might be difficult.

IBRD: 1 Case

Providing a legal basis for organization of water-users associations was a condition of a loan (Afghanistan). Because of neglect of this provision by the government, no conduit for credit for investment in irrigation systems was available. Small farmers, for whom these associations provide some method of articulation, were severely disadvantaged. There are no informal associations in the project area.

The hypothesis is not refuted but is supported by a total of only four cases.

HYPOTHESIS #6

Technical assistance to farmer-builders, with no payment for construction work, is more likely to instill a sense of ownership and incentives for system maintenance than is payment in cash or kind.

AID: 3 Cases

"Voluntary labor contributions by cultivators represented the primary input into the ongoing operation and maintenance of local irrigation." (Indonesia Sederhana Project). In the HACHO (Haiti) Project evaluators commented on the change in the attitude of rural villagers towards contributing labor for food following institution of a free food program during the drought.

The belief that government agencies do not invariably expect beneficiaries to contribute directly to projects from which they will reap returns had great impact. Evaluators questioned the Food-for-Work program in this regard in both Haiti and Afghanistan. Evaluators in the Afghan project felt that water-course improvements which were funded through a direct pay-off for farmers should have been constructed by farmers voluntarily.

IBRD: 3 Cases

In one of the Bank projects (Philippines), lack of technical assistance to farmers relative to the installation and operation of small irrigation systems was cited as a major constraint on the irrigation component of the project. This result supports the hypothesis. In two other projects, however, farmers had to be paid to improve most of the tertiary canals. No record is available of farmer willingness to maintain canals and "own" the system once constructed, particularly because one system will require the investment in additional canals if a change from field-to-field flooding is to be made. Maintenance problems such as the failure to clean weeds from canal banks have been recorded. This hypothesis is neither confirmed nor refuted by the results.

HYPOTHESIS #3

Rotation systems of water distribution are more likely to lead to equitable water supply to farmers at tailworks of irrigation systems whose location often identifies them as relatively lower-income farmers.

AID: 3 Cases

This hypothesis is substantiated by a number of projects as well as by the general literature. Irrigation systems, whether canal/pump systems or well-driven systems, are rarely technically good enough to insure that all locations can be equally served through continuous flow irrigation.^{6/} Rotation of turns for water supply enables water to be supplied for longer periods when it has farther to travel, for example, to reach farmers at tailworks. Often, however, rotation systems must be managed at the regional level to insure equity.

In the Sederhana project, in areas where irrigation systems had historically been managed cooperatively, rotation systems were in use directed at rectifying inequities in water distribution. These rotations were managed by a single local leader, generally a water master. However, in other systems in Pakistan and Laos, local water masters distributed water inequitably, and cultivators at tailworks of systems expressed dissatisfaction.

The original hypothesis developed was "Rotation of irrigation turns, managed by a local water master, leads to a more equitable distribution of water to farmers at tailworks of systems than does continuous flow irrigation." It was modified in response to findings that local water masters in some communities are not able to deliver water (in any system) equitably.

^{6/} Westley suggests that two methods for insuring equitable water distribution are the indirect--through technical improvement, and direct--through management and timing of distribution, p. 27.

Also,

"It may not be technically possible to carry canal water or feeder roads to the farm gate of the typical small producer, or to provide him with equal access to a crop processing facility. In such cases it often requires the establishment of an appropriate institutional infrastructure to ensure that physical infrastructure facilities serve the desired development purpose." McInerney, p. 17.

Particularly in villages where cooperative norms have eroded, specialized organizations above the village level are required to effect rotation. This is also true where customary water rights oppose efforts to distribute supplies equitably.

IBRD: 2 Cases

Two Bank projects registered complaints that farmers at tailworks (tertiary canals) received less water than those with land near the main or secondary canals. In one of these, a rotation system was planned as part of the follow-on project. In the second, lack of assurance regarding water supplies impeded borrowing for irrigation development by "downstream" farmers. A related concern was expressed in a third project where farmers at tailworks could not receive cooperation of "upstream" farmers to improve canals supplying them. The project scope was eventually expanded to include support for reconstruction of these tertiary canals.

The rotation method of distribution as a means to insure equity is generally supported.

HYPOTHESIS #14

Canal rehabilitation projects generate a faster financial return for farmer participants and a faster economic return overall than do projects which provide for installation of sophisticated systems like drip or sprinkler irrigation.

AID: 2 Cases

One AID project in Nicaragua planned for installation of a sprinkler system to irrigate cotton and corn. As a pilot

for small farmers, the project was a failure. High costs per manzana (unit of farmland) and per family invalidated the project's feasibility as a pilot for small farmers.

In contrast, the evaluation of a rehabilitation project in Indonesia states that costs are well on the way to being recovered.

IBRD: 2 Cases

This project was, like AID's, in South America, designed to irrigate high-value crops by a sprinkler system. The project had a rate of return below 5 percent (after a projected 11-25 percent rate). High-value crops could not be raised and the choice of a sprinkler system was deemed inappropriate.

In contrast, the canal rehabilitation project yielded rates of return of 30 percent. Isolating these technical aspects and generalizing from two projects is dangerous. However, sprinkler investments were estimated to cost roughly US\$8,000/hectare in yet another (non-sample) project discussed in the literature as opposed to costs of between US\$600 and US\$1,700/hectare in the sample rehabilitation project.^{7/}

HYPOTHESIS #28

Earthen lateral canals can be constructed and maintained by farmers and when correctly compacted are more cost-beneficial than concrete-lined laterals.

^{7/} Miles G. Wedeman, "Irrigation: Paradox for Sahelian Development" REDSO/AID Paper, March 21, 1977.

AID: 1 Case

This hypothesis was developed from AID project results in Pakistan. Decreased maintenance requirements make concrete-lining of tertiary canals extremely attractive to farmers and to some project designers. Frequently, concrete-lining can be done only at prohibitive cost. One consequence of lining is that when maintenance is required, special technicians must be called in. Farmers may no longer maintain irrigation works. In the AID project in Pakistan, technical assistance to farmers enabled very satisfactory results in water conveyance efficiency to be obtained with correct compaction of earthen canals. Farmers were dissuaded from their emphasis on concrete.

IBRD: 2 Cases

Two IBRD projects provided for canal lining. Although lining was a major objective, crucial to the switch from use of ground to use of surface water for irrigation, in the first project, the cost-effectiveness of the measure could not be quantified.

In the second case, incorrect compaction as a result of a shortage of skilled construction advisors caused erosion, sliding, and slumping of canal embankments. In addition, mission members found that some of the secondary and tertiary canal structures in concrete and masonry were "more massive than required." This case does not point to a lack of need for lining of secondary structures, but merely emphasizes the importance of correct compaction of earthworks and the predilection towards "overbuilding" of canals.

This hypothesis is supported, in a limited way.

4. Hypotheses Requiring Further Testing

HYPOTHESIS #22

Organization of user groups around distinct subcomponents of canal networks or other physical components of irrigation systems, rather than on a community-wide basis, improves the performance of routine maintenance and operation.

AID: 1 Case

This hypothesis was supported by one AID project in Laos. In others, too little data on the way in which water-users' organizations were formed was available to test the hypothesis sufficiently. It is our suspicion, however, based on limited information, that this hypothesis deserves wider testing.

IBRD: 1 Case

One IBRD project contradicted this finding. The lack of coincidence between boundaries of tertiary canal systems and village boundaries is listed by the Indonesia evaluation report as a constraint to farmer cooperation on construction. Support for organization of user groups around the village community is implied.

HYPOTHESIS #29

In conjunction with adequate control of disease vectors, fabrication of canal turnouts in concrete allows for use of turnouts for human bathing and watering of cattle, while preventing destruction of canals and impaired delivery of water to fields.

AID: 1 Case

In one AID example from Pakistan, it was easier to adapt small areas of canals to social and economic uses to which they were already subjected than to try to train villagers not to use them. The expense of fabricating concrete turnouts had to be amortized but was worthwhile in terms of alleviated maintenance and water waste prevented. Information at this level of detail is not available from many evaluations.

IBRD: 1 Case

However, in one IBRD project in Indonesia the need for this type of structure is also mentioned.

HYPOTHESIS #25

Control of those snails which are vectors for schistosomiasis is facilitated by clearing of weeds from canal banks.

AID: 1 Case

IBRD: No information

In the Philippine Small Farmer Systems project, a substantial environmental review was completed which recommended weed-clearing. Minimal environmental information for most projects prevented testing of the hypotheses regarding the spread of water-borne diseases.

HYPOTHESIS #5

The shift from volunteer to paid labor for construction of irrigation works, and the shift in responsibility for construction from local groups to regional or national bureaucracies increases local ties to the state at the expense of local social structure.

AID: 1 Case

This hypothesis was developed from the irrigation literature and from the Sederhana project which had a thorough social impact analysis accompanying the project paper. Some evidence exists to demonstrate that although farmers may increasingly rely on state services whether or not projects interfere in their lives, this process is hastened when functions previously performed, however poorly, by local informal organizations are subsumed under project operations.

IBRD: 2 Cases

The Indonesian canal rehabilitation project and a Malaysian irrigation project both ended up paying farmers to construct some tertiary canals, although initially project evaluators thought work would be performed voluntarily. The need to switch to paid employment in the Indonesian case is attributed to decline in voluntary labor throughout Java and to unwillingness to work on canals which lead past one's own fields downstream if one were already well-supplied. Farmers were motivated to work voluntarily on canals adjacent to their fields and when they could perceive possibilities to obtain some water during the dry season.

58'

Whether organization of labor and institution of a pay system affects farmer willingness to operate and maintain canals after construction is unknown. In the Indonesian case, labor was paid under rural works projects administered by village leaders. It is likely that impact on local social structure in that project at least was minimized.

HYPOTHESIS #13

Recovery of construction and/or operation and maintenance costs of irrigation systems through taxes or water charges inhibits water waste and strengthens farmer responsibility for the system.

AID: Not tested

IBRD: 3 Cases

This hypothesis was developed after repeated reference was made to collection of water charges as an issue within the Bank.^{8/} After nearly ten years, the need to emphasize cost recovery in projects remains at issue. Borrower attitudes towards the Bank's requirements in this area are not entirely favorable, often because of the political difficulty of imposing water charges on newly-enfranchised farmer or because logistic difficulties prevent fair assessments of costs. Two cases from the Bank sample provide unusually clear examples of the problems and possibilities associated with assessment. In an Iranian project, project designers had planned that charges for irrigation system operation and maintenance would be collected. At the end of the project, it was impossible to collect money; rather the entire system was subsidized. In the Mexico Third Irrigation project, water charges were collected throughout most of the area and were described as encouragement for farmers to refrain from wasting water.

^{8/} See "A Policy Framework for Irrigation Water Changes," World Bank Staff Working Paper No. 718.

HYPOTHESIS #16

In societies where village membership (rather than ownership of land) confers water usage rights, lenders for irrigation improvements who accept joint liability of farmers proving local residence and previous production ability rather than requiring land as collateral will encourage small farmers to borrow.

AID: Not tested

IBRD: 3 Cases

This hypothesis was developed from three projects in India, Afghanistan and the Philippines where agricultural credit was the modus operandi for irrigation development. Rural banks' strict security requirements were constraints to small farmer borrowers. Larger farmers borrowed principally for farm machinery; the security requirement was one in a series of factors which resulted in less irrigation lending, despite relatively high financial return on irrigation investment for farmers.

HYPOTHESIS #26

Management of surface and groundwater resources as alternative parts of a closed system prevents depletion of water resources in one area at the expense of another.

AID: Not tested

IBRD: 2 Cases

This hypothesis was developed from two IBRD projects where hydrologists studied only water supplies in the project

area rather than the potential effect of planned irrigation facilities on water supplies as a whole. In a Mexico project, evaluators state that lack of integrated management of water resources created problems in anticipating water supplies from wells and surface facilities and making projection of benefits over time quite difficult. In the other, in India, well drilling activity conducted before initiation of the project and continuing during the project threatened to deplete groundwater supplies. Wells were not spaced widely enough.

HYPOTHESIS #2

In areas where sharecropping continues, land registration (where land survey teams record leases) offers temporary security for tenants on irrigated farms, facilitating tenant cooperation in physical and financial support of the irrigation system.

AID: Not tested

IBRD: 2 Cases

This hypothesis was developed because research indicated a Bank tendency to require that tenants receive security of some sort on the land they farm prior to Bank support of agricultural investment. Registration is prerequisite to systematic collection of any water user charges or taxes which is another reason for its emphasis. In a Malaysian project, the registration component was neglected which meant that payment of water charges could not be enforced. The second project simply points to insecurity of tenure, a function of an on-going land reform program, as causal in farmer reluctance to borrow for construction of minor irrigation schemes.

HYPOTHESIS #21

Where irrigation projects include a new technical package (seeds, equipment, fertilizer, pesticides) as part of the inputs to the farm, local infrastructure (including transportation, storage and credit facilities) should be sufficient to ensure that the package can be delivered on time within the cropping cycle.

AID: 2 Cases

Although two cases were discovered where inputs other than water were critical to achievement of project yields, this hypothesis proved less applicable than expected to irrigation projects. Many projects are concerned with additional agricultural inputs only after irrigation systems are successfully in place. In addition, evaluators of the projects reviewed commented only briefly on inputs other than the water from the irrigation system.

IBRD: Not tested

Many audit reports referred to additional inputs such as fertilizer being made through government programs but rarely were these a part of the project per se. Problems regarding delivery of inputs were frequently mentioned in the context of improvements which could be made in future projects.

HYPOTHESIS #1

Project areas where villages are governed by an elected or appointed council show greater potential for equitable decision-making about water use than areas where villages are dominated by a small number of landlords.

AID: No evidence

IBRD: No evidence

This hypothesis derives from a paper by Ashfaq Mirza which is a case study of ground and surface irrigation water distribution decision-making in an Indian village. The distribution of political power in an irrigated area is said to have a significant effect on the distribution of water. Even in state-operated systems, some disputes must be resolved and some allocation decisions must be made locally. Landlords invariably sit on bodies allocating water and adjudicating conflicts over water supply. Small farmers are not only situated poorly in relation to main canals, but may have little recourse if their water supply is short. (Research by Hunt and Mirza shows that the presence of large landowners may mean more water for the village as a whole. Communication between the irrigation bureaucracy and particular village is greater when that village includes several large landowners who can entertain officials, however these larger village allocations still may not benefit smallholders.)

Substantiation of this hypothesis will depend on information about local political systems which was not available in project evaluation or design documents.

HYPOTHESIS #15

Demonstration farms are effective as research stations but have minimal spread effect unless farmers perceive that the inputs (seeds, fertilizers, pesticides, tools) of similar quality and quantity are available to them.

AID: 1 Case

This hypothesis grew out of examination of AID projects in Pakistan and Nicaragua. Because the demonstration farm in the Precision Land-Leveling project in Pakistan was not fully operational at the time of the evaluation, the hypothesis could not be applied as expected to that project. In Nicaragua, desired spread effects were not apparent. In the evaluator's view, absence of easily obtainable inputs of similar quality for surrounding farmers was to blame. Mention was made in this evaluation, however, of farmer's copying the irrigation system. Further information on spread effects was not available.

HYPOTHESIS #23

Because of extreme variations in supply of water caused by rain, closure of canals for maintenance and imperfections in canal design and location, legislation governing water distribution and water rights must be flexible enough to provide for sale and trade of water by local water user associations.

This hypothesis was developed from the Reidinger article referenced in the Bibliography and could not be tested against projects in either sample.

HYPOTHESIS #8

Irrigation water serves fields from which male family members receive greatest remuneration, while potable water projects are more likely to benefit market gardens from which women benefit.

This hypothesis was developed from results of one AID project in Latin America. It could not be tested as the role of women was not addressed in either project sample.

HYPOTHESIS #4

Successful irrigation projects located near urban areas generate urban out-migration which can be controlled through closed water users associations.

This hypothesis was also generated by a single AID project, in Chad. It does not appear to define a significant problem area. One IBRD project in Iran shows some absentee farm owners, presumably urban residents, but it is unclear that their role in the area does not predate the project.

G. CONCLUSIONS - IRRIGATION

The conclusions and recommendations for this study are based on comparative review of AID and IBRD materials. Irrigation conclusions represent a synthesis of the supported hypotheses.

1. Incomplete technical design may imperil successful use of water. Unless land leveling is carefully and precisely done, water application efficiency is severely reduced.

2. Locally-managed irrigation systems are generally better maintained and are more efficient in water control than systems dependent upon state operation. This is especially the case where local control is derived from a traditional and solid social structure. Thus, there is a foundation for giving and executing orders, for the review of grievances, and for the correction or sharing of inequities. With state controlled systems, these matters must be handled through governmental procedures and mechanisms which may not be compatible with local customs and regulations. In addition, such a system tends not to be as responsive as the locally controlled system for timely irrigation of crops.

This is not to say that all locally-controlled systems are good and state-controlled, bad. The use of locally controlled systems tends to perpetuate whatever social inequities may exist and indeed these may run counter to the purposes of the project itself. (Likewise, state-controlled systems are generally necessary in large projects, and may be so even in smaller-scale projects.) For example, if a new farming area is being opened up and is to be settled by migrants, then state-managed systems are necessary while transition to local management is investigated.

As a group, AID irrigation projects focus considerably greater attention on the development of irrigation at the farm level while the World Bank irrigation projects focus on development of regional systems. This is the case both technically and institutionally in our sample. AID provides more support to local institutions while IBRD is principally concerned with development of central government organizations which can in turn support local groups.

3. A review of projects and evaluations indicated to us that expectations are too high in regard to the time span required for agricultural innovation to produce results. Examples of the innovation to which reference is made are precision land leveling and canal construction relying on farmer labor, allowing fields to lie fallow or a willingness to incur debt for farm investment. These are concepts well outside the scope of knowledge of subsistence farmers who are generally the first occupants of the newly irrigated lands. Such a farmer is accustomed to looking ahead not much more than one crop cycle and to farming under totally non-scientific circumstances. For a subsistence farmer to embrace intellectually sophisticated concepts such as deferred income requires more time than is generally allowed in estimating future returns from irrigation projects.

4. Irrigation techniques and associations of irrigation farmers appear to be introduced more successfully in those areas where extension is of high quality. The reports to which we have had access indicate that extension work in these areas carried prestige in the local society and provides a better than average existence for the extension worker. In other areas, there was a high turnover among extension workers or, in some cases, little or no extension services were provided.

We must conclude that irrigation projects in particular require a high order of extension assistance. As explained above, the farmer is often making a quantum jump in technology and farming practices and thus requires competent outside help.

5. Projects which initiate irrigation in an area must be based on the most thorough study of soils and hydrology. Feasibility studies must be carefully reviewed by the donor agency. Soils may vary within a proposed project area. When variations are not discovered early enough, either inappropriate irrigation systems are installed or the project must be redesigned.

6. Simpler projects such as those directed at rehabilitation of irrigation systems generate faster returns to the small farmer than large, multi-component projects. The exception to this statement is projects which include land reform with irrigation investment. When farmers no longer have to share their crops with landowners, their incomes are greatly increased.

7. The most effective method to improve incomes and position of the poorest rural population, the landless, is through increased employment opportunities on and off the farm brought about by increased agricultural production. The "poorest of the poor" are the landless or those small farmers whose land at peak production will not provide a subsistence income. These individuals must rely on jobs generated by increased agricultural production in the area stimulated by irrigation and similar inputs to the farm.

H. RECOMMENDATIONS - IRRIGATION

1. The use of simple land-leveling techniques should be encouraged. On-farm water management training should be enhanced. Farmers should be given "hands-on" experience designed to demonstrate that water can be more effectively used if applied in a manner appropriate to their objectives.

2. Particular study and analysis should be made of the patterns of cooperation in project areas among user-farmers. These should facilitate the design of strategies for the organization of water users associations based as they would be on sound and proven sociological and economic experiences.

3. An assessment should be made to determine as precisely as possible the level of economic and financial inputs target populations are capable of providing to a proposed project. Designers should tailor projects (i.e. outputs) to level of these inputs. For example, the willingness of farmers to have their land out of production to enable land-leveling operations should be assessed.

4. The importance of extension services in newly irrigated areas cannot be over-emphasized and this concern should be reflected in inventorying the availability of these services and in planning for their delivery to farmer participants. The availability of extension or "change" agents in the host country should be assessed in depth before this role is assigned to badly under-funded or under-staffed organizations. This recommendation applies equally to provincial as well as central offices if they are expected to assume extension functions. Local or lower level offices do have better contact with target populations but quite often such

offices have a number of other priorities and responsibilities which they are attempting simultaneously to discharge. Therefore, there must be a positive finding that able extension agents will be available to the project and to the participants in a regular and timely manner.

5. Projects introducing irrigation for the first time require thorough soil and hydrology surveys before irrigation systems are designed. A set of general specifications for conduct of such surveys might be developed and compared to contractor proposals.

6. Projects which show the greatest success in achieving crop yield increases and improving the lives of target populations are those which added or improved irrigation with adequate extension support, to a farming area. If agency goals are to support visibly, relatively "quick-yield" projects, simple projects such as rehabilitation schemes might be given priority in project selection.

7. Employment impacts of irrigation projects might be closely examined at the design stage and carefully evaluated. A number of factors which were not encompassed in this study, such as the relation of rising land values after irrigation installation to land consolidation purchases, make long-term employment effects of these projects difficult to predict. However, initial effects of increased production (without mechanization) on employment generation appear positive.

A. INTRODUCTION

Part 2 of the study will discuss the findings of the study with regard to the evaluation reports reviewed and the lessons learned by the study team regarding the present evaluation system at AID and IBRD. The focus of this section is the AID evaluation system. The IBRD system is reviewed for comparative purposes.

The second section (B) provides an account of the search procedure to obtain project information and a description of the data used in the study. Section C discusses the differences in fundamental outlook between the two organizations. Section D gives an overview of evaluation methodology and structure. Section E analyzes how well evaluation objectives are met.

Section F provides the framework of objectives within which the AID evaluation system and comparatively, the IBRD system, are discussed. Section G offers recommendations on directions the AID evaluation system might take. Sections H and I list conclusions and recommendations relevant to evaluation.

B. DATA COLLECTION

This section of the report discusses the documentation used in this study, and the procedures used to obtain it.

Problems encountered in collecting a sample of evaluation and design documents on AID-funded small- and medium-scale irrigation projects are in some respects symptomatic of inconsistencies in the AID evaluation system itself.

1. AID Documentation

The initial task was to cull project names, locations, numbers and descriptions from AID's Development Information Systems (DIS). Searches of four automated systems, TEXT, PBAR, PAIS and BREF, yielded 76, 46, 155 and 35 project titles, respectively.

An abstracted description of the nature and extent of the irrigation component is available only in the TEXT system. It appears that many (PAIS) projects are pre-feasibility surveys. For these reasons, some projects with a very minor irrigation component appeared in the inventory (see Appendix D).

The PAIS system lists old (pre-1974) projects by country, but without isolating them by type. The number of irrigation projects on the PAIS system is difficult to discern because project titles are frequently ambiguous. The TEXT, PBAR and BREF systems access only those projects begun in 1974 or later. We were provided with two earlier reports done for AID on irrigation projects. This enabled the study team to identify older projects.

Evaluation documents which provided information for pattern analysis ranged from Special Evaluations, PAR's (Project Appraisal Reports) and PES's (Project Evaluation Summaries) to brief End-of-Tour Reports and memorandum progress reports. Audit Reports for all projects in the universe were requested.

Because complete information about project purposes and goals is not available in evaluation documents, project design reports such as CAP's (Capital Assistance Papers), PROP's (Proposed Project Papers), PP's (Project Papers), and Social Impact and Environmental Impact analyses and feasibility studies, where available, were included in the search. (As noted in the data base, research and studies in project areas were used as contributing documents for a few projects.)

The initial Statement of Work was predicated on the accessibility of information about irrigation projects administered by AID, available at the Development Support/Development Information and Utilization Branch (DS/DIU). All of the reports named on the BREF system were also supposed to be available at DS/DIU. Manual searches for reports and additional projects were made in the AID Reference Center and the Information Office, offices of DS/DIU. Manual searching involved perusal of shelf documents and evaluations being readied for shipment for copying. Reorganization of the Information Library and the Reference Center and shipment of reports for microfiche reproduction complicated the search.

We found, as DIU personnel had informed us, that the DIS system was incomplete even for projects begun in 1974. The manual search at the Reference Center yielded eight evaluations. Several of these eight lacked project numbers,

however, and the titles do not appear in the DIS readouts. It was unclear whether or not these were AID or other donor-financed projects. The manual search at the information office yielded more numbered evaluations. In summary, the manual search at DS/DIU yielded several new titles but very few hard copy documents.

Check-out of documents was a difficult procedure because it was unclear who had the authority to release them. The reorganization of DS/DIU may clarify where this authority lies. Once the evaluations were moved to the Information Center, we were able to check them out.

The third step in the document search was to contact all four regional Bureaus, both evaluation (DP, Development Program) offices and project planning (PD, Project Development) offices. Obtaining project papers for current projects in PD offices was a straightforward process, as these are generally produced in quantity. Feasibility studies and separate social and environmental impact reports, which may be referenced in the PP, are more difficult to procure. These design documents, as well as those evaluation reports which may have been sent to project offices, are frequently kept in locked files.^{9/} Our manual search at the regional PD offices yielded project design documents and a few evaluation reports.

Regional evaluation offices (DP) had, with a single exception, many gaps in evaluation holdings. The evaluation office in the Latin America Bureau which has been in existence for some time has reports classified by project within countries.

^{9/} Because we did not have current security clearances, it was impossible for us to go through these files, even though the documents sought were unclassified. Very specific requests had to be made for information to minimize the assistance required from regional bureau staff and (frequently) bureau staff was unable to help, so we relied on bulk files.

These can be obtained with a minimum of staff assistance as they are listed in a central log accessible to non-AID personnel. The Asia Bureau evaluation office was recently reorganized. Bureau staff are, themselves, requesting reports from project offices to build their files. They were, however, able to provide us with copies of several reports not previously reviewed. Development of evaluation office in the Africa Bureau was delayed by numerous personnel changes. Reports on older regional projects are virtually all retired or dispersed. Few evaluations of new projects have been received. We were unable to obtain very many evaluation reports covering projects in the Near East and North Africa region.

Another search method for relevant, well-documented, projects was to conduct interviews within the Bureaus themselves. A list of regional evaluation officers, appropriate project officers, and Development Support personnel, was made available to us by PPC. Interviewees suggested other AID personnel knowledgeable about irrigation projects. These were added to the list. The interviews and research at the Bureau level was extremely valuable in narrowing the list of viable projects and highlighting available reports.

Interviews with both evaluation and project officers were a particularly rich source of information about specific projects. Because individuals had frequently served in several posts, their knowledge of projects extended beyond their current area of concentration. Most of these professionals were able to provide capsule summaries of current and past projects and quickly respond to questions about projects listed in our inventory for which we could find no documents. Project personnel provided a reasonably objective explanation regarding project status. Both successful and unsuccessful projects were recalled, in general, with equanimity.

Results of interviews with project officers led us to conclude that the Agency has a substantial untapped institutional memory which may be the only effective source of information within AID on "old" projects. Information about AID projects completed two years before a search is extremely difficult to obtain under the present system. Storage limitations necessitate retiring of files on completed projects annually. Project files are retired in boxes, with more than one project to a box. Therefore, box and lot numbers are required to retrieve a project file. Clear records of these numbers are not available from the Bureau which retired the files. Some projects have two sets of documents, classified and bulk, which are retired in different boxes. The vagaries of the system may explain, in part, why we found no AID personnel who had experience in retrieving documents.

A final source of information was interviews with technical bureau officers, in particular in the Development Support Bureau/Agriculture Office (DS/AGR). Irrigation experts in these offices had collections of irrigation project reports for both design and evaluation stages of projects. Technical officers' own libraries were one of the best sources of relevant documents collected on single projects.

2. Gaps in AID Evaluation Holdings

The purpose of this section is to highlight gaps in evaluation holdings for small- and medium-scale irrigation projects relevant to this report. As indicated in the previous section, evaluation reports for projects over two years old are extremely difficult if not impossible to retrieve.

Evaluation reports for several projects which were terminated for reasons beyond control of the project are not available, even in the form of short completion reports.

There are a number of projects for which evaluations are recorded in the DIS system but which were unobtainable in a search which continued over several months. Centralized hard copy of these documents is currently not available.

Finally, there are evaluation reports available for projects whose concerns are similar to the concerns defined as those of small- and medium-scale irrigation projects, but which the cognizant Bureau deemed inappropriate for use in our study.

The following list shows projects for which evaluation holdings are incomplete. The last part of this list shows several projects for which evaluation reports are due within the next year.

Retired projects files: evaluations not retrievable

Irrigation Construction (489-0706) - Korea
On-Farm Water Management (277-0526) - Turkey
Rahad Irrigation (650-0100) - Sudan
Water and Irrigation Project (664-0178) - Tunisia

Terminated projects: evaluations not available

Cotonou Bridge/Dam (625-0009) - Niger
Sidamo Water Development (663-0167) - Ethiopia

Missing evaluations

Bakel Small Irrigated Perimeters (685-0208) - Senegal
Irrigation Construction (489-0211) - Korea
MONA/SCARP IIB (391-0221) - Pakistan

Project evaluations deemed inappropriate by Bureaus

Doukkala-Semamra Irrigation (608-0127) - Morocco
East Ghor Canal Extension (278-0193) - Jordan
Triffa Irrigation (608-0126) - Morocco
Zarqa Triangle (278-0179) - Jordan

Relevant projects: evaluations to be completed in the future

Egypt Land and Water Management (263-0017) - Egypt
Lake Chad Irrigated Agriculture (677-0001) - Chad
Lower Moulouya (608-0045) - Morocco
Mahaweli Ganga (383-0042) - Sri Lanka
On-Farm Water Management (527-0170) - Peru
On-Farm Water Management (383-0048) - Sri Lanka
Rural and Village Wells (676-0003) - Central African Republic
Desalinization (655-0005) - Cape Verde
Sierra Water and Land Use Improvement (527-0156) - Peru
Use of Treated Sewage for Irrigation (527-0159) - Peru

3. IBRD Documentation

We obtained IBRD documents under the joint document lending arrangement that operates between the Bank and member governments. The Agency for International Development holds documents for two years. We had access to their copies of IBRD project evaluation and design documents dating from 1976.

The documents used were of three types, Project Performance Audit Memoranda (PPAR's), Project Completion Reports (PCR's) and Appraisal Reports. An Appraisal Report corresponds to an AID project paper as the primary project design document delineating a course of action. Evaluations of projects which have been disbursed are performed and the results written in a PCR. A PPAR represents an audit of the Completion Report. The audit procedure is discussed in Part 2, Section D, Evaluation Methodology.

The Appraisal Reports available for the past two years covered projects at their inception. The Audit and Completion Reports done in the past two years covered a sample of projects several years "older" than the AID sample as Bank projects generally are of longer duration than AID projects for reasons which have already been stated. (Part 1, Section C)

Because Appraisal Reports done in 1970 would have been difficult if not impossible to obtain and because the study team chose to restrict its search to Bank documents accessible at AID, the team therefore relied largely on evaluation documents to test the IBRD sample. The decision not to try to locate an Appraisal Report for each of the ten projects was based on the fact that most frequently Audit Reports summarized the Appraisal Report and other design documents and compared results of the project to the projections used at the time of design in a single document.

In several cases the Bank has undertaken post-project impact studies. These were obtained and reviewed. In fact, one of these covered an irrigation project in the sample, significantly adding to information available on that project.

Supporting documentation used included reviews of irrigation programs in agriculture sector reports and Bank working papers on issues such as irrigation water charges, small farmers, the landless and water-borne diseases. Much of the Bank documentation used is available to the public.

No attempt was made to obtain evaluations for projects completed prior to 1972.

Several supplementary interviews were conducted at the Bank which proved as valuable as the comparable AID interviews in providing information about the IBRD evaluation system in general and several projects specifically.

C. COMPARISON OF AID AND IBRD APPROACHES

The Bank and AID have different mandates which must be taken into account before their evaluation methods and procedures can be compared. The predominant role of the World Bank in international lending and the participation of shareholders in decisions are factors which distinguish the Bank from all bilateral aid institutions, including the Agency for International Development.

Policies of both organizations create and respond to new concepts in development theory. However, AID responds to the mandates of Congress while the Bank answers to a broader constituency and one less concerned with details of Bank operations. The Bank participates actively in the international financial markets and is more sensitive than AID to the views of these lenders.

The Bank's character as a financial institution may explain its heavier concentration on quantifying project results than occurs at AID. Further, the Bank has a greater concern with such matters as economic rates of return although AID certainly does not ignore this aspect of project analysis. However, since the "New Directions" legislation of the early 1970's, AID tends to measure project success and failure more in terms of social benefits which are difficult to quantify.^{10/}

Methods of project selection are different. Both organizations receive project requests from host governments and take an active role in project preparation. The Bank may

^{10/} Attempts to quantify social impacts are made in Squire and van der Tak, Economic Analysis of Projects, and with particular reference to an irrigation project in Bruce and Kimaro, An Economic and Social Analysis of the Chao Phya Irrigation Improvement Project II.

exert more pressure to obtain borrower compliance with conditions precedent to the loan than AID. In choosing projects, the Bank relies more heavily on rate of return projections and less on particular development goals than does AID.

AID's presence in the form of an in-country mission facilitates project development and project management. The IBRD approach to project management generally relies on a series of "missions," groups of Bank professionals in appropriate fields who visit the country and the project at intervals over the course of the loan. Both agencies rely on host government administrators for project management, but AID is, by virtue of its continuing presence, uniquely positioned to provide continuing support.

In listing these differences in approach, the study team is not suggesting that one or the other produces better or poorer project results. The team does feel that the differences are worth mentioning as a partial explanation of the variations in evaluation material.

D. EVALUATION METHODOLOGY

The procedures and tenets for evaluation of the success or impact of development projects at the Bank and AID are strikingly different.

1. Aid Evaluation Structure

AID evaluations are tentatively scheduled in the project paper before the loan is made final. The in-country Mission schedules evaluations for projects each year at the request of a central regional evaluation office.

The evaluations are performed for purposes of monitoring projects in progress and making appropriate adjustments. Further, evaluations assess the success of the project in terms of providing projected outputs, and achieving purposes and goals in a timely manner. Project management problems and relations between borrower and donor are discussed in AID evaluations. Issues related to procurement are examined separately by the AID Auditor General's office.

Since the early 1970's, when evaluations formally became part of the project process, the guidelines governing evaluations have been evolving. The current guidelines follow the Logical Framework used in project design and are embodied in the PES (Project Evaluation Summary) (AID Forms 1330-15 and 15A).

Evaluations which follow the PES format can be any length because the form simply provides section headings for expository entries.

In the PES, evaluators are asked to highlight "action decisions" which should result from their conclusions about the project, and to present these on the front page, specifying which project documents might require revision based on evaluation findings. A summary of project achievements follows, with a discussion of the evaluator's methodology. Finally, evaluators are asked to gauge the extent of achievement of project outputs, purposes, and goals and the effect of external factors on the project. Implementation of the project, including provision of promised inputs by AID, the PVO, if applicable, and the host government is also given space on the PES. Separate subject headings for discussion of Beneficiaries, Unplanned Effects, and Lessons Learned are provided.

Additional types of evaluations include progress reports which are used principally to monitor the pace of construction of physical works, End-of-Tour Reports, PAR's and Special Evaluations. End-of-Tour Reports and PAR's were used in the 1960's and early 1970's, respectively, and have been phased out.

It appears that special evaluations are performed for 1) large-scale integrated projects, 2) projects requiring redesign at mid-stage, or 3) projects for which successor projects are being planned. Special or "full" evaluations frequently do not follow PES guidelines. They are more likely to include thorough investigation of project results in a number of areas. Some Special Evaluations have specific environmental or social impact sections attached. Most contain substantial quantities of data on institutional, technical, and economic outputs.

AID evaluations may be performed by in-country mission professionals, AID/Washington technicians or generalists, specialists from other U.S. Government agencies or outside

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contractors from universities or consulting firms or some combination of the foregoing. There is no meaningful orientation guidance for evaluation teams prior to departure for the field. Interviews led us to conclude that host countries are gradually being given a role in the AID evaluation process. However, at this writing, such input has been minimal.

Completed AID evaluations are not widely distributed. Copies are kept at the Mission or in the regional bureau. Again, interviews led us to believe increased emphasis is being placed on collecting evaluation documents in a central repository, abstracting them for inclusion in an automated retrieval system, and filing hard copy in appropriate evaluation offices. Occasionally, an evaluation is printed and widely circulated. These practices appear to be limited to intercountry sectoral program evaluations. AID does not currently perform post-project evaluations several years after project funds are disbursed.

2. IBRD Evaluation Structure

World Bank projects are scheduled for evaluation only at the close of the loan, and it appears, therefore, that evaluation scheduling is a far simpler process. Monitoring of the project during the course of the loan is performed by Bank Missions on brief country visits. Project redesign is done through amendments to the loan agreement when suggested by Mission supervisory reports.

Two distinct evaluations are done at the close of every project loan. The PCR (Project Completion Report) is written by project and country economists and specialists during a

final mission to the country. The PCR gives a history of important events which occurred during the life of the project. However, the PCR has as its primary purpose analysis of "whether the project was worth doing and what lessons may be learned from it." ^{11/}

PCR's generally discuss 1) project preparation, including objectives at the time of appraisal and descriptions of feasibility studies that were performed; 2) project implementation including disbursements and procurement; 3) institutional development and performance of Bank, borrower, and consultants; and 4) social, economic, financial, and agricultural impacts. It appears that statistics including farm budgets, rates of return, crop production figures, and crop price histories are developed over time from the appraisal report projections. Tables on these subjects are included as annexes to the PCR.

Like AID, the World Bank began evaluating projects in a structured manner in the early 1970's. The Operations Evaluation Department (OED) was established as the autonomous evaluative arm of the Bank in response to concerns about Bank "effectiveness." OED attempts to provide objective analysis of project outcomes. OED's Director reports directly to the Board of Directors and may receive no further appointments within the Bank following his term. OED staff is not involved in specific project design, performing exclusively an evaluative role.

^{11/} J. Malone, "Post-Project Evaluation in Irrigation and Drainage; The Experience of the World Bank," Draft Summary and Conclusions. P. 1.

OED reviews and "audits" every PCR. It should be noted that their understanding of a project develops from reading the Appraisal Report, legal documents related to the loan, Board comments, borrower submissions and Mission supervisory reports. OED then prepares a Project Performance Audit Memorandum which details any issues they find skirted or skimmed in the PCR, explains OED's opinion regarding the completeness and comprehensiveness of the PCR and highlights particular lessons relevant to Bank programs in general. Such Memoranda highlight recurring problems or themes in particular classes of projects (such as development of the issue of irrigation water charges referred to in Part 1) and recording the success of managerial efforts in particular fields or first projects in new countries.

Should a PCR have been neglected or done in a superficial manner, the audit memorandum will be done within the context of a mission to the country and will cover the same areas listed above. The PCR then becomes a minor attachment to the Audit Memorandum. The PCR and PPAR deal with questions regarding completion of physical outputs, achievement of purposes, and how well objectives were met. However, unlike the AID PES, the PCR does not contain a section where questions on achievements are frankly addressed.

One of the most valuable features of the Audit Memorandum is a listing of major points for the reader's reference at the front of each memo. These points are subsequently "collected" from each PPAR in a Concordance which is used as a reference work to locate information on particular topics. The results of all PPAR's completed during the year are synthesized in an "Annual Audit Results Review of Project Performance." This report summarizes the Bank's project experiences, "the major lessons derived therefrom and the implications for the World Bank and its members." ^{12/}

Bank projects have increasingly included components designed to increase borrower capability in the area of project monitoring and evaluation. In line with such a policy, attempts are made to include borrower nation representatives in evaluation work. PPAR's are circulated to the borrower upon completion. One or two of the reports reviewed included acknowledgements of receipt from borrower government officials, but these letters did not comment further on evaluation content. According to "Finance & Development," a Bank periodical, borrowers are now being asked to prepare their own completion reports ("Finance & Development," December, 1978, p. 9).

The Bank occasionally undertakes sector-wide evaluations as does AID. These evaluations examine the broader implications of investment in specific areas such as irrigation, health, or other programs.

Recently, the Bank instituted what OED officials call a "second look" post-project evaluation. The "second look" resulted from the need to assess project impact and because of a sense that, in many cases, PCR's were prepared before a project reached maturity. The Impact Evaluation Report, as this study is called, looks at the "benefit stream" past and future, rather than at shortcomings in project design and implementation. Irrigation projects are deemed well-adapted to post-project evaluations. The first impact evaluation study of a Bank irrigation project is included in our data base. ("Mexico: Impact Evaluation Report: Third Irrigation Project," June, 1979.)

E. EVALUATION OBJECTIVES

Several evaluation objectives were identified by the study team to provide a framework for discussing the relative merits of the AID and IBRD evaluation systems, in light of conclusions drawn during the first stage regarding problem areas in the AID system. The objectives used were:

- Uniformity or comparability of evaluations--do evaluations provide information which is comparable and can they be used in analyses of the relative success of investment in various sectors?
- Depth and breadth--do evaluations provide information on all significant areas of project achievement and impact? If they omit an area, is an explanation provided? Is data collected in sufficient detail to substantiate conclusions and enable lessons to be drawn for future projects of a similar nature?
- Quality control--are consistent standards applied so that adequate records exist of project results?
- Objectivity--was the evaluation team made up of individuals who were technically knowledgeable, yet impartial?
- Timeliness--was the evaluation conducted at a stage in the project cycle such that it could be a valuable tool for either redesign or in providing lessons for the future?

Our comments on the efforts of both systems in these areas are based on our review of over ten AID PAR's, five PES's, eight Special Evaluations, 12 End-of-Tour and Progress Reports, and of more than 12 IBRD PCR's, 12 PPAR's, and two impact studies. ^{13/}

1. Uniformity

The conclusions of the study suggested that AID evaluations fall short of meeting the framework of objectives. Evaluations are not comparable. The approach used in evaluative studies is not uniform, nor are particular areas reviewed in consistent depth. Explanations for why evaluations focus on certain areas and exclude others, such as special problems in those areas, are not provided. In PES reviewed, evaluators picked and chose which areas they wished to evaluate. While selection of subjects expedites the evaluation process, it results in significant gaps in knowledge regarding the project as a whole. Special evaluations may on the other hand be quite thorough. Projects of approximately equal purpose and funding receive vastly different evaluation emphasis. The reason some projects received special evaluations when others with problems of equal concern did not is unclear. Special evaluations completed recently begin to address project outputs, purposes, and goal achievement and occasionally assumptions, but not in a consistent manner. These reports are difficult to compare across projects, although they contain in most cases substantial quantities of data and insights of importance beyond the project addressed.

Regulation of special evaluations might be attempted so that the data are organized in a consistent manner. A standard format allowing maximum flexibility (such as the PES) might

^{13/} These are the reports used in the sample. Additional evaluations, evaluation plans, and appraisal reports were reviewed before the final sample was selected.

constitute a valid first effort to provide consistent analysis. An important category on the standard form would be a statement of the reason a special evaluation was initiated. A section on social impact data pertinent to the project should appear in all evaluation reports. Sections on technical outcomes, institutional effects, economic and financial effects should also be more clearly delineated.

Significant gaps in the use of the Logical Framework in evaluations were apparent. The "Assumptions," "Goals," and "Purposes" sections are not thoroughly addressed. The "Assumptions" column is an extremely sensitive portion of the log frame structure on which achievement of project purposes and goals frequently depends. The validity of assumptions about producer price levels, climatic conditions, political stability, the cost/benefit ratio of the various investments, personnel availability, farmer motivation, government capability to provide inputs, and data collection must be analyzed during the evaluation process if obstacles to the achievement of project purposes are to be identified. This paper does not question the value of the "log frame;" however, if it is to become a more valuable tool, its components should be addressed in a systematic manner by evaluators.

In the design stage, as shown in the project summaries, project designers tend to confuse the goals and purposes of a project. This confusion, in turn, handicaps the evaluator's capability to determine a satisfactory level of effectiveness since several projects may contribute to the achievement of a single goal while at the same time having unique purposes.

Goals at the national policy level were rarely discussed. Evaluators did not even summarily review import and export developments since crops produced in the project area entered

the market. Import substitution goals were not addressed. Impact and income data were not routinely provided. Evidence to indicate improved administrative ability in support of institutional goals was also rare.

Evaluators do, however, use the outputs section to determine the project's effectiveness. This is most likely used because outputs are readily understood and measurable. However, it has been noted that project outputs are often confused with purposes.

Inputs are generally handled in discussions of management and implementation issues, the focus of most of the evaluations reviewed. Operating problems of projects were in most cases discussed at the expense of project impacts.

2. Depth and Breadth

AID evaluations tend to focus on technical, institutional and project implementation issues, and are not broad enough in scope. A review of evaluation team composition reveals a reliance on technicians and engineers whose competence in evaluation of the technical aspects of irrigation is recognized. However, these same evaluators were also asked to examine the institutional, agricultural, economic, sociocultural and economic aspects of the project. The result of this choice of evaluators is that minimal attention is paid to sociocultural and economic aspects of those projects which technicians are assigned to evaluate. Many more projects in which technical assessments were done were noted as opposed to those which encompassed sociocultural concerns. Similar results are apparent when AID Mission professional whose general

background may be economics attempt to evaluate all aspects of a diverse project. Bank staff in the OED appear to be generalists whose review of technical aspects of the project relies on the opinions of consultants or Bank engineers from the technical offices.

It should be noted that when irrigation projects are limited in scope solely to engineering or construction considerations or other single-factor goals, professional skills required for evaluation are also fewer, with the consequence that evaluations can be more sharply focused. Evaluations for smaller projects are comparatively clearer, more comprehensive and incisive. Improved evaluation in these projects may simply reflect the fact that the irrigation project is limited for evaluation purposes to one clearly defined technical specialty.

A broad assessment of project impact would be facilitated by providing opportunity for host government input. The host government is frequently the only representative of the end-user. The ultimate beneficiary of any project should be able to affect the project process as it evolves through appropriate host government channels.

Host government input might well provide AID evaluators with additional information on host government priorities. In one project where host government representatives were not included in the evaluation process, it appeared that government priorities had changed to the extent that project phases had to be completely redesigned.^{14/} One project phase was eliminated

^{14/} Precision Land Leveling (Project No. 391-0401). Pakistan

without agreement of the AID team. Host government needs and priorities can be better reflected if host government representatives are closely involved in both interim evaluation and final evaluation.

The depth in which particular issues are addressed may vary from project to project according to the purposes of the project. However, if increasing emphasis is to be placed on recording project impacts and addressing the assumptions, goals, and purposes stated in the "log frame," more attention will have to be given to data collection. Evaluators' conclusions regarding the success of the project in terms of carrying out its purposes can only be stated very generally because, for example, income data is frequently not collected. Further, baseline data developed in the project design phase have inconsistent application in project evaluation.

3. Quality Control

Evidence of quality control was seen in only one regional bureau. One evaluation officer was willing to reject evaluations which were incomplete or superficial. Otherwise the prevailing attitude appears to be that evaluations do not need to be subjected to the same standards and review imposed on other project documents. Because project evaluations are not widely circulated they are sometimes viewed as having little utility beyond meeting reporting requirements.

Project design efforts tend to receive far greater attention in the field than do project evaluations. Highest level management attention to evaluation would have significant benefits in quality control and should result in increased utility of evaluations in project design.

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4. Objectivity

The evaluation system is not structured in a manner that results in the greatest objectivity. Team composition tends to be a major factor influencing evaluation outcome. AID Mission officials who have been responsible for project management may also be sanguine about project outcomes. Many evaluators are former AID employees who have field experience under circumstances that are similar to those under which present evaluations are carried out. This perpetuates an "insider's point of view." Consultants, outside government agency experts, and university faculty have a mixed concern with maximum objectivity. There is no check to determine to what extent evaluations are objective. However, one may expect that personal biases may seriously affect the objectivity of the evaluation.

5. Timeliness

At present, evaluations appear to be timed according to calendar years or completion of project phases. Evaluations at reasonable benchmarks prior to project completion should be continued. Indeed, interim evaluations are a valuable tool to correct project design and maximize return on project investment or terminate ineffective or ill-conceived projects. Where projects are behind schedule, evaluations are not always postponed. The resulting report may analyze causes of delay, but frequently is a "shell" evaluation with no real data, nor information on project progress towards purposes or goals. Included in the sample is a training and management project in India which was evaluated after the tenth month. Evaluations concluded that little was being accomplished in a project that had over four years to completion. Such a conclusion could not be accepted as meaningful under the circumstances.