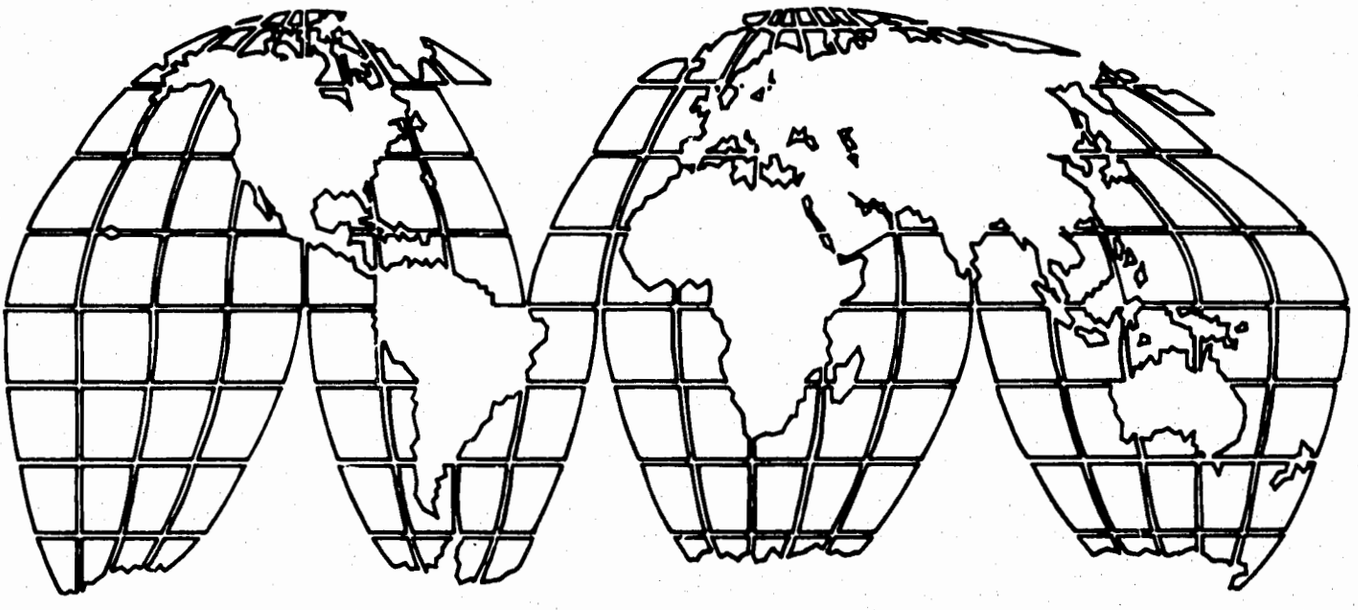
A.I.D. Program Evaluation Report No. 8

Irrigation and AID's Experience: A Consideration Based on Evaluations



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IRRIGATION AND AID'S EXPERIENCE: A CONSIDERATION BASED ON EVALUATIONS

A.I.D. Program Evaluation Report No. 8

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FOREWORD

This paper is important reading for all persons concerned with improving the use of one of the world's vital resources, water. Water for agriculture has been recognized as a chief constraint on efforts to improve the world's food supply. Billions of dollars have been spent by many countries and international agencies to harness major river systems to serve the purpose of agriculture. We haye learned much about irrigation design, hydraulics, construction and the relationship between plant growth and water. Far less is known about water management. Yet, it is clear from the evidence presented in this paper that unless we improve the efficiency and effectiveness of the human dimension in irrigation, there is a real danger the vast source of money invested will produce less than optimal results. Even now older systems require substantial rehabilitation because of poor water management practices in the past.

Based on extensive review of existing literature, original studies by AID of its own experience in irrigation and the results of an AID sponsored international conference on Irrigation management, Mr. David Steinberg has prepared this excellent analysis and summary of what is known in this field. More important he raises crucial issues which must be addressed by development community. It is filling that this volume is being published in the same year that a new international institute is being established in Sri Lanka to focus world wide interdisciplinary research on the problem of improving water management in irrigation systems.

AID and other donors are considering increased assistance to countries on the African continent to begin the exploitation of the remaining great river systems in the world. We hope that this report will encourage and assist those involved in these crucial developments to give full measure of attention to the difficult problems of water management. We can no longer afford to ignore the lessons of experience.

Richard Blue
AAA/PPC/E

NOTE:

The hurried reader who wishes to learn of the impact evaluation results and the practical lessons of AID's experience may turn to Chapter 3 (page 22), Appendix II (page 114), Appendix IV (page 166), and Appendix VIII (page 228). The summaries of the evaluations are contained in Appendix III (page 137).

Summary of the Volume

AID, through a variety of impact evaluation and special studies, has explored its experience in the broad field of irrigation. Together with a review of the work of other donors and the academic literature, this background paper was written to conceptualize the issues, and a conference was held to discuss them. This volume brings together these materials.

Although irrigation normally improves yields, it is not a simplistic solution to food deficits. In spite of continued optimism demonstrated by vast investments by host government and foreign donors, multilateral and bilateral donor-supported irrigation projects have failed to realize their potential. Although the causes are varied, the major impediment seems to be poor water management. The donor experience in irrigation, however, has generally been positive to some degree even if the goals have usually been inflated. The issue of when or when not to invest in irrigation is dependent on a variety of factors, only some of which are economic. There is no universally valid answer to this question any more than there is a single formula for successful irrigation. Irrigation strategy should be considered in the context of a natural resource strategy, and the relationships between irrigated and nonirrigated areas must be understood.

Irrigation systems may be ranged analytically along a continuum from autonomy to dependence, from local management to external, usually state or parastatal, control. Issues such as technological choice, size, the public versus private, or rehabilitation versus new construction are interrelated and often interdependent. The evidence indicates that it is likely that irrigation will be more effective by reflecting local needs the closer that management is kept to the user.

The problems of water management, either by water-user associations--the sine qua non of success--or the implementing agency are exacerbated by donor internal bureaucratic priorities that foster inappropriate planning. Existing water-user associations should be encouraged when appropriate, the principle of equitable cost recovery from beneficiaries based on capacity to pay should be fostered, and attention should be given to recovery of operation and maintenance costs from users where possible. Technological choice should permit maximum flexibility in design, installation, and operation.

Economic analysis should be conducted with more candor, and rehabilitation should take into account the changing nature of the systems. Host government commitments to irrigation and its continuing needs must be analyzed.

Irrigation is inherently an optimistic undertaking, but a greater sense of realism is required to assure its effectiveness.

Preface

Readers Guide to the Study

Introduction

The potential of irrigation for solving the world's food deficits is great, but this optimism is tempered by the pessimism of many who have found that irrigated areas rarely perform at their full potential. The cause essentially seems to lie in inadequate water control or poor water management. (pp. 3-4)*

There have been major increases in irrigation, largely in Africa, although Asia is the locus of the vast area of irrigated land. Effective irrigation is complex. There is no one universally applicable formula to solve irrigation issues. (pp. 5-6)

The origins of this study are rooted in the magnitude of earlier AID investments that, although extensive, were modest compared to those of the World Bank or host governments. The impact evaluations, an art form rather than a science, are the nucleus of this study, but they are supplemented by illustrations drawn from the donor and academic literature. Materials prepared under the AID-supported Water Synthesis Project have been used. (pp. 7-10)

Irrigation--The Scope of Analysis

There are four main issues in donor-supported irrigation: (1) policy questions, including the basic requisite of a national resource policy into which irrigation fits; (2) overly optimistic assumptions of irrigation's benefits; (3) questions of technological choice and the level of skills that accompany such choices; and (4) issues of institutional administration and water management. The assumption of this paper is that agronomic and engineering problems are more easily resolved than managerial ones. The original rationale of the impact evaluations--who benefits and how--is largely a site-specific issue. (pp. 10-12)

A variety of irrigation typologies, each of which might be useful for some other purpose, have been suggested by various authors, but for donor-supported systems a continuum is

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*Page numbers in parentheses refer to the location in the text of more extensive discussion of the subject of the paragraph.

suggested that focuses on the problem of effective water management, which seems to be the critical desideratum in relation to which projects fail. This continuum ranges from relative autonomy of the farm to dependency, and three types of systems are apparent along its range: (1) individual farm irrigation, (2) community-based irrigation, and (3) agency-based irrigation. These types are derived from the locus of management and responsibility and are essentially idealized. There are few pure systems. Most important is not the type, but the dynamic and actual (as contrasted to the hypothetical) relationships between locally based and external, usually governmental, centers of administrative power. (pp. 12-20)

Parallel to the locus-of-responsibility continuum are three other continua: private to public ownership, subsistence to surplus production, and technological sophistication. (pp. 20-22)

The Social and Economic Impact of Irrigation

While any analysis of the impact evaluations must assume two important caveats--the difficulties inherent in attempting to trace causality and the fact that evaluations are often conducted too soon after project completion--these evaluations did note increases in aggregate production (although whether they increased sufficiently to justify costs is a separate issue). Yields also increased substantially, but in most cases other causal factors were also present. There is, however, no necessary correlation between increased yields and improved farmer income because of a variety of other factors including debt, price policy, tenancy, energy costs, and amortization of equipment or systems. (pp. 22-27)

The social and institutional aspects of irrigation are much more difficult to assess than its economic consequences. Increased civic participation in irrigation projects received mixed reviews. The stress on improved participation as a project goal may have been related more to the packaging of projects than to their social realities. Few of the projects discussed the role of women, and those that did reached ambiguous conclusions about improvement in either status or quality of life. Nutrition and health were also only marginally covered, and again the results were unclear. Environmental concerns were generally addressed, and in smaller systems few major adverse effects were noted, but in major projects there were a number of serious concerns, some of which the projects were designed to overcome. Where farm income did go up, improvement of educational opportunities for children was accorded high priority. The role of irrigation in promoting private sector activity either within or outside of the irrigated perimeters was mixed: effective in some systems and ineffectual in

others, as was the impact of irrigation on employment generation off the farm. Although the overall impact of irrigation projects on farm families was positive, these results should lead to questioning of many of the optimistic assumptions of project planners. The effects of irrigation on the nonirrigation-oriented activities of the farmers, as well as the potential polarization between irrigated and nonirrigated farms, should also be assessed carefully, as should the growth of trade and industry beyond the irrigation perimeters themselves. Where land has been held communally, the increased value of irrigated land can lead to a breakdown of traditional property rights, resulting in increased social and economic tension. This may be especially important for parts of Africa. (pp. 27-35)

Irrigation Within the Policy Setting

Implicit in the status of a developing nation is the paucity of fiscal, managerial, and other skill capacities. The choice of concentrating some of these scarce resources on irrigation at the expense of some other developmental good is called agricultural triage and involves difficult decisions among alternative investments, a process in which donors also become involved. These investments are predicated on economic or other returns and involve supporting mechanisms such as sufficient credit and technological choices in infrastructure and agronomy. Although there seemed to be no universally applicable rule to determine when irrigation was an inappropriate developmental response, past failures, alternative investments, weak economic policies and institutions, and undeveloped or obscure dispute-settlement methods should be considered. They are often in inchoate conflict internally in any nation, and sometimes have international implications. In a sense the success of the new agronomic technologies is predicated on improved irrigation, which economically requires the expansion of yields under this technology. Irrigation is sometimes viewed as a means to alleviate population pressures. (pp. 35-42)

The primary policy issue is who pays for irrigation. The solution may be accomplished through a variety of mechanisms, and various governments historically have taken different approaches to addressing this issue, some regarding water as a social or religious good. Related to this issue is the estimation of the variety of benefits of irrigation that will accrue, many of which have been overestimated, although it may be more difficult to calculate benefits because of the difficulty of calculating rates of return so far into the future. The principle of some cost recovery from beneficiaries, related to ability to pay, ought to be encouraged. The traditional, community-based irrigation systems are often ignored in policy

considerations, sometimes because they represent effective, local-level sources of power. (pp. 42-47)

Irrigation Investment Strategies

Seven possible objectives of irrigation are noted, with the proviso that they are not necessarily in conflict and may be mutually supportive. Centrifugal pressures between donor and host government objectives are natural and need articulation. Irrigation strategies are sometimes made at a higher administrative level than an irrigation department, but they involve four basic but broad and intimately interrelated choices: (1) whether investments should be made in new systems or in rehabilitation of existing ones; (2) whether larger or smaller projects are desirable; (3) whether management should be public or private; and (4) what type of technology is best suited to achieve the desired results. (pp. 47-50)

Governments are finding it more difficult to support the construction of major new schemes because of their costs. The alternative, which is finding increasing favor, is the rehabilitation of older works. This should not necessarily be considered in a pejorative sense. Rehabilitation may include a variety of activities, from drainage of large areas or desilting of tanks to reconstruction of small weirs or diversions. New construction is often symbolic of modernity and has been favored by many regimes and donors. Rehabilitation advocates stress the relatively low new capital costs, the sunk investments, earlier productivity, and the farmers' previous experience in irrigation. (pp. 50-54)

Although the dichotomy between larger and smaller systems is prevalent in the academic and donor literature, it is imprecise, less analytically useful, and in many cases false. The advantages of smaller, community-based systems lie in local management that is cognizant of local issues. They offer more scope for innovative and user-oriented design. Larger systems are almost invariably government run or managed through a parastatal organization. There is conflicting evidence on the relative efficiency of larger or smaller systems. Many of the larger ones have split or diffused management, relegating some decisions to locally based groups, public or private. (pp. 54-57)

The distinction between public and private systems is attracting considerable attention, but the evidence of the relative effectiveness of each is mixed, and in a sense the dichotomy is false. Community-based systems may be regulated by government or be part of larger governmental systems. Private management may be more effective when local knowledge is required, when decisions must be made frequently but not

routinely, when quick responses to crises are needed, and when changes in cultivation practices are required. Drainage, however, seems more a public concern. The question of market forces operating for water charges and repayment of infrastructure has rarely worked in donor-supported systems. More important analytically than the distinction between public and private is the interaction between both elements within a single system. (pp. 57-61)

Choice of technology seems the easiest of the irrigation dilemmas to solve, yet it is exceedingly complex and closely related to other irrigation choices. Technology may be circumscribed by the degree to which it is dependent on externally required technical or managerial skills and hardware. Yet it is often thought of first. The training of donor and recipient agency staff in large part determines the technology choice. Tubewells as a technological choice have been slighted in this paper because the impact evaluations basically dealt with other systems. The technology chosen will also affect the type of water allocation system, of which five are listed. Various examples of simple, appropriate technological choices are discussed, together with examples of ill-chosen technologies. Choice of technology raises issues of maintenance skills among staff and farmers, and the related costs of both construction and maintenance. There are important implications for mechanized agriculture as well in such choices. In the long term, perhaps the most important contribution that donors can make is the institutionalization of skills that lead to the capacity for indigenous technological adaptation and change. Technology choice should be interdisciplinary and should allow for the greatest degree of flexibility, which may imply greater costs. The implications of the technology for capital, operational, and maintenance costs should be considered. (pp. 61-66)

Lack of good management has been noted as the principal cause of mediocre performance of irrigation systems. Management of the water is rooted in part in the local culture. It is dependent on farmers' perceptions. It affects who in an irrigation system is supplied with sufficient water and the relative equity of the system. Water management from the farmer's perspective is often based on pragmatic expectations of water availability rather than agronomic ideals. Poor management of irrigation substitutes the whims of man for the unreliability of nature. There is little dispute that more farmer involvement in the planning of systems will lead to better farmer management of irrigation. (pp. 66-71)

There is a generally perceived need for water-user associations, but in many cases they have been difficult to form, although in some societies traditional, community-based groups have been very effective. There is a gradual shift away from participation as larger groups are formed. One of the primary

functions of water-user associations is to adjudicate disputes and to allocate labor and the costs of maintenance. Related to the issue of management is the question of corruption. It is likely that the closer the management of the water is to the farm, the more likely it is that the farmer will benefit. There seems to be a growing belief that water-user organizations should be formed before construction begins and that farmers should be involved in the planning stages of irrigation construction or rehabilitation. (pp. 71-76)

Management of the program is essentially concerned with the implementing agency--the group with which the donor works. These groups often compete within the government bureaucracy for authority, and efforts have been made to encourage or enforce cooperation and coordination. These institutional arrangements have varied in efficacy, but the issue has not been sufficiently studied. The rewards of implementing agencies lie in effective budgetary manipulation and construction rather than in local institutional development and farmer-based considerations. Infrastructure, which is the means, sometimes becomes the ends for the agency. Donors have often been willing allies in this approach. (pp. 76-82)

Donor management suffers from similar problems of fiscal years and budgetary cycles which provide pressure for major expenditures. It is often assumed that host implementing agencies reflect farmer concerns, but this assumption should be challenged. There is a need for more AID staff trained in all disciplines related to irrigation. Some concern is expressed for problems of donor competition and programmatic fads. (pp. 82-83)

Maintenance, Decay, and Rehabilitation

Although poor design may result in system deterioration, normal maintenance is a question of both management and the locus of responsibility. In community-based systems, the responsibility is unambiguous. With government intervention, responsibility may shift in part, with government assuming a greater share based on the complexity of the technology and the operation of community-based systems as parts of larger agency-based ones. As the locus shifts away from the community, performance seems to become more perfunctory. With the shift to government budgets comes greater reluctance to provide public funds for operation and maintenance. Donors have increasingly advocated supplying local currency to meet some of these costs. Rehabilitation should not be considered as a restoration of systems to their original state, but a process that brings irrigation back into harmony with its context. (pp. 83-86)

There have been general expectations that local costs will increasingly be borne by the local community, and that if payments for water reflect actual costs, there will be less wastage. Yet the evidence is unclear. Donors increasingly advocate helping supply local costs, but donor proliferation places strains on both local budgets and staff. One hypothesis is that whatever fees are charged for water, the systems are more likely to be more efficient the closer to the users the user charges are kept. Drainage, however, presents a special problem for its immediate beneficial effects are less obvious. (pp. 86-88)

The decay of irrigation systems may be in part related to poor design or maintenance, but it can relate to environmental degradation beyond the system, or even beyond national boundaries. Other factors in hastening decay include the inexperience of design engineers with irrigation, inadequate subcontracting, or corruption. Rehabilitation often begins with construction, but should rather start with the building of maintenance and water-management capacity. Rehabilitation sometimes includes mass incorporation of smaller, community-based systems into larger agency-based ones. This often results in a loss of social cohesion at the local level, and the lack of interest by local groups may be attributed to the arrogance of technological and administrative elites and the distribution of political power. (pp. 88-90)

The Effectiveness of Irrigation Programs

The project development process is subject to a series of pressures emanating from a variety of sources that prompt hurried approval. Projects are generally more expensive and take longer to complete than anticipated. World Bank and Inter-American Development Bank experiences are noted. Among the other problems encountered in project design are a lack of specific irrigation or agronomic knowledge on the part of irrigation project designers, lack of consideration of the farmer and the agronomic package and the capacity of the extension service, the need for better feasibility studies, lack of understanding of local social systems and power structures, poor donor coordination, and few rewards in donor agencies for institution-building and social analysis. These issues are exacerbated by the use of the project proposal as a sales document wrapped in current development chicness. Too many projects are couched in extravagant economic goals and pious hopes. Irrigation is not equity neutral. It reinforces and may exacerbate income and social differences. To change either implementing agency or donor attitudes, an incremental learning process is required together with appropriate rewards and sanctions. (pp. 90-95)

Monitoring has been criticized by both donor and recipient, about themselves and each other. Generally, too little gets done, yet sometimes it can be an impediment to project success. Monitoring cannot be left to contract personnel, and the contract function is criticized because of delays and the inappropriateness of some personnel. The implementing agencies also were noted as having monitoring problems. (pp. 95-96)

Problems with research and research designs were noted and suggestions made for building indigenous research capacity and links between local academic and bureaucractic institutions, as well as for action research and concentration on actual issues. (pp. 97-98)

Need was noted for farm-level discussions on the sustainability of irrigation systems. A new approach to evaluation was suggested based on accumulated experience rather than the attainment of original, quantifiable goals. (pp. 98-99)

The paper closes with the note that although it is an antidote to overoptimism in irrigation, inherently it is optimistic about the possibilities of improvement in irrigation and its importance. (pp. 99-100)

Acknowledgments

The preparation of this paper and its delineation of issues has been helped enormously by the cogent comments of Agency for International Development (AID) staff in all bureaus in Washington and the field, and by the author's attendance at an OECD meeting on irrigation in Paris in September 1982, as well as one with a somewhat different focus in Manila sponsored by the East-West Center and the Asian Institute of Management in November of that year.

Since this series of evaluations has begun, the work of AID has benefited immeasurably from the programs carried out by AID's Bureau of Science and Technology and Bureau for Asia under the Water Management Synthesis I and II projects, efforts that have brought together three outstanding American institutions in the field of irrigation and water management: Cornell, Colorado State, and Utah State Universities.[1] In addition, the Asia Bureau of AID has explored in detail a variety of irrigation experiences in a number of countries, including Pakistan,

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[1]See Water Synthesis Project II (936-4127), August 2, 1982. See also, Mark Svendsen, Douglas Merrey, and Worth Fitzgerald, "Meeting the Challenge for Better Irrigation Management," Horizons, March 1982.

India, Thailand, Nepal, Bangladesh, and Sri Lanka, and from this they have distilled a regionwide strategy.[2] Although this series of evaluations started out in what was an AID vacuum, the void has partly been filled by efforts that have occurred since that time. In fact, it could be argued that these subsequent developments validated the original choice of irrigation as an issue, if not the length of time it has taken for this study. Conflicting priorities, funding issues, and staff availability have been partial constraints to completing work in this sector.

During May 3-6, 1983, the Office of Evaluation sponsored a meeting on irrigation at Leesburg, Virginia. Some 17 officials from foreign governments attended, as did representatives of 11 AID missions. Broad academic and other donor participation was encouraged, as was representation from all the relevant AID Washington offices and bureaus. About 120 persons participated for all or part of the sessions.

This paper was prepared in draft form as background for that meeting, and was circulated to all those attending. The conference proceedings are included in this volume, and although the revised version of this essay incorporates some of its conclusions, the two documents are quite separate. This work, therefore, does not attempt to reflect the official record of those discussions.

In fairness to the reader, the author has an obligation to note what this paper is, as well as what it is not. This is a highly idiosyncratic attempt to portray what the writer believes to be the critical issues in donor-supported irrigation projects. It differs from what the Office of Evaluation normally distributes as "sector summaries," for although this paper performs that function by summarizing AID experience, it peripatetically reviews other literature and is organized in an effort to focus attention on what the author (and others) view as important irrigation and development issues. It reflects the impact evaluations, but is not bound by them. It is not, in addition, a balanced review of worldwide irrigation experience, but mirrors both the author's extensive involvement in Asian affairs and the fact that irrigation is most widespread in that region. Even within that region, however, there are important gaps: China and Japan are barely mentioned, as AID was not involved in those countries, and India is an important omission as a site for impact evaluations. Although the literature on India is extensive, exhausting if not exhaustive,

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[2]Max L. Lowdermilk and Mark Svendsen, "Planning Concepts for Flexible Irrigation Water Management Strategy in Asia," 1982. See also the individual country analyses.

AID-supported projects were too new to evaluate for impact on the beneficiaries. We believe that the diversity of Indian irrigation experience is worthy of a separate volume even though some of the problems of Indian systems are reflected in this paper.

This report was written intentionally in a nonbureaucratic, nonacademic style. What it loses in terseness one hopes is made up in readability for the nonspecialist. Footnotes, however, have been provided throughout the text; the desire to avoid being considered pedantic has lost precedence over the need to document the sources of the information, some of which are ephemeral and might otherwise be difficult to retrieve.

Thanks are due to all those who have provided ideas for the study, commented on drafts of the report, and given intellectual, moral, and inspirational support. Professors E. Walter Coward and Gilbert Levine of Cornell University were especially helpful in critically reviewing drafts of this report as were Mark Svendsen and Douglas Merrey of AID, among many others. All those who participated in the AID irrigation conference are unwitting contributors, and if their views have been misrepresented here, I hope they will accept my advance apologies, taking solace in the fact that the conference proceedings more accurately present their conclusions. As with all papers in this series, the contents do not necessarily reflect the official position of the Agency for International Development.

Mention must be made of the encouragement of the staff of the Office of Evaluation, and the comments of Richard Blue, and especially Cynthia Clapp-Wincek who was Irrigation Conference Coordinator. During the long gestation period over which irrigation was an office concern, she tried to keep our ideas focused, our prose pointed, and our data available. Errors in analysis and fact rest, as always, solely with the author.

Glossary

EARIS	Egyptian-American Rural Improvement Service
Falaj	Traditional irrigation systems of Oman
FAO	Food and Agriculture Organization (of the United Nations)
IBRD	International Bank for Reconstruction and Development (World Bank)
IDB	Inter-American Development Bank
ISA	Community-based irrigation systems in the Philippines
NIA	National Irrigation Administration (of the Philippines)
O&M	Operations and Maintenance (of irrigation systems)
OECD	European donor aid organization
OMVS	The development authority for the Senegal River Basin
Sederhana	"Simple" irrigation systems of Indonesia
Subak	Community-based irrigation systems in Bali
Zanjeras	Community-based irrigation systems in the Philippines

It is my chief desire to gather up an abundance of grain by all that lieth in my power.... In the Kingdom that belongeth to me there are many paddy lands that are watered chiefly by the water from rain clouds; but the fields that depend upon a perpetual supply of water from the rivers and tanks are very few in number.... In a country like unto this not even the least quantity of water that is obtained by rain should be allowed to flow into the ocean without profiting man.[3]

King Pasakrama Bahu (1153-86)
from the Mahavamsa of Ceylon

Irrigation projects generally endear themselves to agriculturalists because they tend to promote maximum yield per hectare--a well-understood and indeed, cherished goal. They also reduce risk assignable to weather. Irrigation projects have, in addition, many attributes that satisfy the objectives of politicians; particularly a rapid, visible, and dramatic impact, and the tendency to be closely associated with a political promoter. Donors of economic aid favour irrigation projects for similar reasons. Engineers enjoy the challenge of designing irrigation schemes, particularly when they are on a large scale, and therefore speak of water "wasted" when it runs into the sea; if it runs into the sea through a good dam site or a desert they become almost uncontrollable. Development administrators see irrigation as creating opportunities for enforcing discipline in production, marketing, and finance....[4]

Ian Carruthers

The cost of building dams is always underestimated;
There's erosion of the delta that the river has created,
There's fertile soil below the dam that's likely to be looted,
And a tangled mat of forest that has got to be uprooted.

There's the breaking up of cultures with old haunts and habits lost,
There's the education program that just doesn't come across,
And the wasted fruits of progress that are seldom much enjoyed
By expelled subsistence farmers who are urban unemployed.

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[3]Quoted in B. H. Farmer, Pioneer Peasant Colonization in Ceylon: A Study in Asian Agrarian Problems, London: Oxford University Press, 1957, p.185.

[4]Ian Carruthers and Colin Clark, The Economics of Irrigation, Liverpool: Liverpool University Press, 1981, p.1.

There's disappointing yield of fish, beyond the first explosion;
There's silting up, and drawing down, and watershed erosion.
Above the dam the water's lost by sheer evaporation;
Below, the river scours, and suffers dangerous alteration.

For engineers, however good, are likely to be guilty
Of quietly forgetting that a river can be silty,
While irrigation people too are frequently forgetting
That water poured upon the land is likely to be wetting.

Then the water in the lake, and what the lake releases,
Is crawling with infected snails and water-borne diseases.
There's a hideous locust breeding ground when water level's low,
And a million ecologic facts we really do not know.

There are benefits, of course, which may be countable, but which
Have a tendency to fall into the pockets of the rich,
While the costs are apt to fall upon the shoulders of the poor.
So cost-benefit analysis is nearly always sure,
To justify the building of a solid concrete fact,
While Ecologic Truth is left behind in the Abstract.[5]

Kenneth E. Boulding

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[5]M. Taghi Farvar and John P. Milton, eds., The Careless Technology: Ecology and International Development, Garden City, N.Y.: The Natural History Press, 1972. Also quoted in Ian Carruthers, "Irrigation Developments: Implications of Recent Experience for Aid Policy," OECD, September 1982.

1. Introduction

Idealism and cynicism are the antipodes of the irrigation universe, as these quotations illustrate. So long has irrigation existed, so extensive are its economic and social influences, and so pervasive are its managerial implications, that it remains a singularly critical element in local, regional, national, and indeed international food calculations. It is not surprising that it should be subjected to the gamut of views, from hortatory rhetoric to satire.

Extreme optimism and pessimism are both justified. Irrigation can increase yields; the 20 percent of the world's agricultural land that is irrigated generates 40 percent of the world's agricultural production.[6] So great is the potential for the effective use of irrigation that the valleys of the Nile, Tigris, and Euphrates Rivers alone, if producing at full theoretical capacity, could solve the world's food deficit problem.[7]

Yet, the pessimism is equally justified. These valleys produce at less than one-quarter capacity,[8] and one-half of all the world's irrigated land is afflicted with problems of salinity.[9] This dichotomy between reality and potential is even more pertinent today because many of the 45 million of the 92 million hectares of land in developing countries that require reclamation as a result of the problems of poor water management were irrigated in the last three decades, at a time when the technological problems of irrigation theoretically were better understood.[10]

Inadequate water control, or water management, is said to be the largest single factor in explaining the gap between

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[6]Leonard Berry, Richard Ford, and Richard Hosier, The Impact of Irrigation on Development: Issues for a Comprehensive Evaluation Study, AID Program Evaluation Discussion Paper No. 9, October 1980, p.3.

[7]Opportunity for Increase of World Food Production from the Irrigated Lands of Developing Countries, Report to the Technical Advisory Committee of the Consultative Group of International Agricultural Research, International Development Research Center (IDRC), 1979.

[8]Ibid.

[9]Berry et al., op. cit.

[10]IDRC, op. cit.

actual and potential paddy yields. More than half the total irrigation water supply is wasted before reaching the crops. There are, of course, important distinctions between the humid and arid tropics. In the Indus Basin alone, water exceeding the full amount of the Nile's flow is depleted before it reaches the farmers' fields.[11] In some systems, up to 70 percent of the water is lost before reaching the farmer.[12]

This negative view of irrigation must be balanced by consideration of the effectiveness of other systems: the administrative elegance of the Balinese subak and the efficient Taiwanese irrigation systems, for example.[13] This paper is intentionally focused on problems so that the quality of donor-supported irrigation may be improved. It therefore slights those systems, usually older, traditional ones, that operate in harmony with their social and ecological environments.

Perhaps half of the world's population is directly influenced by irrigation systems, traditional or modern, large or small, effective or ineffectual. More are indirectly affected, for national security, development, and political strategies are often predicated on their effective use.

As one of the oldest forms of collective enterprise on which evidence exists, dating back some 9,000 years, it is no wonder that elaborate social and political theories have been constructed around irrigation. One need not accept the conclusions of the "hydraulic society" theory, postulating despotic governments generated by the need for irrigation and flood control,[14] to recognize that some of the major centers of world civilization might not have flourished without extensive irrigation systems controlled by powerful governments.

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[11] Ibid.

[12] See K. William Easter and Delane E. Welsch, "Socioeconomic Issues in Irrigation Development and Distribution," St. Paul: University of Minnesota, Institute of Agriculture, Forestry and Home Economics, Department of Agriculture and Applied Economics, ER83-5, April 1983.

[13] See, for example, Clifford Geertz, "Organization of the Balinese Subak"; and Canute VanderMeer, "Changing Local Patterns in a Taiwanese Irrigation System," in E. Walter Coward, Jr., ed., Irrigation and Agricultural Development in Asia. Perspectives from the Social Sciences, Ithaca: Cornell University Press, 1980.

[14] Karl Wittfogel, Oriental Despotism, New Haven: Yale University Press, 1957.

Irrigation has historically provided substantial returns to traditional societies, but with high costs in human labor if not in capital outlays. Today, with sophisticated agronomic and technological developments, even greater magnitudes of yields are possible, but with increased energy and capital costs substituting only in part for intensive labor. To balance this optimism about irrigation's potential, it should be noted that the new technologies also provide greater possibilities for rainfed areas in many nations as well. As with other development programs, the choice that societies make to invest their limited development budgets in expensive irrigation systems directly benefiting relatively few farmers is one that often precludes support to other necessary or desirable activities--economic, social, military, or cultural--and automatically excludes large portions of the population from its primary benefits. Donor agencies, multilateral and bilateral, are often confronted with similar dilemmas.

Responding to the allure of increased yields, or in the case of Egypt to increased cultivable land area and social benefits, there have been major increases in irrigation around the world. Between 1961 and 1976, Africa increased its irrigation hectarage faster than any other area, by 31 percent; South America did so by 24.6 percent; Asia, from a far broader base, by 18 percent; and North and Central America, by 18.3 percent.

Of the nations that doubled or more than doubled their irrigated areas in this period, three were in Asia (Bangladesh, 183.4 percent; peninsular Malaysia, 300 percent; Nepal, 146.7 percent), but nine were in Africa, including Benin (500 percent), Gambia (108.3 percent), Ivory Coast (500 percent), Kenya (300 percent), Malawi (150 percent), Mali (109.3 percent), Zimbabwe (100 percent), Sierra Leone (400 percent), and Zambia (100 percent).[15] It should be recognized, however, that impressive as these figures are, the areas covered are relatively small except in Bangladesh. Irrigation on a large scale is largely an Asian phenomenon; Asia has 90 percent of the developing world's irrigated land.

There has been a tenacious optimism concerning the potential of irrigation, to which this paper is a partial antidote. Irrigation simplistically seemed the panacea for food deficits. This is not a new phenomenon. After a decade of U.S. rule in the Philippines and rice imports totaling 120 million pesos, the Philippine Commission noted that if those funds had been

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[15]Berry et al., op. cit., p. 10.

expended on irrigation, it "would have put the country today in the position of exporting rice instead of importing it."[16]

Although the allure of ever-increasing yields based on expanded areas seems persistent, the results are sometimes ephemeral. One leading irrigation authority could write as late as 1982, "In Africa irrigation is either largely unimportant or unsuccessful.... The temptation to see irrigation as the solution to arid land and unreliable climate should be resisted."[17] Thus without careful planning, the ambiguous results of irrigation to date should obviate turning to irrigation as the simplistic solution to food supply problems.

One basic agricultural dilemma, elemental to any formulation of development policy, is whether to invest in irrigation or in some other productive food or fiber activity. The choice is sometimes difficult, and benefit/cost analyses only partially helpful, for what may be lost by support of concentrated irrigated production may in part be made up by more extensive rainfed agricultural growth, and what may be gained in localized improved equity may be achieved by diminishing the potential general welfare. This issue cannot be decided in this paper, either generally or for any particular locale, but some exploration of the considerations raised below could lead to a more rational resolution of such a dilemma. Our purpose here is not to resolve the issue of <u>whether</u> irrigation, although the question will be treated below. We will concentrate, however, on <u>if</u> irrigation, then what and how? Because support to irrigation becomes part of an assistance strategy, however, the tensions inherent in formulating such a strategy need discussion, if only to raise the issues and not resolve them.

Effective irrigation, in spite of its critical physical engineering infrastructure that theoretically could be designed for universal application to achieve specified water rates and volumes, is not dependent only on the laws of physics. If it were, the problems with irrigation systems would not exist. Effective irrigation is complex, involving the interaction of physical structures, water, agronomy, soils, the environment, climate, management techniques, social and political systems, cultural practices, and a host of supporting factors. It also includes transport, marketing, pricing policies, and storage facilities that require careful attention to critical local details.

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[16]David Joel Steinberg, <u>The Philippines: A Singular and a Plural Place</u>, Boulder: Westview Press, 1982, p. 93.

[17]Ian Carruthers, "Irrigation Development: Implications of Recent Experience for Aid Policy," OECD, September 1982.

Thus, all evidence points to the absence of a single formula with worldwide applicability to achieve maximum benefit from such systems. Even as the world searches for universally applicable technologies to solve developmental dilemmas, such as malaria or bilharzia vaccines, the temptation to posit equally widespread and relevant answers to irrigation issues should be eschewed. If, indeed, there were such answers, they would have been employed.

This paper itself will solve no problems. It is not a guide for the irrigationally perplexed, nor can it provide intellectual liquidity in approaching irrigation issues. It simply attempts to set forth issues that should be explored, concerns that must be examined, possible effects that might be considered. It does, however, recommend criteria for considering support to irrigation projects. The stage is thus set to explain the genesis of this paper and suggest issues.

Background to the Irrigation Study

Upon its formation, the Office of Evaluation designated a variety of development investments that should be examined to determine what AID had learned from these interventions. One of the areas selected was irrigation. The choice seemed appropriate, for at that time there was no overall, articulated policy in the Agency that considered irrigation in depth. Irrigation was not at that time rigorously defined, but was considered to mean the controlled supply and management of water for productive purposes. Thus irrigation as a field for study could include elements of flood control and consist of improved or protected food or fiber production for internal use or export.

In spite of a lack of coherent policy, investments in irrigation by AID were extensive. An effort to determine the precise amount AID expended, an exercise dear to many in the bureaucracy, was defeated by obscure project titles, multipurpose projects such as those involving hydroelectric power generation, and the general paucity of sufficient detail on the early activities of AID and predecessor agencies. It is still possible to estimate, however, that perhaps $3 if not $4 billion had been invested directly by the U.S. government in overseas irrigation activities through the 1970s. Perhaps an additional $1 billion will be spent on similar works over the next half decade, about three-quarters of it in Asia. The sheer magnitude of AID's activities, past and projected, and the need to learn from this experience were compelling reasons for the choice.

AID, however, has been but a relatively modest donor in the field of irrigation. The FAO had called for investments of

$40 billion in irrigation in 1975 prices in the decade beginning that year.[18] Another 15-year proposed plan for doubling rice production in South and Southeast Asia called for capital costs, in 1975 prices, of $52.6 billion for converting 30.4 million hectares of rainfed land into irrigated areas and for improving 17.5 million hectares of inadequately irrigated fields.[19] Although both goals are far from realization, expenditures have been substantial. The World Bank through June 1982 has supported 285 irrigation projects, investing more than $10.4 billion in them, with additional contributions of some $15 billion from host governments.[20] Almost 10 percent of all Bank lending has been in irrigation, which also represents about 38 percent of all agricultural sector loans.[21] The African Development Bank by 1981 had provided $273 million, and the Inter-American Bank, about $800 million under 34 projects, adding some one million hectares to that region's irrigated area.[22] By the end of February 1979, the Asian Development Bank had committed $653.2 million in this field to irrigate 1.2 million hectares.[23] The annual budgets for irrigation in South and Southeast Asia totaled $1.7 billion in 1975 prices.[24] In AID's Asia Bureau alone, 30 percent of the budget for agriculture through 1988 is anticipated to be devoted to irrigation.[25]

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[18]Berry et al., op. cit.

[19]Umberto Colombo, D. Gale Johnson, and Toshio Shishido, Reducing Malnutrition in Developing Countries: Increasing Rice Production in South and Southeast Asia, the Triangle Papers No. 16, New York: The Trilateral Commission, 1978.

[20]Frederick L. Hotes, "World Bank Irrigation Experience," OECD, September 1982. It is significant that to date the World Bank has no policy paper on irrigation, as there are internal disputes on such matters as water-user fees and technological issues such as the lining of canals.

[21]OECD Irrigation Conference material, September 1982.

[22]Ibid.

[23]Asian Development Bank, Irrigation Development and Management, Proceedings of the ADB Regional Seminar on Irrigation Development and Management, Manila, The Philippines, 29 January-16 February 1979.

[24]Ibid.

[25]Asia Bureau Strategy Paper, December 1982.

As in a number of other sector analyses, the Office of Evaluation's first effort was to support a "pattern analysis," a look at what AID had done based on what was readily retrievable from available documentation. Although far from satisfactory because of the paucity of analysis of some of the more complex issues and the limited scope of the inquiry, the study, "Pattern Analysis of Small- and Medium-Scale Irrigation Projects,"[26] did bring together a representative number of AID projects, supplemented by some World Bank experience, and drew from them a number of generalized issues and conclusions. A second study, "The Impact of Irrigation on Development: Issues for a Comprehensive Evaluation Study,"[27] was commissioned to raise questions more generically related to irrigation. This study noted that with the exception of a single memorandum on Niger, no AID evaluation until 1979 could be found that served as a general guide to project planners, as contrasted to including project-specific recommendations. No study in AID dealt with the policy context of irrigation. AID, as an article of faith, seemed to consider irrigation an unmitigated good.

It was at this point in 1979, under instructions from AID management, that the Office of Evaluation began its program of impact evaluations. Irrigation was one area chosen for inclusion because of the magnitude of investment and the two previous evaluation activities sponsored by that office. Impact evaluations, despite their surprisingly innovative character in concentrating on the supposed beneficiaries of projects, are by definition limited. They sometimes embrace other elements of development strategy and administration. They are essentially circumscribed by only a month in residence in the country concerned, and usually much less at field sites. Such evaluations, as their individual methodology sections suggest, are plagued by problems both of the paucity of data and interview sampling procedures that cannot withstand statistical analysis. The impact evaluation technique, dignified by the University of Sussex as "rapid rural appraisal," is in a sense more an art form than a science. The evaluations are as good or as limited as the sensitivities, acumen, and experience of their team members, and the availability of data. Although no one evaluation could address all the issues in irrigation, together they have considered many of the salient problems.

This study draws heavily on these impact evaluations, but there was a need to supplement them with other materials

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[26]Checchi and Company, Pattern Analysis of Small- and Medium-Scale Irrigation Projects, AID, November 13, 1979.

[27]Berry et al., op. cit.

including AID analyses that could not be done, or were not appropriate to do, in the field. The analytical work of other donor organizations has also been included to ensure that a variety of the issues not possible to consider in impact evaluations were addressed, and some of the academic literature on the subject has also been examined to provide breadth to this study (see Bibliography). This paper, within time and space limitations, will attempt to draw together what evaluation has found, where evidence is lacking, what problems seem yet to be explored, and what remains to be done.

2. Irrigation--The Scope of Analysis

Donor-supported irrigation systems have improved production, but seldom have they equaled expectations in accordance with anticipated schedules, and even more rarely have they continuously realized their potential. On some aggregate scale, however, irrigation projects may be considered successful, although there is no known overall economic analysis of the results of AID-supported projects. The AID impact evaluations do indicate some degree of accomplishment, at least for certain periods. The discrepancy between improved and potential yields, however, illustrates the need to consider how projects might be better designed and implemented. For this purpose, an analysis of problems associated with irrigation projects is necessary.

Based on evidence from evaluations, types of irrigation systems may be ranged along a continuum for analytical purposes. The designation of such a continuum may assist project designers in anticipating potential problems and project managers in determining the causes, as contrasted with the symptoms, of poor performance.

A Concatenation of Irrigation Problems

It is possible to delineate four main types of problems in donor-supported irrigation systems. Some of these are causally linked and interact. These are

1. Broad questions of policy that transcend irrigation and affect a wider spectrum of the economy and society (although irrigation may intensify some issues);

2. Overly optimistic assumptions about the immediate effects of irrigation, leading to questions of the economic effectiveness of projects;

3. Questions related to technological choice in design of irrigation; and

4. Issues of institutional management and administration of both the water and the program.

The issue of who benefits from irrigation and to what degree--the original rationale for the impact evaluations--is discussed in Section 3. The purpose of this summary paper is not simply to generalize on this aspect of the findings, which are largely site specific, but rather to ascertain whether there are generic causes of irrigation problems that can be identified and corrected, thus leading to improved project design.

Policy questions do not begin with irrigation, or even with agricultural pricing--the provision of adequate incentives for increasing, to the optimum in relation to costs, yields on irrigated land--although this is obviously a critical element in policy formulation. More basic is the development of a national resource policy, the absence of which may result in ineffective irrigation. Such a policy might include not only the determination of exploitation of water sources and their use, but equally important environmental, fuel, and power policies. If these policies lack integration, the result may be inefficient pricing of energy, degradation of watersheds, flooding, and siltation of irrigation systems. If the concern with getting water onto the land ignores the need to take it off as well, it often leads to increases in salinity, which destroys the economic usefulness of the irrigation investment.

Overoptimistic assumptions about economic returns have sometimes blurred the question of the economic validity of irrigation investments. Assumptions about the likely availability of water and its shared use, the intensity of cropping, the costs of systems, and the amount of time needed for construction or for irrigated areas to produce at optimal levels, as well as the long-term durability of improvements all have contributed to lowering of anticipated economic rates of return, sometimes to levels where other investments in productive enterprises would have garnered greater rewards.

Technological choices at both ends of the spectrum may be inappropriate; the most appropriate choice between self-reliant village-level technologies and those on which a community is externally dependent is often very difficult to make. Some technologies may be too simple to withstand the rigors of use and have insufficient long-term economic efficiency; some may be too sophisticated for the level of training of those who use them or entail capital expenses and maintenance difficulties that are too great.

Although there is evidence from a variety of irrigation experiences that too little attention has sometimes been given to hydrographic and soil conditions as well as to physical

structures, as both intensive and extensive data collection may be sporadic, the overwhelming evidence indicates that problems most often are rooted in institutional deficiencies: shortages of managerial, organizational, and administrative skills. These necessary skills should not be predicated in accordance with some abstracted public administration model (usually of western derivation) but considered in concert with local social and cultural realities. The paucity of such skills may be found at all levels, from water users to implementing organizations, and among donors as well. Inadvertent neglect of existing formal or informal organizational structures, operating in the social milieux at the irrigators' level, sometimes may lead to their replacement by less efficient but more modern institutions inappropriate to local conditions.

The evidence from the academic literature and other donor experience indicates that water management in an institutional setting is the most critical of factors in project planning of contemporary donor-supported irrigation systems. Management problems, operating within the context of policy settings, are the most difficult issues to solve both because the state of knowledge of these factors is less developed and because they involve an understanding of the political culture, the distribution of power, and social organization. Although AID may be able to assist in improving management, control over basic resource allocation is a more intractable issue. The assumption of this paper is that agronomic and engineering problems can more easily be resolved than management questions, and thus, to improve project design, more attention should be paid to management at all levels, and to the interaction between these different sets of management controls. It is, thus, important to develop an irrigation typology, or more accurately, an irrigation continuum based on management issues, that will delineate more clearly how these problems may be addressed.

From Autonomy to Dependence: The Continuum of Irrigation

A conclusion of this paper is that the historical origins of irrigation systems, the types of crop, the sources of irrigation water, the sizes of systems, or their types of energy are less important conceptually than is the problem of effective water management, from either watershed or aquifer source to user. This seems to be the critical desideratum on which systems fail.

A variety of irrigation typologies, however, have at various periods been suggested, each useful for different purposes. Using an historical approach, one typology includes three

different irrigation systems.[28] The first is the colonial system, introduced by an occupying (usually European) power to increase production in a specific area. Illustrations of these systems include Indonesia (the north coast of Java), the Indus Valley of what is now Pakistan, the Sudan, and Somalia, and to which may be added Japanese efforts to increase irrigation in Korea and Taiwan. The second type is the export promotion category, including irrigation in the Helmand Valley in Afghanistan, the Sudan, and Mexico. The first and second types are not mutually exclusive. The third type is the community systems that service restricted areas. Examples of these would include the subak systems of Bali[29] and the zanjera irrigation works of the Ilocos region of the Philippines.[30] An additional category might be added: those massive irrigation and flood control regions, of which perhaps the Yellow River Valley in China is the most obvious example, which gave rise to such speculations as the hydraulic civilization theory. These categories, although of some limited historical usefulness, are less germane to conceptualization of the problem today and do not serve as a useful approach to effective programming. They take no account of investment criteria or operational relevance.

Another typology might focus on the source of water: groundwater, run-of-the-river systems, or those with storage and flood control capacity. The technology for each of these categories is well developed. A third might consider the source of energy for irrigation: human/animal labor, gravity, or pumps--diesel, solar, or electricity powered. Another approach might concentrate on hardware: tanks or storage areas, diversions, and pumps. A further possibility might deal with size: small, medium, or large, however defined. All these approaches are more related to construction than management. They are of minimal help in conceptualizing management issues.

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[28]Berry et al., op. cit.

[29]Bali Irrigation Project, "Development and Improvement of a Subak Irrigation System in Bali," a paper for the Workshop on Organization as a Strategic Resource in Irrigation Development, East-West Center--A.I.M. Conference, Manila, 1982 (hereafter referred to as the East-West Center--A.I.M. Conference). See also Geertz, in Coward, op. cit.

[30]Benito P. Visaya, "The PRMP and the Zanjeras," East-West Center--A.I.M. Conference. Also, Henry T. Lewis, "Irrigation Societies in the Northern Philippines," in Coward, op. cit.

A more useful analytical typology for donor-supported systems has been developed by Chambers.[31] This includes five types focusing on the process of water allocation and acquisition:

Direct appropriation	--	User gets water directly from a well or private dam
Acquisition through contract	--	User gets water from a supplier for goods or services
Community allocation	--	Communal source of water is allocated among a community of users
Bureaucratic allocation	--	Water is allocated by a bureaucratic organization to individual users
Bureaucratic communal allocation	--	Water is allocated by a bureaucratic organization to one or more communities, each of which distributes it to members

Another typology designates four categories of state and water-user interaction systems: (1) direct state management, (2) state coordination through existing village organizations, (3) state interaction with pan-village organizations or water-user associations, and (4) joint management by government and water-user associations.[32]

In spite of the validity of these approaches for other purposes, it is perhaps more helpful to consider the variety of irrigation systems not as separate types, which inevitably leads to a proliferation of exceptions to general categories, but rather as one basic continuum, with a series of parallel continua, along which various systems might be examined in a manner that will concentrate on system failure or problems so that they can be better addressed.

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[31]Robert Chambers, "Basic Concepts in the Organization of Irrigation," in Coward, op. cit.

[32]Somluckrat Wattanavitukil and Concepcion Cruz, Irrigation Water Management at the Village Level in Selected Asian Countries, Environment and Policy Institute, Background Paper No. 3, East-West Center, October 4, 1982 (draft).

The issue of management and institutional efficiency has already been identified as the most important constraint. Starting with the water and the water user, the primary issues are twofold: where is the locus of management or responsibility, and what is the degree to which cooperation with others is required to receive water and where is that institutional structure, if any, located?[33]

Along this management/cooperation continuum, ranging from relative independence to dependency, three basic, abstracted types of systems become apparent, although in reality they blend together. These are

1. Individual farm irrigation,
2. Community-based irrigation, and
3. Agency-based irrigation.

Individual Farm Systems

The individual farm system is essentially a relatively autonomous, self-sufficient unit requiring no cooperation for production, although it is dependent on an external supply of equipment and spare parts. At the simplest technological level, it is illustrated by the bunding systems of Somalia in the Arabsiyo region. Although constructed with mechanical equipment, they are technologically simple enough to have been built with human or animal power. Self-contained within a single farm, once constructed they can be easily maintained and continue to improve yields for several decades by trapping

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[33]One article sets forth an irrigation continuum from "democratic" (decentralized) to "authoritarian" (centralized). The use of the term "democratic" is perhaps better reserved for a more specific decisionmaking process. "Participatory" might be more appropriate. See John O. Reuss, Gaylord V. Dkogerboc, and Douglas J. Merrey, "Watercourse Improvement Strategies for Pakistan," Water Supply and Management, Vol. 4, 1969. It is, of course, possible to develop other criteria, such as one based on social organization. This would be far more complex and data would be more difficult to obtain. One other categorization ranges from "simple" to "complex," involving external dependence. See Brian Spooner, "Irrigation and Society: The Iranian Plateau," in Theodore E. Downing and McGuire Gibson, eds., Irrigation's Impact on Society, Tucson: The University of Arizona Press, 1974.

rainwater for irrigation. This was perhaps the most technologically simple irrigation system examined.[34]

Another simple system is the Bangladesh hand pump system supported by AID.[35] These wells are predicated on a high water table that is seasonally replenishable, small--almost miniscule--farm or plot size, and surplus agricultural labor. The Bangladesh farmer is hydrologically autonomous, because the aquifer is easily renewed. If this were not the case, as in Yemen, then the drawing down of the water table would force either cooperation or competition with similar farmers or others.

These systems are so simple and mobile that both the pumps and the tubing can be moved as required, and can provide potable water for domestic use on the farm. In other societies or areas with lower water tables, larger farm size, less available labor, and a more affluent farming community, these pumps may be driven by diesel or electricity, and usually are stationary. In some societies, such as the northern Luzon region of the Philippines, mobile diesel pumps are used to provide irrigation to individual farms for dry season crops that require less water than rice, such as cotton, tobacco, or vegetables.

Larger tubewells may also be used to irrigate a number of farms, either on a cooperative basis, as in Burma, or as in the Tihama region of Yemen, where a wealthy landowner-cum-entrepreneur will provide water to his tenants (receiving 50 percent of the crop as rent and an additional 25 percent for water), or to other independent farms for one-quarter of the crop.[36] Farm tubewell systems thus can extend beyond the individual farm, involving external cooperation, and they blend into the second type, the community-based system.

Community-Based Systems

A community system is one that involves a number of farmers cooperating together to plan, distribute, and share water; to mediate disputes and impose regulations; and to provide for maintenance and the costs of operation of the system. These organizations may involve part of a village, or

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[34] Somalia Soil and Water Conservation, AID Project Impact Evaluation (in preparation).

[35] Bangladesh Small-Scale Irrigation, AID Project Impact Evaluation No. 42, 1983.

[36] UNDP expert, Yemen (personal communication).

one or more villages, and are usually determined on the basis of topography, but they may include or exclude groups for social or cultural reasons. They may be single purpose or have multiple functions, traditional or modern, legally recognized or informal, state assisted or controlled, or completely private.

These are generally small systems, but they are not circumscribed by any set size alone, for any definitional limit on hectarage would by necessity be arbitrary. Although size is often related to cost, and in donor-supported programs costs often seem to drive design, size is less relevant than management issues.

Examples of these systems include a number of traditional, community irrigation networks that have been privately managed, including some in northern Thailand,[37] the subak of Bali,[38] some of the systems of Java, the falaj of Oman, and the zanjeras of the Philippines.[39] There is now a considerable literature on these systems, although only the Sederhana projects in Indonesia were supported by AID. Those assisted by AID and on which impact evaluations have been completed include the government-organized, legally recognized, but privately managed small-scale irrigation systems (ISAs) of the Philippines,[40] the small government-assisted sederhana (simple) systems of Indonesia,[41] and the government-sponsored and -run bureaucratic systems of Korea.[42] To these should be added several others: the systems of Peru,[43] the small irrigated perimeters of

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[37]Abha Surivongs na Ayudhaya, "Water User Associations in the Mae Taeng Irrigation Project," East-West Center--A.I.M. Conference.

[38]Bali Irrigation Project, op. cit.

[39]Benito P. Visaya, op. cit.

[40]Philippine Small-Scale Irrigation, AID Project Impact Evaluation No. 4, May 1980.

[41]Sederhana: Indonesia Small-Scale Irrigation, AID Project Impact Evaluation No. 29, February 1982.

[42]Korean Irrigation, AID Project Impact Evaluation No. 12, December 1982. For a detailed study of Korean irrigation, see Robert Wade, Irrigation and Agricultural Politics in South Korea, Boulder: Westview Press, 1982.

[43]Peru: Land and Water Use in the Sierra, AID Project Impact Evaluation (in preparation).

Senegal (such as Bakel), and some of the planned AID-supported efforts in India. Some, such as the Balinese ones, are not only integrated into the social fabric of the society but also into its religious life.

Along the continuum, community-based systems gradually give way to an intermediary stage between those where the locus of control is in the community and those large, bureaucratically organized entities designated as agency-based systems. This mixed system is composed of irrigation in which control of the secondary or tertiary canals may be communal, but where the main canals, tanks, or pumping systems are under the auspices of some entity, usually governmental or parastatal, for which the user community is not responsible. Examples include the Pakistan On-Farm Water Management Project (not a single system, but a large number of separate systems),[44] Turkey irrigation,[45] and the irrigation projects evaluated in Egypt.[46] In special cases, such as areas in China, these intermediate systems have their own catchment area and are known as "melons on a vine" systems.[47] These are highly complex organizationally, because of the interaction between the community and bureaucratic organizational structures.

Agency-Based Systems

The third category is that of agency-based irrigation. These are major schemes, but the principal determining factor in this type is not size, although some are massive, but more importantly where responsibility lies for their management. These systems are always managed beyond the village, either in some provincial or regional authority, and are controlled in some manner by a government-sponsored entity, either directly or through some parastatal agency.

These systems are highly complex, both irrigationally and bureaucratically, and authorities may have responsibilities

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[44]The On-Farm Water Management Project in Pakistan, AID Project Impact Evaluation No. 35, June 1982.

[45]Turkey Irrigation: Partners in Development, AID Project Impact Evaluation (in preparation).

[46]Egypt: The Egyptian-American Rural Improvement Service: A Point Four Project, 1952-63, AID Project Impact Evaluation No. 43, 1983.

[47]See James E. Nickum, "Local Water Management in the People's Republic of China," in Coward, op. cit.

that include the integrated or sequential development in one or more sectors of a whole geographic region, such as a river valley or watershed. Efforts of this sort included in the impact or other AID-sponsored evaluations are the Helmand River Valley in Afghanistan,[48] the Jordan River Valley in Jordan,[49] the Bicol area development project in the Philippines,[50] the Lower Moulouya River development in Morocco,[51] the Rahad project in Sudan,[52] and the Lam Nam Oon project in Northeast Thailand.[53] Other AID-supported efforts that fit this category are the Mahaweli project in Sri Lanka, various Indian irrigation schemes, the Doukkala project in Morocco, and the Luwu and Citanduy projects in Indonesia.

These complex, large systems are often multipurpose in either production (hydroelectric capacity as well as agriculture in the Mahaweli and the Helmand Valley) or in goals (watershed preservation in Citanduy and the Bicol, and resettlement in the Luwu, Rahad, and Helmand). The last two involved complicated resettlement efforts including the teaching of irrigation skills to transhumant pastoralists. (The Mahaweli requires the movement of large, diverse ethnic populations and skill groups to a new region.) One project (Bicol) initially included as one of its purposes the stemming of the outmigration of peoples from the region to the capital, although this purpose was eventually dropped from the project paper.

Of critical importance, however, are not necessarily the multipurpose natures of the projects, but the bureaucratic complexities that such programs require (and that some donors seem to prefer), such as central government intervention into the

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[48]Cynthia Clapp-Wincek, Helmand Valley Irrigation, AID Evaluation Special Study (in preparation).

[49]David Sharry, Jordan: Irrigation and Area Development in the Valley (duplicated but not published).

[50]BICOL: Philippines Integrated Area Development, AID Project Impact Evaluation No. 28, January 1982.

[51]University of Minnesota, University of East Anglia, An Assessment of the Lower Moulouya Irrigation Project, AID Evaluation Special Study (in preparation).

[52]Sudan: The Rahad Irrigation Project, AID Project Impact Evaluation No. 31, March 1982.

[53]Robert Muscat, Lam Nam Oon: An Irrigation and Area Development Project in Thailand, AID Evaluation Working Paper No. 46, September 1982.

planning and management process. In some cases, central, extraministerial authorities were created; for example those in Afghanistan, Jordan, Morocco, and the Philippines. In others, coordinating mechanisms were established, such as in Thailand. In two cases, Egypt and the Bicol, an extraministerial authority was created, but implementation was left to the line ministries. In many instances, not only irrigation was supplied, but other facilities, such as mechanisms for credit (Jordan), health (Bicol, Egypt, and Rahad), education (Jordan and Rahad), and a wide range of other infrastructure such as roads, electricity, and housing. Because of the complexity of the irrigation technology and the need to consider development within the region more broadly, permanent (at least to date) bureaucratic structures were established to manage and/or plan the main systems and even the region as a whole. In some cases the on-farm water distribution was left to local or subordinate groups. These projects were predicated on what were considered to be economies of scale in water control and production, as well as on national development and political factors.

Some of these systems were developed in areas new to irrigation (Rahad and Helmand). The Egypt project expanded existing networks to new lands, while others--such as the Bicol--absorbed many small communal systems into the larger one.

More important than the idealized community-based or agency-based models is the interaction between the two. If the locus of responsibility and management is a cardinal consideration, it is likely that operations or maintenance problems will occur where that responsibility is split or indistinct. Formalized relationships, furthermore, between locally based water-user associations and an external agency managing headworks or main canals sometimes do not reflect the real distribution of either power or responsibility, which may be based more on cultural norms than on administrative agreements. It is likely that donors may pay more attention to the formal structures than to the real dynamics of responsibility and decision-making.

Other Continua

Parallel to the locus-of-responsibility continuum, which should not be thought of as an evolutionary model inevitably moving from community to agency control, are three others. The first is ownership of the irrigation system, as distinct from the land system (either owner or tenant operated) in which the continuum moves from the small, private farm to state-owned and -managed systems. The middle range of the continuum, however, is complex and unclear. The ISAs of the Philippines are legal, private entities, registered with the Philippine Securities and

Exchange Commission. They can own property and borrow funds. Some of the zanjeras of the same country are legally unrecognized, while others have formalized status. The Korean systems are government owned and operated; and in Indonesia, when the government provides assistance, with AID support, to the Sederhana systems, in some cases the government may assume some responsibility for the headworks, even if the rest of the system is locally managed. The Pakistan systems considered here are complex; community based at the local level, government owned in the main canal.

Internal and international political shifts also can affect how this continuum operates. "The political shift (from American to Russian influence) was responsible for the failure of EARIS to achieve its wider goal, to serve as a model for wide-scale land reclamation and rural development. The model of small-scale owner-operated farms was never divorced from its reclamation schemes. Even some of the land reclaimed in the closing years of EARIS was not distributed to settlers but used to create state farms."[54]

Whether publicly or privately owned, it is relatively safe to say that where responsibility and ownership are divorced, the irrigation system is likely to be in jeopardy over time as disputes will arise over responsibility for repairs and maintenance.

Another parallel continuum relates to production--from subsistence to locally available surpluses to regionally, nationally, or internationally distributed crop surpluses. The productive purpose of irrigation, and indeed its economic justification, is to provide such surpluses. There is no discernible correlation, however, between specific points on the responsibility and surplus continua.

A fourth, more tenuous, continuum is that of technical sophistication: from the simple hand pumps of Bangladesh or the bunds of Arabsiyo in Somalia to the Aswan Dam. Yet critics of this type of categorization will note that community-based systems can have highly complex technologies, and that simplicity or complexity of a physical structure has minimally no correlation, or perhaps even an inverse correlation, to social complexity. What may be more important than the technological complexity of systems is the degree of external technological dependence, bringing with it requirements for training beyond the local capacity of the water users to provide, and for

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[54]Egypt Impact Evaluation, op. cit.

materials that cannot be produced in the vicinity of the irrigated areas.

Thus, as donors consider the possibility of support to irrigation projects, the issue of whether that foreign agency is fostering a necessary or unnecessary external dependency (from the local community to a state-fostered bureaucracy) should be addressed. If it is deemed necessary, then whether the external organization has the capacity to provide the required services becomes a salient issue.

The concept of grouping irrigation systems for analytical purposes to improve donor-supported programs raises a series of issues regarding the relationship of irrigation to policies beyond irrigation itself. The continua of irrigation systems should help clarify both policy choices and the tensions inherent in such choices as well as critical issues in irrigation investment strategies. These include such elements as size, ownership, technology, the locus of institutional management, and even past or future donor support.

Before turning to these more abstracted findings that extrapolate from the impact evaluations and other material, it is appropriate to turn to the evaluations themselves to consider both the economic and social results of AID-supported projects.

3. The Social and Economic Impact of Irrigation: Lessons From Evaluations

The immediate purpose of irrigation is, of course, to supply water effectively, but its ultimate value is in improving the well-being of both the users and the nation, the latter because irrigated agriculture is almost by definition a move beyond subsistence to surplus production. In spite of the limits of time in a rapid rural appraisal, it is possible to garner considerable evidence, especially if supplemented by national or regional data, to determine how life has changed after the project.

It is, however, quite a different matter to be able to attribute accurately these changes to the project alone, or to allocate shares among various factors. Villages do not exist in a laboratory, and controlled experiments are rarely possible. Whether, therefore, it was irrigation that improved income, or whether it was pricing policies, development of other infrastructure, marketing improvements, availability of fertilizer, or any one or combination of a number of these factors probably cannot be ascertained with any degree of accuracy. Under certain conditions, especially in arid areas, irrigation may be a necessary, but it is rarely alone a

sufficient cause of progress, even when it is both efficient and reliable. With this major caveat in mind, the results of the impact evaluations can be discussed.

Production and Farmer Income

In each of the cases studied, aggregate production increased as a result of irrigation projects, either new or rehabilitated. It is important to qualify this obvious conclusion. It must first be admitted that the impact evaluations considered here were generally limited to recently completed projects, with the exception of Egypt, Somalia, and Turkey. This was a management determination in the hope that newer projects could provide more relevant lessons than older ones. From the experience of other donors and based on the academic literature as well, however, it is apparent that in the case of irrigation this is most likely too early a period in which to study these systems and from which to draw definitive judgments about their productivity. Production and yields do not usually reach their peak until the irrigation systems have been in operation for some years and over a number of cropping seasons, and some problems, such as deterioration of improvements or salinity, may not appear for some time.

Where land was not previously intensively farmed, as in the Sudan and Egypt, or where significant new hectarage was added to the system or multiple cropping became possible, aggregate production had to increase. Whether or not it increased rapidly enough to justify the economic costs, or to result in realization of any nonagricultural rationales, is an issue on which one cannot generalize. More important than aggregate production for purposes of generalization is the issue of yields, especially in relation to farmer income and to timing.

Yields generally increase with either new irrigation or rehabilitation. In Pakistan, better water management increased sugarcane production 30 to 60 percent and rice and wheat yields about 25 percent, in addition to saving scarce water resources. In the Bicol and elsewhere in the Philippines and Indonesia, rice yields doubled. In the Lower Moulouya, yields increased from one and a half to five times. In Korea, there were also major increases until the summer of 1980, when cold weather devastated the rice crop.[55] In the Helmand Valley and Rahad, however, yields increased quickly but could not be sustained; they fell in both areas but for quite different reasons. In

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[55] Korean Agricultural Research, The Integration of Research and Extension, AID Project Impact Evaluation No. 27, January 1982.

the Helmand, salinity cut production, or stopped it completely in the most severely affected areas. The major AID involvement after 1975 was designed to overcome this problem. In the Rahad, however, yields dropped rapidly over time (by about 100 percent for cotton after higher increases) because of lack of incentives, rigid regimentation, and the farmers' perceived need to engage in cattle production, to grow groundnuts free of government control, and to raise sorghum--the staple of the diet. It might also be noted that in the Gezira project in the Sudan, cotton yields did not increase over 20 years.[56] In the Egypt project, the success of irrigation in Fayoum undercut progress as private land reclamation overwhelmed water availability.

Yield increases, except in the initial period of irrigating new land, cannot be ascribed to irrigation alone. The most extreme case of a wide-ranging assault on low yields (and low farmer income) was in Korea, where a concerted effort to raise production included more irrigation; use of high-yielding varieties of rice; extensive, mandated use of fertilizer, pesticides, and herbicides; expansion and improvement of the extension service; increases in farmgate prices for rice to more than double the world market prices; and an enormous expansion in rural infrastructure that turned Korea from a series of small, regional markets into one national market. To ascribe these increases in yields to irrigation alone would be inappropriate. There is some evidence that irrigation's contribution to improved rice yields accounts for about 30 percent of the factors involved in the Philippines, but it is dangerous to generalize about this figure for other areas or other crops.[57]

In less dramatic and comprehensive efforts, increases in yields in Indonesia, the Philippines, Pakistan, Egypt, Morocco, and Turkey can also be related in part to irrigation, but it is likely that other factors were also present and were significant, even if they may not be quantifiable. In general, we may conclude that irrigation will expand yields, at least for a period, but that yields will continue to be high if irrigation is combined with adequate drainage, other agronomic improvements, better training and information, and incentives in pricing and marketing. It may be significant that in Egypt irrigation of sites near Alexandria did well because marketing was good, but in more distant desert sites it did poorly and

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[56]John D. Montgomery, "Productivity Contributions of Public Participation in Water Management," September 24, 1982.

[57]Philippines Small-Scale Irrigation, op. cit.

marketing facilities there were limited. Lack of marketing facilities was also a limiting factor in Senegal.[58]

An increase in yields of irrigated areas may mean an increase in farmer income, but there is no necessary correlation between the two, as is sometimes assumed. Farmers in the Philippine ISAs who were tenants seemed to be going into debt in spite of higher production and even the use of double cropping because of high rents to landlords, the costs of amortization of the pumps, expensive electricity, increasing fertilizer prices, and a relatively low price for rice sold to merchants and even with a somewhat higher price when sold to the government. In many cases farmers could not meet the quality standards insisted on by the National Grains Authority to compete on the world market. If family labor costs were calculated, many farmers were losing money. In the Rahad, the cost of production is higher than the gross returns to farmers who supplement their income with extralegal cattle raising and put their energies into commercial groundnut cultivation.

Conversely, when farm incomes rise, the total farm production unit should be considered, for such increases may be the result of greater attention to livestock or rainfed holdings, or to off-farm employment. Irrigation can rarely be considered in isolation from non-irrigation activities. In Senegal, some irrigated areas were abandoned for rainfed sites during the rains.[59]

Even when effective, the present high costs of irrigation generally preclude its use, as once was prevalent in monsoon areas, as a simple type of insurance policy: the guaranteeing of sufficient water for the main crop. Most often it is assumed that irrigation will allow doubling of cropping intensity (from one to two crops each year) or in some cases a tripling of crops grown (in Pakistan cropping intensity increased 15-50 percent). This comment does not apply to Korea, where climatic conditions preclude a second crop of rice, but where lack of incentives has lowered the amount of barley produced without irrigation during the winter.[60] Although irrigation does increase cropping intensity, and in many cases significantly, often the nature of the irrigation network or the

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[58]See Jack Keller et al., Project Review for Bakel Small Irrigated Perimeters, Senegal/USAID Water Management Synthesis Project, WMS Report 9, Logan, Utah: Utah State University, 1982.

[59]Ibid.

[60]Korean Agricultural Research, op. cit.

quality of water management does not allow for complete double cropping. The Aswan Dam was planned to allow perennial irrigation, but it did not occur universally. This is true in Indonesia for run-of-the-river systems where dry season flows may not be sufficient, and in the Philippines where water cannot reach all parts of the network. In general, expectations of universal double cropping should be treated with caution in project design. In a World Bank study, cropping intensity increased as a result of irrigation projects to 132 percent for rice and only 82 percent for non-rice crops.[61]

Tenancy has a profound effect on farmer income. In Korea, where two land reforms were instituted and where owner-cultivators receive the benefits of improved irrigation, land reform was extremely important. In other countries this is only partially true. In Pakistan, irrigation systems that were improved with AID support were required to consist of 75 percent small farmers, but the impact evaluation noted that land ownership patterns had an important effect on income. The Rahad is the exact opposite of Korea. All farmers there are tenants of the state, and, in fact, irrigation in the Sudan, at least in major donor-supported areas, is state-farm irrigation.

In the Philippines, the situation is different. In spite of land reform in rice and maize areas, the success of which is still the subject of much acrimonious dispute, landlords may retain up to seven hectares of paddy land, which is of considerable size compared, for example, to holdings in Java. In those areas where irrigation has been provided, it is the tenant, not the landlord, who must pay for both the amortization of the system and its operating costs. Further, where the tenant legally has paid a maximum of 25 percent of one crop as rent (in fact, interviews indicate that there are many instances where the legal limit was ignored), with irrigation, landlords receive rent on all crops. Landlords, without risk, therefore receive windfall profits that undercut the rhetoric of equity in the rural development strategies in the Philippines.

This is not to suggest that land reform alone is the single factor that will increase incomes or productivity, for the impact evaluation in Haiti indicated that in spite of the most egalitarian distribution of land in Latin America, Haitian production has suffered badly. "Land reform alone has no necessarily positive effect on raising production per unit

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[61]John M. Malone and Poonsook Mahatanankoon, "Post-Project Evaluation in Irrigation and Drainage. The Experience of the World Bank: An Updated Review," Washington, D.C.: The World Bank (n.d., 1983?) (mimeo.).

area...."[62] Land reform, however, is a singularly effective means to increase income and provide incentives for improved production if combined with other appropriate measures. In Bangladesh, because a well-conceived technological innovation was not paralleled by a similar innovation in credit, tenants often could not get credit for hand pumps and sold their rights to them to larger farmers, thus undercutting the purposes of the project.

Overall, credit is not a subject that is consistently covered in the impact evaluations. In many cases, the governments attempted to supply credit both for seasonal use and to encourage improved productive capacity. This was true in Turkey, Bangladesh, the Philippines, Thailand, Egypt, Jordan, and the Sudan, but in many cases the credit was insufficient and recourse had to be made to the moneylender or to other informal sources. This issue is specifically mentioned in the cases of the Philippines, Bangladesh, and the Rahad. The question of credit is the subject of an extensive and varied literature and cannot be covered in any detail here, but it is evident from the Bangladesh, Turkey, Pakistan, and Philippines experiences that careful planning of credit needs and the sufficiency of the mechanisms proposed in project papers must be essayed if irrigation is to reach its full potential.

The timing of credit and the payment for produce is another factor that affects farmer income. In the Philippines, the evaluation noted that the National Grains Authority did not pay for produce on delivery, and the hiatus between the two came at a critical period in the seasonal cash flow of farms. Farmers were often forced to take a lower, but immediate, payment from private merchants because they needed cash. The situation in Turkey was even more severe, because farmers had to bear the brunt of rapidly rising costs in an inflationary period while the government held payments for many months at low interest rates. Project papers ought to give as much attention to the timing of credit and payments for crops as they do to the provision of funds and purchasing supplies or equipment.

Social and Institutional Impact

The social and institutional impact of irrigation is much more difficult to assess than the economic consequences, since the latter can be measured to some degree even if the causal relations between income and irrigation are sometimes murky.

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[62] Haiti: HACHO Impact Evaluation, AID Project Impact Evaluation (in preparation).

There are a few general lessons that might be deduced from the impact evaluations related to institutional impact, but they are more concerned with donor assumptions than with the societies concerned or the projects themselves.

In very few instances were new institutions created that enhanced the participation of the irrigators themselves. In fact, the attempts to form irrigator associations in Pakistan and Thailand utterly failed. In Pakistan, it has been suggested that "Punjabi rural society is characterized by a set of values and mechanisms which encourage conflict, make conflict endemic and unavoidable, and thus tend to discourage cooperation on a long-term basis."[63] In the Sudan, the parastatal organization recognized the need for local institutions such as village councils, but their role in relation to the productive aspects of life was slight. Water-user associations were formed in Korea, but they were not participatory; rather, they were mechanisms through which to deliver water and collect fees, in spite of AID project purposes to the contrary. In Ceel Bardaale in Somalia, group cohesiveness was fostered through the leadership of a charismatic religious figure, who was both the spiritual and temporal authority of the community.

In the Philippines, the situation is more complex. ISAs are generally participatory organizations in which members seem to play an active and significant role. The hope that the ISA could also be a force for other useful village programs, however, has not been realized, for villagers perceive of the ISA as single purpose in scope, and other village-level groups and individuals can be mobilized to achieve different purposes. In the Bicol area, the government generally took the lead in reorganizing traditional water-user groups with questionable effect, but in one part of the Bicol (Buhi-Lalo) dissatisfaction with commercial contractors encouraged local farmer groups to bid on construction work. Here, participation was pronounced and quite different from other areas within the Bicol. The Bicol Program Office did establish a private advisory committee to consult on the social aspects of the project, but an earlier study indicated that the aspirations and priorities of the people differed considerably from those of officials.[64]

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[63]Douglas J. Merrey, "Irrigation and Honor: Cultural Impediments to the Improvement of Local Level Water Management in the Punjab, Pakistan," Field Report No. 9, Fort Collins: Colorado State University, Water Management Research Project in Pakistan, July 1979.

[64]Frank Lynch, "Let the People Lead," Naga City: Ateneo de Naga, 1977.

Pakistan also poses a special case. Local officials and local elected bodies were not included in the operation of the project, and in fact the evaluation hints that the democratic process failed to achieve realization of the interests of the group, as individuals could manipulate the process for their own interests.[65] This conclusion may only be localized in the Northwest Frontier Province and needs further study.

Generally, project designers stressing participation seemed to be playing a role more for the audience acquainted with the Foreign Assistance Act of 1973 than they were taking into account the social and institutional realities of the societies in which projects were to take place. There is an understandable interest in building onto irrigator associations a variety of other desirable nonagricultural functions, but the evidence seems to question the success of these efforts.

Few of the impact evaluations dealt with the problems of women in any depth, the Korea and Egypt reports being exceptions. In Korea, the evaluation found that in spite of a dramatic rise in family income, women were working harder and received less benefit than might have been assumed under the project.[66] The Pakistan report noted that irrigation did save women some time, and they had better washing facilities, but that women's education did not materially improve; a similar finding was reported in the Sudan. In Somalia, in the early stages of the irrigation project, women played a greater agricultural role even in an orthodox Muslim community, but as irrigation became institutionalized, this new role atrophied.[67] Women assisted in the arduous job of hand-pumping water in Bangladesh, but whether this could be considered a positive finding is questionable. In the Philippines, where the power of women is already considerable, the meager information from the small-scale irrigation evaluation indicated that in those parts of the country where other field data had indicated considerable involvement of women outside of the home, the same held true in irrigation associations. It did note the important role of women in the Farm Systems Development Corporation

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[65] The On-Farm Water Management Project in Pakistan, op. cit.

[66] Korea Irrigation, op. cit.

[67] Somalia Soil and Water Conservation, op. cit.

where they performed very valuable organizing functions with elan and competence.[68]

Health, nutrition, and environmental impacts seemed to vary considerably from project to project. Health considerations were covered under a special project included within the framework of the overall Bicol umbrella, although proposed and approved separately. The only other project evaluation in which health was treated in some detail was in the Rahad report, which noted the negative effects of the project on seasonal workers in the area. It discussed the problem of bilharzia in the region, and the efforts to monitor the problem. Sanitation was discussed in the Egypt report. Nutrition was treated only in the Korea report, which found that although family income did improve, the link between better nutrition and higher income is not a necessary one, as traditional weaning and feeding practices of children often continue in spite of access to better and more nutritional foods.

Few serious adverse environmental effects were found in the small irrigation projects, mainly because irrigation was pronounced in the regions if not on the specific sites, although in Korea the potential for pesticide and herbicide contamination was mentioned, and in Turkey the spread of waterborne plant diseases was increased. In Pakistan, water-logging and salinity were noted. In the larger systems, however, the situation was mixed. The later Helmand efforts were designed to overcome some of the environmental degradation of the earlier programs. Without the construction of drainage in Thailand, environmental problems may be expected in the next decade, as salinity has built up in other, similar areas of that country. The Bicol project included an element of watershed preservation in an attempt to reverse the problems that are plaguing a large part of the Philippines. Although the Rahad report found that there was an increase in illegal felling of trees to supply charcoal to the expanded project area, there were some positive environmental results as well, including the provision of greater nesting areas for water birds.

These findings should not be cause for complacency, since the salinity of the Nile delta, which AID is helping to reverse in other projects, and the potential spread of waterborne

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[68]For a study on women in irrigation in Sri Lanka, India, and Indonesia, see Kathleen Cloud, "Women and Water Management: Understandings Gained From My Asian Trip," Consortium for International Development, Women and Development Project, November 30, 1982.

diseases such as malaria and bilharzia require careful monitoring on a continuous basis long after the donor has fully funded the project. A careful assessment must be made not only of the government's interest in the problem during the project's life, but also its interest, administrative and technical capacity, and inclination to provide funds to deal with the issues indefinitely into the future.

If farm incomes did improve, what were the family priorities for use of extra funds? In Korea, the answer was clear: education. This is not surprising in a Confucian-oriented state, but the fact that children went to school longer had a number of effects. It forced more work on the woman in the family as children stayed in school longer. It also encouraged physical mobility, with all respondents hoping that daughters would not marry farmers and that sons would find urban employment. The result is an aging of farm families, a subject noted in the academic literature and confirmed by the impact evaluation.

In the Philippines, education was also a priority, but in Pakistan it was listed as one of three, along with investments in improving the farm and the home. Although there was little surplus capital for tenants in the Rahad, the lack of schools and social services in the areas of the project that were developed later was a source of discontent for many. In Egypt, housing was of priority.

Did irrigation projects attract investment or participation by the private sector in the region so as to increase the resources available for development, to create more employment, or to provide the basis for better social services? Here the answer once again is mixed. For Turkey, it is unequivocally positive, for the private sector did respond rapidly to take advantage of the need for new agricultural equipment. In Morocco, the development of the Lower Moulouya area was able to attract a considerable amount of capital into the region, thus improving the overall economy. The Bicol situation was equivocal. Banks expanded their interests in the area in the hope that the project would attract more opportunities, but there was little corresponding private investment by industry in the region. The capital generated by the land reform program, in which landlords were compensated for the land they relinquished, found its way to Manila where interest rates and opportunities were considerably better than in the Bicol. Although brisk private enterprise is reported from the Rahad, it is more in the way of petty trading than entrepreneurial activity. This may be due to the strong and pervasive government influence in a region that is remote from population centers. Smaller irrigation works may have a marginal impact on improving the private sector in the area. The provision of pumping facilities does encourage local spare parts and repair facilities, most of which are private in many societies.

One aspect of potential private sector investment in irrigated areas is the creation of employment opportunities. In Egypt, land available for housing encouraged small-scale private traders and craftsmen. Sometimes the irrigation works themselves are planned to do that. Conversely, some are based on the impression that since there are limited off-farm employment possibilities, work on irrigation for subsidiary crops would be an acceptable alternative. These assumptions must be treated with caution. It was anticipated, for example, that in the dry season in Northeast Thailand there would be a surplus of labor that could be pursuaded to irrigate the Lam Nam Oon area. This assumption proved false, for the risks were high and alternatives existed. In the Sudan, migrant labor was attracted to the region, but the government's calculation that half of the population would be landless and would work on the farms proved also to be an overstatement. It also did not mesh with government plans for 100 percent mechanization of this vast area, a plan that, as in so many other countries, has proven difficult to implement. Seasonal shortages of labor were noted in the Pakistan report, and perhaps the extensive Pakistani migration to the Persian Gulf states may account for this fact. In the Bicol, there was an interesting but unexplained reversal of policy. In road construction, which was part of the Bicol development plan, labor-intensive construction at first provided some 9,000 person years of employment, but then a shift was made to more capital-intensive methods, which produced only 1,000 person-years of employment. The reasons for the shift are unclear, given the very high (although officially unrecognized) unemployment rate there, and the extensive migration from the Bicol to Manila. In considering the effects of irrigation on private sector activities, it is apparent that greater attention should be paid to the subsequent development of markets, small-scale industries, and service trades outside of the irrigated perimeters.

Irrigation is sometimes intended to provide direct employment for the landless. The impact evaluations did not deal with this to any degree except in the Rahad. One recent study from the Philippines indicates that hired (presumably much of it landless) labor income on irrigated land decreased relative to the income of farmers on such land although it increased in absolute terms.[69] This might be a fruitful avenue of further inquiry.

Attention has been devoted in this section to what a government-sponsored project has done for the people, but to complete the picture the question of what the people have done for the government must be asked. The first and most obvious

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[69]Easter and Welsch, op. cit., citing M. S. Adriano.

contribution is heightened production that has, at least potentially, lowered the need for the import of food in some countries, or increased exports of either food or fiber in others. These contributions can easily be calculated, but the implications are not always as clearcut. The Philippines exports rice, but there is a major element of its population that cannot afford to buy it. If, for example, a 6 percent increase in per capita consumption of rice were desired there, an additional 340,000 hectares of irrigated land would be necessary together with a $250 million subsidy for fertilizer over a decade to reduce the disincentive of declining farm prices.[70] For a few years Korea was self-sufficient in rice as well, as a result of extensive irrigation and other factors. During this same period, however, wheat imports continued to rise, indicating the changing dietary patterns of a growing urban population.[71] In any analysis of the contribution of irrigation, these factors beyond the commodity, and indeed beyond the sector, must be considered.

There are other purposes for which government uses irrigation and the organizations associated with it. One use is political. In Korea, irrigator associations are one more form of government political control at the local level. Even the President of the Republic, in May 1981, remarked publicly that the bureaucracy was manipulating data to fulfill government-required quotas when it indicated that all paddy land was irrigated, while complaining about a drought that officially should not have existed.[72] In the Philippines, the government announced the completion of some of the irrigation works in the Bicol as political propaganda at a time when the water was not yet in the system. Although the ISAs in the Philippines were not used overtly by the government for any political purpose, according to the evaluation, there was of course the indirect implication of government interest and support for the problems of the farmer. The Helmand Valley project, partially designed for resettlement, had as a subsidiary motivation the ensurance of the loyalty of the Pushtun tribes of the region. None of this is new or especially significant, for these actions are typical of a variety of governments. Donors should, however,

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[70]Pat S. Ongkingco, Jose A. Galvez, and Mark W. Rosegrant, Irrigation and Rice Production in the Philippines: Status and Projections, International Food Policy Research Institute, International Fertilizer Development Center, and the International Rice Research Institute, Working Paper No. 4, Rice Policies in Southeast Asia Project, 1982.

[71]Korean Agricultural Research, op. cit.

[72]Ibid.

expect that this type of activity will occur and be prepared to deal with its consequences, if any. Irrigation has political symbolism as well as having economic implications.

The conclusion of the impact of irrigation on the farmer and the farm family is positive overall, but the differences that have been demonstrated and the varying effects of irrigation, even within the family, should prompt project designers to question all assumptions about the positive benefits of irrigation until they have ascertained how a specific society operates. Irrigation cannot be left to engineers, economists, or social scientists operating alone, nor can it be left to all working separately on the same project. The need is not for a multidisciplinary approach to irrigation, but rather an interdisciplinary approach, where each phase of project design is considered by all disciplines together.

Irrigation may seem to be one of the more self-contained of projects, operating as it must within circumscribed perimeters. Yet its effects may extend beyond those limits, and not merely because of its production of an agricultural surplus.

Many farmers depend as much on the availability of non-irrigated land for a different set of crops as they do on their irrigated holdings. In fact, the uncertainty of the supply of water when needed may prompt farmers not only to abstain from making improvements to their land and in moving from lower yielding, but drought-resistant crops or strains, to higher yielding varieties responsive to better water management,[73] but also to spend more time and attention on their rainfed holdings. Where cattle are important either economically or because of the social prestige their ownership may confer, more energy may be extended on their nurturing than on irrigated crops. Cattle are an important, unofficial element in Rahad economics and are likely to play some critical role in other parts of Africa. The impact evaluations essentially omit the problem of possible polarization between irrigated and non-irrigated farmers, a subject that may be of considerable significance, especially in areas new to irrigation. The impact evalutions do not cover as well some of the problems associated with the introduction of irrigation onto land that was not previously irrigated, and in populations that have had no experience in that demanding occupation. Irrigation causes increases in the value of land irrigated. This intensifies the potential for disputes, and may also signal the breakdown of concepts of

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[73] Wattanavitikul and Cruz, op. cit.

communal-held property into individually owned plots.[74] This radical economic change is likely to increase social tensions. These issues should be addressed in any project planning or evaluation, especially in parts of Africa where there is a long tradition of ethnic or clan land holdings.

Of great importance is the growth of commercial market centers beyond the irrigation perimeters. This is documented in the Rahad study and in the Lower Moulouya, and is evident in other societies as well, such as in the Muda project in Malaysia, which was financed in part by the World Bank. The benefits in terms of employment, increased commerce and trade, and the formation of alternative poles of migration are difficult to calculate particularly within the methodological limits of the impact evaluations, but may in the long run be as significant as the irrigation itself.

Having reviewed the results of the impact evaluations, summaries of which appear in Appendix III, it is now necessary to turn to the policy and strategic issues at which some of the impact evaluations hint.

4. Irrigation Within the Policy Setting

Dr. Panglcss to the contrary, the world of water is often not the best of all possible worlds. Natural conditions are rarely optimal. Difficult choices under financial stringency and competing requirements are often necessary, and limited administrative capacity slows accomplishments. Thus, the world of water is often a world of tradeoffs--choices between competing needs and goals.

Agricultural Triage

It is unlikely that most developing nations can provide a complete mix of the necessary components in the development equation at the same time, for reasons both financial and administrative. To state this may be a tautology, for the very status of being a developing country implies that the fiscal, managerial, and skills capacities are not fully in place. Additional administrative requirements inherent in any development program further stretch already strained bureaucratic systems.

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[74] In some parts of the Bakel irrigated perimeters in Senegal, some land was still held communally in spite of official pressures to divide it up, indicating the strength of traditional social patterns. See Project Review for Bakel Small Irrigated Perimeters, op. cit.

Donors try to fill both of these gaps, but funds are rarely sufficient and technical assistance, even if effective, cannot substitute for indigenous bureaucratic capacity. What may become necessary, therefore, are two types of triage: first in development policy and then within the agricultural sector. Triage is choice, but the term has assumed dramatic overtones. It is used here to stress the political and economic difficulties inherent in making such choices among competing development approaches and then in agricultural policy determinations. Such difficult decisions are rarely if ever alluded to in such stark, undiplomatic terms because they would be politically indefensible. These decisions are made on the basis of factors far beyond the scope of this paper to predict in detail, and most probably beyond the power of the donors to influence. The following must often be considered: whether industrial expansion (as in Korea) or agriculture should push development; the perceived need for strategic food reserves; a volatile urban population demanding food subsidies; higher prices paid to farmers for productive or political reasons; political requirements to favor a particular regional or ethnic group; and so forth.

Policy consistency is a rare commodity, and inconsistencies and tensions exist in formulating policies internally in recipient nations, between donors and recipients, and in donor institutions themselves. The tensions in U.S. policies between disposing of U.S. surplus grain stocks and increasing grain production overseas is one example. There is often conflict between mercurial urban demands and those of the rural population. For example, in the case of Korea,[75] adequate pricing incentives to raise both production and farmer income have involved heavy subsidization of rice and barley for farmers. If the government needs to keep urban consumer prices low, and if a country enters into a period of economic malaise, then economic reality intrudes and forces triage for overarching national goals. In Egypt, low agricultural prices deemed necessary for urban consumers are regarded by AID as a major constraint to agricultural development.

Even in those relatively rare cases where donors are able to influence policy (and the magnitude of loans or grants is not the only or necessarily the critical consideration), the identification of a foreign government or organization with selected policy triage would most likely be unacceptable. If, however, aid is to be provided to irrigation systems and the requirement of extensive local government support to them restricts other developmental activities, political problems may ensue. The donor should realize the political implications of

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[75] Korean Agricultural Research, op. cit.

association with such assistance--both for the national government and for the donor--and be prepared to accept the consequences.

Agricultural policy triage involving support to irrigation within national fiscal constraints may be equated with the sacrifice of assistance to extensive elements of the population, such as rainfed cultivators, for the benefit of a relatively small but potentially productive group of irrigators. The first question that might be asked, therefore, is: when is a donor intervention in irrigation an inappropriate response to a developmental problem?

Irrigation as an Inappropriate Response

Although there seems to be no universal, simple formula for successful irrigation (although there is a diversity of means--discussed in this paper--by which irrigation might be improved), there are a number of conditions under which support to irrigation might not be considered as a policy option. Although some physical and climatological factors, such as soils and hydrology, may preclude irrigation as a major investment opportunity, more often the issues relate to economic, social, or political considerations which are considerably more diffuse and difficult to measure.

Whatever the objectives of irrigation, a subject discussed below, caution is indicated when there is an unresolved presence of irrigation failure in the past, and when alternative modes of productive investment with lower infrastructure costs are possible. Some of the new technologies that have made irrigation more productive have also been similar stimuli to rainfed agriculture. If irrigation intrudes into a fragile environment, ecological or social, if it involves massive dislocation of peoples, or if it will exacerbate social tensions through intensifying maldistribution of income, serious questions of support should be raised.

When economic policies or institutions are weak, these are serious constraints to effective irrigation. Poor agricultural pricing policies, ineffective marketing facilities, high transport costs, or the unavailability of required agricultural materials may make irrigation an inappropriate investment, either for the state or the individual farmer or both.

If the institutional capacity to manage irrigation at any level has not been demonstrated, or if overall management is weak, these are warning signs that irrigation programming may be difficult. The donor's institutional capacity should also be assessed, for if a long-term commitment on the part of the aid agency is unlikely, if the required disciplinary skills and

sociocultural knowledge are lacking, or if the capacity to monitor the project effectively is missing, then perhaps a different type of investment might be more appropriate, leaving irrigation to more qualified donors.

Finally, circumspection would be wise if legal or dispute-settlement factors are undeveloped or obscure. Issues such as security of land tenure (either individual or communal) and ownership of or access to water rights and physical structures, or questions related to allocation of responsibility or alleviation of grievances (either through formal legal or administrative structures or through informal but socially established precedents) should be carefully assayed prior to making commitments (also whether legal, political, or social) to support irrigation.

Having set forth some of irrigation's storm warnings, the issue of development strategies should next be considered.

Development Strategies

Basic to the formulation of a development strategy is the need for a national resource policy, and within that policy a specific policy for water.

Some nations must determine their national or regional water policies or face critical problems later. Water is often a scarce commodity, either seasonally or perpetually, and irrigation often intrudes on other water uses, some of a more strategic or political concern. Even when water scarcity is not an issue, a corollary policy question is the allocation of resources to maintain existing water distribution arrangements, as in the case of Pakistan's growing and costly problem with siltation of the major canals. Under conditions of severely limited surface water supply or subterranean reserves, choices must sometimes be made about using water for agriculture, urban water systems, and industry. The cases of Jordan and Yemen are illustrative. The political and social needs for water to service the urban Amman population have prevented full exploitation of the irrigation systems of the Jordan Valley,[76] because there is not enough unpolluted water for both. In Yemen, the falling aquifer levels indicate a strain between agricultural and industrial uses, and indeed between competing private

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[76]David Sharry, op. cit.

interests' exploitation of limited water for agriculture.[77] Some have suggested that "there is little doubt that the development of groundwater is usually a vastly profitable exercise and, as such, it is likely to be monopolized by the few--or to be over-exploited by the many."[78]

Monopoly control over water or its quality may lead to internal political problems. Internally in India, Sikh demands for more autonomy include a greater share of irrigation water.[79] In Indonesia in 1980, about 200 villagers burned down a chemical plant in West Java that had for three years polluted irrigation water so that the land was no longer productive.

Sometimes the choices of the uses, distribution, and quality of water transcend the nation and become international concerns; disputes arise between conflicting national interests in the use of water for agriculture. International agreements are sometimes necessary. On the one hand, enmity over the Indus Valley water distribution systems between Pakistan and India was resolved under World Bank auspices with considerable financial investments. The enmity involving India and Bangladesh, however, over the Indian construction of the Farakka Barrage just within the Indian border, where this construction diverted water that Bangladesh considered necessary for its irrigation systems during the dry season, is still an issue.[80] Irrigation needs on both the left and right banks of the Jordan River have created issues between the two countries. The Sudan and Egypt have signed an agreement on sharing water. Deforestation in Ethiopia causes siltation problems in the Sudan, just as similar environmental degradation in Nepal affects India.

Water control, including irrigation and drainage, has assumed even more importance within the past two decades with the introduction of higher yielding grain varieties. These technological innovations, in the aggregate perhaps the single

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[77] D. Steinberg, Field-trip notes, 1976. See Yemen Arab Republic, Agricultural Sector Assessment, USAID/Ministry of Agriculture, Sanaa, December 1982.

[78] Ian Carruthers and Ray Stone, Economic Aspects and Policy Issues in Groundwater Development, World Bank Staff Working Paper No. 496, October 1981.

[79] Far Eastern Economic Review, December 10-16, 1982.

[80] The Washington Post, January 20, 1983.

most important agronomic advance since the spread of maize from the New World, are not without their price. Improved rice, for example, is shorter--energy going to larger heads and thus to more grain, increasing yields instead of stalks--and requires more deft management of water levels both to provide a predictable supply and to prevent drowning, and more fertilizer and in some cases pesticide, thus utilizing more energy, to take advantage of their genetic potential.

In a sense we have become economic prisoners of our new technology. Without better water control and management and more fertilizer, the new high-yielding varieties will not surpass the traditional ones; but the more such varieties are planted, the greater the need for more costly irrigation systems, the more careful the water management must be, the more training is necessary, the more urgent the requirement for expensive fertilizer, and the greater the danger of environmental and health degradation. The old adage of no free lunch is ever with us.

Irrigation policies may be strongly affected by population pressures that can lead to fragmentation of holdings, and governments may view expanded irrigation as the solution to population increases, as did Egypt, or migration to the primate city, as in an early conceptualization of the Bicol project in the Philippines. Although irrigation can obviously support denser populations, it is likely to alleviate only temporarily the burgeoning economic or social demands that such increases impose on the state.

Even when more abundant water supplies are assured and better water management is available, these are but two of the critical components in an effective agricultural strategy involving irrigation. Some decisive elements are technological, others economic, and some organizational. The delicate balance of all these factors in the equation producing the highest returns at the lowest costs with the least damage may only be determined in local settings.

Economic considerations are obviously critical. Of primary concern are pricing policies, the returns that farmers receive for their agricultural produce. Pricing policies that encourage production and provide economic incentives for farmers have often been cited as one important element that fosters increases in yields, thus validating the investments in expensive irrigation. Yet the issue is somewhat more complex, since there may be substitutes for adequate pricing incentives, and some incentives may be too great. Low prices for rice have been maintained in Burma, lower than in other Asian nations, but increased yields have resulted because implicit coercion

has been substituted for attractive prices.[81] The growth of other, higher income crops may offer an attractive substitute for grain, as, for example, vegetables do in Korea[82] in spite of national objectives for grain self-sufficiency, and in the Jordan Valley.[83] Disparate pricing policies between neighboring countries may also encourage illegal international sales, such as rice smuggling from Mali to Senegal, Niger, and Upper Volta, or from Burma to Thailand and Bangladesh. In the former case, government pricing policies in the irrigated areas of Mali have been characterized as "extortion."[84]

Pricing is of course only one element of a variety of economic incentives. Another is timing: when payment is made for produce. Farmers often are willing to accept a lower price with immediate payment rather than a higher, but delayed, price.[85] Other questions are the quality of the grain and the price that higher quality demands, and how the farmer is or is not able to achieve such quality.[86]

A closely related issue, both economic and technological, is the timing, availability of, and prices for agricultural resources such as fertilizer, pesticides, and herbicides. These elements too are sometimes subsidized, substituting in whole or in part for higher grain prices. When these are kept low, this may mean leakage of these commodities into other markets. The smuggling of fertilizer from Burma to Bangladesh is said to be significant, for example. Pesticide use is extensive, as in the Sudan in Rahad, or in Korea. Herbicide requirements,[87] a major component of the Korean farm budget, are more a product of the high costs and limited availability

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[81]The government can withdraw the farmer's right to cultivate the land, as residual ownership resides with the state. See David I. Steinberg, Burma's Road Toward Development: Growth and Ideology Under Military Rule, Boulder: Westview Press, 1981.

[82]Korean Agricultural Research, op. cit.

[83]David Sharry, op. cit.

[84]Carl K. Eicher, "Facing up to Africa's Food Crisis," Foreign Affairs, Fall 1982.

[85]Philippine Small-Scale Irrigation, op. cit. See also Turkey Irrigation, op. cit.

[86]Ibid.

[87]Korean Agricultural Research, op. cit.

of farm labor than they are a necessary element of the new technology.

Increased use of this complex package known as the new technology is usually dependent on increases in agricultural credit. In many cases credit has been supplied by the government (the Masagana 99 program in the Philippines is one example) through government-sponsored outlets. It may also be considered as an advance on sales to the state, as in Burma. In the Rahad project, the costs of state supply of services and commodities is deducted from farmer accounts. Agricultural credit programs had a mixed review almost a decade ago,[88] and there is only limited evidence that they have become more effective. Whether for irrigation pumps in Bangladesh,[89] or for less specialized needs in other societies, the poorer farmers often seem to be deprived of access to noninstitutional credit sources. The inherent contradiction in many areas is that land is the only real collateral for rural credit, and land is what the poorer cultivator lacks.

Although nonagricultural infrastructure is often excluded in considering the composition of an agricultural strategy, it is closely related to the success of such a program. Adequate distribution systems for both resources and produce, markets, effective storage, processing, spare parts, and even the mobility of extension agents are dependent on such infrastructure as roads, railroads, a consistent and predictable electric supply, and marketing facilities. One study concluded, "Such open-ended policies of crop promotion without a simultaneous marketing development program to absorb the increased output has led to farmers' reluctance and, in some cases, loss of faith in adopting new varieties of seed and other modern technologies recommended by the government."[90] Some opium poppy crop-substitution programs in Thailand have suffered because of lack of both markets and transport at appropriate prices. Policy choices inherently involve tensions among a variety of competing demands, not all of which are limited to the agricultural sector.

Policy Issues and Irrigation Choices

Any government providing extensive benefits in terms of infrastructure, rehabilitation, or technical support to a

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[88] The Spring Review on Small Farmer Credit, AID, February 1973.

[89] Bangladesh Irrigation, op. cit.

[90] Wattanavitukul and Cruz, op. cit.

segment of the agricultural community, such as beneficiaries of an irrigation system, must face the primary issue: who pays for these efforts? Even with donor grant funding or largely concessional lending, the recipient nation must assume a major portion of the costs as well as the continuing commitment to them. Costs to the developing nation are often underestimated, and inflation may place a greater strain on the recipient as project costs escalate if they inflate faster than tax revenues, although inflation may also reduce the real size of debt.

Responsibility for repayment of capital costs usually rests with the national government, although this is not always true. In the People's Republic of China, the central government acts as guarantor of an international irrigation loan, but the hsien (county) governments are charged with repayment.

The state may pay for irrigation through a wide variety of mechanisms. These are determined at least in part by a government's real, as opposed to rhetorical, commitment to rural development, agricultural progress, and rural equity. The government may subsidize a production program through basic revenues accruing to it, such as from general taxes, import duties, or export promotion. Other or additional means may be found that in effect place more of the burden on the rural community, such as a low government purchase price for major crops that becomes in effect a tax on the farmer (rice in Burma, cotton in the Sudan and Egypt), an export tax on the grain (rice in Thailand), or the recovery of the costs of the system from its users.

Governments have viewed the provision of irrigation systems differently. Some, such as Sri Lanka, Indonesia, Turkey, and Thailand, have considered it a governmental function to provide these facilities superficially free (as distinct from any costs for the use of water once the system is operational).[91] These perceived contemporary attitudes have their historical precedents in both traditional Buddhist and Muslim societies, and these factors may be at least partial explanations, along with more obvious political considerations, of

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[91]East-West Center--A.I.M. Conference discussion. Whether the concept of irrigation as a free good leads to poorly delineated policies is an unanswered question. According to one study, the government of Sri Lanka has inadequately considered the role of irrigation in the agricultural sector, and this has resulted in social and institutional weaknesses and insufficient legal foundations for management and farmer participation. Water Management Synthesis Project, Irrigation, Development Options and Investment Strategies for the 1980s. Sri Lanka, WMS Report No. 11.

such decisions. Leach, writing on Ceylon, has argued that the building of an irrigation weir by a monarch falls within the traditional Buddhist form of merit making.[92]

Korea, on the other hand, has subsidized irrigation infrastructure by 70 percent in an attempt to increase production by providing assured water for all of its paddy land.[93] The Philippines is an interesting anomaly, with inconsistencies on irrigation repayment. On National Irrigation Administration projects, including the Bicol project supported by AID, infrastructure is repaid interest-free for up to 50 years,[94] but for Farm System Development Corporation pump projects, also supported by AID, interest rates are 6 percent, repayable over 12 years.[95]

Somewhat analogous to the issue of who pays for irrigation systems, is how payment is made: directly by the central government, or indirectly through local governments, development banks, or other intermediary financial institutions, public or private. Although greater attention will be paid to the issue under the section on irrigation investment strategies, the fundamental decision is one integral to the formulation and execution of a rural development strategy, for it may determine where responsibility for irrigation is located within a state, the types of crops grown, marketing opportunities or prices, and the degree of equity that the project is expected to achieve. It also affects the financial capacity of the relevant entities to undertake maintenance. The Farm Systems Development Corporation of the Philippines, for example, functions as a type of government-sponsored irrigation development bank, making loans and arranging for their repayment. In smaller systems, sometimes payment takes the form of the provision of labor or locally available materials, as in Thailand

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[92]Edmund Leach, "Buddhism in the Post-Colonial Political Order in Burma and Ceylon," Daedalus, 102, 1, 1973.

[93]Korean Irrigation, op. cit. This figure was originally 60 percent. It was subsequently raised.

[94]East-West Center--A.I.M. Conference discussion.

[95]Philippine Small-Scale Irrigation, op. cit. Professor Gilbert Levine has noted, "The inconsistencies in Philippine irrigation repayment are almost exactly analogous to the inconsistencies that exist in the U.S. so the causes for the Philippine situation are reasonably clear. We subsidize our western irrigation with almost the same terms used by the Bicol project, and deal with eastern irrigation much the way the FSDC projects are handled" (personal communication).

and the Philippines. In some cases, the distinction between corvee labor and voluntary donations of services may become indistinct.

In general, the principle of some cost recovery from beneficiaries, based on their capacity to pay and thus founded on the actual benefits of irrigation, is one that donors might encourage.

Related to repayment, of course, is the estimation of the benefits that accrue from irrigation, both to the state and to the farmer and his family. This is an important recurring theme, for the multilateral donors are operating as bankers, even if on concessional terms, and the bilateral donors normally require advantageous internal and economic rates of return.

There has been widespread and prevailing donor optimism that irrigation will, virtually automatically, result in both continuous higher aggregate yields and improved farmer welfare. As one author noted, "Whilst it would be difficult to imagine irrigation failing to increase yield per hectare of cereals it is less certain that it stabilizes production.... If irrigation is poorly managed or maintained, if the supply is extended beyond the water resource capacity, then unreliable irrigation will ensue."[96] Obviously, yields will go up where there was no irrigation before, as in Egypt or the Rahad project, but there is considerable evidence that they may not necessarily occur in consort with improved farmer income, as the impact evaluations have shown. It may be that both yields and incomes will rise, but debt may grow faster than income, as happened in certain circumstances in the Philippines,[97] and in Egypt when water delivery began to fail. In the Rahad, the majority of farmers operate at a loss. In Malaysia, a careful study indicated that paddy production is not profitable on average holdings without supplementary sources of income.[98] Even considerably improved income does not necessarily result in greater nutritional benefits for some elements of the population, as in Korea.[99] Higher yields normally will result from carefully planned irrigation, but such other factors as tenancy, commodity costs,

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[96] Ian Carruthers, OECD, op. cit.

[97] Philippines Small-Scale Irrigation, op. cit.

[98] Donald C. Taylor, The Economics of Malaysian Paddy Production and Irrigation, Bangkok: Agricultural Development Council, 1981, p. 117.

[99] Korean Irrigation, op. cit.

repayment of government-provided infrastructure, and water fees may undercut improved income from increased production. In those nations with a free market (and indeed in those with a controlled market) in produce grown within the irrigated perimeters, the extension of such irrigation systems may in itself improve production to the degree that relative, after-tax farm prices drop sufficiently to deny the farmer the full benefits that had been anticipated from the irrigation system, casting doubt on repayment schedules.

There is a tendency to be overly optimistic about the economic results of irrigation systems. Rates of return are often predicated on doubling or tripling cropping intensities, favorable pricing policies, farmer interest in taking risks, or a surplus labor supply. In an era of worldwide economic stringency, increasing national debts, high energy costs, and debt rescheduling, these analyses need to be approached with considerable skepticism, although in fairness this overly sanguine approach to the economics of projects is widespread in most fields. Since irrigation projects have relatively lengthy gestation periods, rates of return analyses projecting decades ahead are probably less useful and depart further from reality than when applied to any other category of project.

The natural tendency for one bureaucracy, a donor, to deal with another, a host government irrigation ministry, has often led to donor neglect of a vital component of the irrigation community in developing societies: the traditional, community-based systems. Although such systems are small individually, in the aggregate they make up a major portion of the world's irrigated area, and since governments compile the statistics, it is likely that they have been underestimated. They officially constitute, for example, about half the irrigated area of the Philippines.[100]

Most of these systems developed without standing in the modern legal codes in their own communities. In Indonesia, however, they are recognized under "adat" (customary Muslim) law, and in the Middle East by elaborate traditional legal systems. There is evidence in some countries, such as the Philippines and Thailand, that they have been very effective, for there is no issue in those systems as to who is responsible for their management. In Thailand, for example, they have been found to be more effective in solving irrigation disputes than

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[100]There are over 5,500 communal systems in the Philippines. See Benjamin U. Bagadion and Frances F. Korten, "Developing Viable Irrigators' Associations: Lessons From Small-Scale Irrigation Development in the Philippines." Agricultural Administration 7(1980):273-287.

government-sponsored irrigation systems.[101] In Sri Lanka, Malaysia, and Tamil Nadu, systems have deteriorated because management responsibility was unclear.

Donor organizations have often ignored the traditional community-based systems, leaving them out of their planning, as has the Japanese aid program in the Philippines[102] and AID in the Bicol. Some of these have been absorbed into massive government structures without adequate justification.[103] Evidence is growing from work carried out in Asia that the seemingly necessary dichotomy between the small, community-based system and the larger agency-based one is false. Government takeover of small irrigation associations should not automatically be attributed only to bureaucratic inclinations, however. There is also the tendency for a variety of governments to attempt to stifle localized, pluralistic centers of power, which irrigation associations frequently represent. Thus, issues of political mobilization or co-optation, to which donor agencies have often unwittingly contributed, should not be ignored.[104]

These are some of the policy issues that affect irrigation choices, within which irrigation investment strategies operate.

5. Irrigation Investment Strategies

Basic to the consideration of irrigation strategies are the purposes for which irrigation investments are made.

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[101] Vanpen Surarerks, Water Management Conflicts in Northern Thai Irrigation Systems, Chiang Mai University, February 1980 (mimeo).

[102] Akira Takahashi, University of Tokyo (personal communication).

[103] East-West Center--A.I.M. Conference discussions.

[104] An anecdote from the Philippines, before martial law was imposed, noted that politicians seeking election sometimes would prefer to speak before community-based irrigation organizations rather than other groups because they had more influence. (Prof. E. W. Coward, personal communication, cited in Henry Lewis, Ilocano Farmers.)

The Purposes of Irrigation

One irrigation authority[105] lists five focal objectives and criteria in considering irrigation:

Productivity	-- This may be measured by aggregate yields, production per unit area, gross or net income, or by production per unit of water delivered.
Equity	-- "For both general and operational purposes, equity can, then, be taken to mean more rather than less equal benefits from irrigation management, more rather than fewer irrigation families, with priority to the disadvantaged."
Stability	-- The sustained achievements of benefits measured by performance over time.
Carrying capacity	-- The "livelihood intensity," the amount of population that can be maintained on a given area of land.
Well-being	-- This includes such factors as improved health, amenities (washing, bathing, drinking, etc.), nutrition, and psychic rewards.

To these objectives might be added two additional ones:

National security	-- The development of self-sufficiency in basic grains to avoid international dependence (Korea, for example).
Political	-- The perceived need to establish national authority over an area; reward a particular social, economic, ethnic, or regional group; or to create the aura of government effectiveness, efficacy, or modernity.

These criteria and objectives should not necessarily be considered as in conflict, for they often are, or can be, mutually

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[105]Robert Chambers, "Irrigation Management: Ends, Means and Opportunities," Paper for the Workshop on Productivity and Equity in Irrigation Systems in India, Lucknow: Giri Insititute of Development Studies, 21-23 September 1982.

supportive depending on the planning and design of irrigation systems. It is important, however, that they be articulated with candor and that both donor and recipient have clear understandings of the motivations that prompt the investments by both groups. Often in many types of development projects, the objectives of both donor and recipient are centrifugal forces, each pulling in opposite directions from a rather narrow band of mutually agreed upon goals or purposes. It thus becomes imperative to articulate these previously inchoate objectives so the full extent of the tension may be anticipated.

Factors in Investment Strategies

Irrigation may be a part of national policy formulation, but once a determination is made to proceed with irrigation for economic, political, security, or social reasons, the choice must be made concerning various alternatives within the irrigation subsector. It is unlikely, of course, that such choices will be made de novo by host governments, for bureaucractic inertia is a strong force for continuity. Choices within irrigation may be influenced by an irrigation department, but in a variety of countries that responsibility is often fragmented. Pressures are often exerted from a higher administrative level that may or may not take the views of specialists into account.[106] Insofar as an irrigation bureaucracy already exists, it will follow, as most organizations do, the predilections of its leadership based upon their training, local precedents, and the reward structures already in place. The donor, however, is less circumscribed, and although influenced by expert technical assistance involving its own set of assumptions and its own institutions, it can, through the review process to which projects are subjected, influence the design and its sensitivity to the local scene. It is to this audience, the donor design and review staff, that the following issues are addressed.

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[106] M. Svendsen (personal communication).

If agricultural triage can be used to describe major choices within the agricultural sector, the term can also be applied in irrigation itself.[107]

Aside from decisions that must be reached beyond any individual irrigation network, such as those involving political or macroeconomic issues, choices related to irrigation are broadly four in scope:

-- Whether investments should be made in new systems or in rehabilitation of existing networks,

-- Whether larger or smaller irrigation projects are more desirable,

-- Whether management of the systems should be public or private,

-- What type of technology is best suited to achieve the desired result.

It will become evident that the simple dichotomies appear more separate in the abstract than in reality, and each category is closely related to the next. They are not, in addition, mutually exclusive. It is not suggested that there is any one universal answer appropriate to any of these choices, but project preparation should automatically consider each and this may, as a result, improve project design.

Additional Irrigation or Rehabilitation

Perhaps the most important single issue, at least in monetary terms, and the one that is receiving increasing attention in an era of international financial stringency, is that of choosing between building new systems and rehabilitating existing ones. Rehabilitation is a broad subject. It is generally defined as the improvement of an existing or old irrigation system to allow it to produce to its previous or,

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[107] Robert Chambers, in another paper, lists four criteria for looking at irrigation: productivity, equity, stability, and utility to irrigators. "In Search of Water Revolution: Questions for Managing Canal Irrigation in the 1980s," Institute of Development Studies, University of Sussex, 18 January 1980. Easter and Welsch (op. cit.) cite G. Levine and list five irrigation investment alternatives: (1) government versus private; (2) wet season versus year-round irrigation; (3) irrigation versus rainfed; (4) expansion versus intensification (rehabilitation); and (5) large versus small.

alternatively, its optimum level. In either case such rehabilitation must take into account current reality and not be based on outmoded technologies or physical designs but consider changed social or economic circumstances. Rehabilitation may involve modest expansion of a system, or a single approach or a multiple attack on a variety of constraints. Rehabilitation might include, for example, the strengthening of a single weir in a simple system, the reconstruction of some major infrastructure that has fallen into disrepair, rationalization of a canal system, desilting of a tank or reservoir, land leveling or rearrangement, lining of canals, or improved drainage to correct the build-up of salinity in the soil. AID at some time has been engaged in each of these activities.

Rehabilitation should not be considered as perjorative--the expiation of previous project sins. It may, of course, be such, as in the Helmand Valley, but it may be a natural consequence of time or changes.

Few developing governments can afford, without donor assistance, to support the construction of major new systems, and even smaller ones now often cost $5,000-$20,000 per hectare.[108] To these costs must be added the additional rural infrastructure--such as roads, storage, and markets--that allow the produce from irrigation to be used effectively, and the supplementary expenses associated with an improved extension service, agricultural research, and supply of necessary agricultural commodities that will allow the irrigation system to be economically profitable, both to the users and to the state.

Even with outside support, governments are finding it increasingly difficult to embark on major programs of new construction and rehabilitation at the same time. Sri Lanka has attempted to do both: to rehabilitate hundreds of old tanks that have fallen into disuse or only marginal utility and to speed the construction of the massive Mahaweli River development, an age-old dream to harness for irrigation and hydroelectric power the major perennial river system in the country. Even with extensive donor assistance of some hundreds of millions of dollars, the local currency costs of both are so great, and are rising, that achievement of many of the Mahaweli planned objectives has had to be postponed.

New construction, especially of major dams and irrigation networks, is attractive. It has symbolic, in some societies even mythic, meaning. It illustrates concretely, if you will, the political commitment of both donor and recipient to solve particular food problems. The Aswan Dam might be cited as the

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[108] Ian Carruthers, OECD, op. cit.

archtypical example. One author noted that "political considerations have also been at the root of the over-emphasis on large structures at the expense of detailed design issues."[109] Such construction allows employment of the latest in technology, excites the imagination of engineers, and allows for substantial employment and side benefits. Often such major new schemes incorporate smaller, existing systems, but the magnitude of the endeavor, the need for more storage capacity or greater flows of water, make these essentially new systems. Major projects included in the evaluation series, some of which are supported by a consortium of donors, are the Rahad project in the Sudan, the Lower Moulouya project in Morocco, the Jordan Valley irrigation project, and the Bicol area development project in the Philippines. Other projects that might have been included in the series, but were omitted for lack of funds or time, were the Luwu project in Indonesia and a number of efforts in India. Other major projects presently under way or planned include the Sri Lanka Mahaweli project and the Senegal River development program (OMVS), which also includes Mali and Mauritania in addition to Senegal. The earlier incarnation of the Helmand Valley project is an example of a major new scheme, while later support to it involved the rehabilitation of the previous effort. Although the capital costs of large projects are extensive and concentrated in a relatively short period, the continuous construction of such works indicates an abiding faith in the efficacy of our current technology and in the potential of existing administrative systems.

Rehabilitation also has its advocates, a growing number who despair about spiraling construction costs and the seeming inability of new schemes to realize their full potential.[110] The arguments for stressing rehabilitation include the beliefs that the capital costs will be less, that there are already considerable sunk costs, that increased production is likely to occur more quickly, that many of the farmers already have considerable experience in irrigation, that the environmental effects are already known, that previous irrigation is usually on the land best suited for the purpose, and that the administrative capacity of the management of the system has either been demonstrated or its deficiencies ascertained.

AID has not only supported the construction of new systems, it has assisted rehabilitation as well. These have

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[109]Anthony F. Bottrall, Comparative Study of the Management and Organization of Irrigation Projects, World Bank Staff Working Paper No. 458, May 1981.

[110]OECD Conference, especially World Bank and Inter-American Bank comments.

included the full gamut of irrigation, from the small, village-level (community-based) projects to the major, regional (agency-based) activities involving large parastatal bureaucracies.

At the smaller end of the rehabilitation scale is the Sederhana project in Indonesia. It was designed, and included in the Indonesian economic plan, as a quick ("Sederhana" means "simple"), relatively inexpensive means to boost rice production through the reconstruction of small weirs in village systems of up to 2,000 hectares that were gravity, run-of-the-river, irrigation networks without storage capacity. They were cheap, when well planned often costing only some several hundred dollars per hectare, and were to encompass at their full extension some half million hectares. The problems generally associated with the project were less technological or irrigational than they were administrative, many of them originating with the donor.[111] It was for its purpose the right technology, but was plagued by bureaucratic impedimenta. AID seemed to have trouble in dealing with the concept of the simplicity of the repairs required.

At the other end of the spectrum was the massive effort to rehabilitate the Helmand Valley system that, through omission of the construction of adequate drainage, was seriously eroding both production in the valley and the political credibility of the Afghan and U.S. governments. After an excruciating analysis of previous problems that resulted in termination of U.S. support to earlier projects in the Helmand region, new life was given to the effort, which was focused on drainage, by negotiations at the highest levels of both governments. The development effort in the Helmand Valley, the "unfinished symphony" as the Prime Minister called it, had to be completed. The earlier Helmand projects, which the drainage program had to rectify, illustrate the general truth of the statement, "traditionally politicians have seen votes in irrigation, but none in drainage, and, in the battle for adequate operation and maintenance funds, it is usually drainage which suffers."[112]

In between these two extremes have been a variety of other rehabilitation projects supported by AID. The Pakistan On-farm Water Management project involved the rehabilitation of a large number of tertiary watercourses through lining of canals, land leveling, and training of farmers. It seems to have resulted both in improved yields and the saving of major water

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[111] Sederhana: Indonesia Small-Scale Irrigation, op. cit.

[112] Ian Carruthers and Roy Stone, op. cit.

resources.[113] A previous project in Pakistan had attempted to eliminate a major cause of poor yields through precision land leveling. This often has been noted in the literature as a constraint to good irrigation performance. The Lam Nam Oon project in Thailand both attempted to expand the current irrigation area and reorient canals for greater efficiency, although there was doubt that some of the models chosen, based on the experience in the vast Chao Phaya plain of central Thailand, were suited to the rolling terrain of the Korat plateau where the Lam Nam Oon project was located.[114]

Because of escalating capital construction costs and the extended time periods required to bring new systems into production, there are many advocates of concentrating attention on rehabilitation of existing systems and improving farm and water management on them to ensure that maximum yields are forthcoming. The Asia bureau strategy recommends concentrating on rehabilitation, as does the World Bank in parts of Africa.

Larger and Smaller Systems

The second choice is between larger and smaller systems. The terms "small"- or "medium"-scale irrigation find their way into many donor project titles, but the definitions are arbitrary and the distinctions are imprecise. The terms are simply descriptive, not analytical. This category is included because customary usage, rather than developmental logic, seems to demand it. Although one of the determining criteria used in this paper here is not exact size, but the locus of management, community-based or agency-based, as noted above, the smaller-medium-larger terminology has donor relevance insofar as it implies or is associated with the amount of project expenditures, a critical concern.

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[113]This was noted in the impact evaluation, although some at Colorado State University, which has studied the total project extensively, have disagreed with the water-saving and longer-run yield increases conclusions.

[114]Lam Nam Oon field staff (personal communication). There are no data available to the author on the economic results of precision land leveling in Korea, where it has been extensively employed in valley regions. This might be a useful avenue for inquiry. D. Merrey notes, "Experience with the Gal Oya Project, Sri Lanka, shows that we do not yet know how to do rehabilitation effectively; and it shows the fallacy of using rehabilitation as a vehicle for 'institutional development,' at least as sequenced in Gal Oya... it remains a problematic area...." (personal communication).

Small systems are constrained by physical and hydrologic factors, but may offer programmatic opportunities that belie its size.[115] Such irrigation may be either communally or bureaucratically organized, or mixed, but involves group action to deliver water. The Bangladesh tubewell project and the Somalia single farm bunds are a separate category, as they operate on a single farm and are thus not a "system" in the use of the term as presently employed. They do not require cooperative management or institutional systems.

Of the evaluations undertaken by AID in this series, five may be considered small scale in scope under this definition: Korean Irrigation, Philippine Small-Scale Irrigation, Turkey, Peru, and Sederhana. All are bound topographically within discrete regions; if not limited to one village, then confined within a few in close propinquity. The Turkey case is somewhat different, as it is larger in scope, although it consists of a series of smaller systems.

The management styles of these projects vary markedly. The Korean case is one where there is a titular irrigation association, but management is essentially in the hands of a local government bureaucracy. In the Philippines, local ISAs (water user associations) have been formed and formally incorporated so that they may legally borrow to build the pumping systems.[116] Similar organizations, some traditional, exist and have been assisted by the National Irrigation Administration. In Indonesia, the Sederhana project helps locally organized groups, but when government support to the project is terminated, the state retains a vested interest in the operation and retains control of some of its work, at least the operation of major headworks. The links are weak and inoperable without community support. Aegean Turkey has a pastiche of systems--farmers' wells, river pumping, dams cum canals--run by individual farmers, village committees, or government agencies. Many communal networks exist throughout the world, from the ancient underground karez (quanat) irrigation systems of the Middle East and Central Asia to local systems of India and Sri Lanka. A few, such as a number in the latter country, are under the control of religious groups.

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[115] M. Svendsen notes, "There is far more scope, often, for innovative and user-centered design in the way in which the system is planned to serve the small groups of users that are its clients than in gross choice of scale" (personal communication).

[116] Philippine Small-Scale Irrigation, op. cit.

Smaller irrigation systems often have the advantage of management that is intimately cognizant of local problems and can mediate its own disputes. Peer pressure under these circumstances is more likely to produce more equitable distribution of water and more effective participation in group-required operations and maintenance, as well as less reliance on outside corruption. The obverse of this strength is that in hierarchical societies, individuals with greater social prestige or economic power may be able to manipulate more effectively the local system to their advantage. It should be noted, however, that community-based systems that include disparate village, clan, or communal groups may find polarization between these elements. This was true in both the Philippines and Senegal, and as a result efforts to link different villages in the same system in the Philippines were abandoned by the Farm Systems Development Corporation.

Larger regional systems are by nature more complex in terms of the types of engineering training required for the system. Certainly, community-based systems may have far more complicated procedures for sharing water and allocating responsibility for operations and maintenance than a bureaucracy. Because such agency systems' sources of water may be further away, the engineering to distribute the water before it reaches the community is likely to be more complex; therefore, both engineering and management skills are probably required in greater numbers, and there is dependence on external sources for both. These systems are almost invariably managed by government directly or by some parastatal organization set up for this purpose. Included in this series are the Bicol, Rahad, Jordan Valley, Helmand Valley, and Lower Moulouya parastatal organizations. In Egypt, small farms were managed by the government irrigation system and a national system of cooperatives. Often these agencies deliver other services beyond water and indeed beyond agriculture.

Larger irrigation networks, because of their political visibility, sometimes may assume an aura highly symbolic of power and modernity. The construction of dams, modern sluices, and complex distribution networks demonstrates visually the political efficacy of an administration, the authority of the state, and the power--physical and figurative--of the government. They may also have the same effect on donors, which by support to such efforts acquire the aura associated with such enterprises. It is less impressive to show a visiting dignitary a series of farm drains than a dam.

There is conflicting evidence about the relative efficiencies of larger and smaller groups. The smaller systems, and indeed smaller farms, are often said to be more efficient, as the Inter-American Development Bank has noted in its evaluations, although the empirical evidence from Malaysia casts

doubts on this issue at least in that society.[117] It should be mentioned however, that in the case of Malaysia, smaller systems are government managed, not private. On the other hand, the small government-managed Korean systems are quite efficient in operation, although they may be less efficient in water use because water is not normally as scarce a commodity as in arid zones.

There are often serious difficulties in administering large systems involving extensive populations and complex engineering requirements, and for such reasons government control is almost always required. Yet on smaller, private systems, there continues to be a need for some government involvement, if not in irrigation management itself then in supporting services, such as training, disaster assistance, and credit opportunities. The public-private issue is examined next.

Public and Private Systems

The question of the public or private nature of irrigation systems is an issue that is likely to generate considerable interest in AID today in light of the Agency's policies supportive of the indigenous private sector. AID is just one of a number of donors that have raised the public/private dichotomy as an issue in irrigation design. The question is complex and a simple dictum on the subject seems inappropriate.

In any particular society, it is patently absurd to predicate the success of a proposed irrigation project on public sector control if all experience in that society points to glaring inefficiencies in public administration. It may be desirable and necessary to improve public institutions, but it is foolhardy to believe that a single project, however large and containing however much training or technical assistance, can change the political or administrative culture of a society. Conversely, to assume that the private sector can autonomously manage irrigation when all evidence in any particular environment points to private organizations being subservient to government's sometimes arbitrary requirements, or to suggest that such groups can act intelligently, but contrary to officially prescribed local or national interests, is equally dangerous. There seems to be no reason to suggest that market forces, the crux of a private firm's advantage over many public sector activities, will automatically improve irrigation

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[117] Donald C. Taylor, Thomas H. Wickham, eds, Irrigation Policy and the Management of Irrigation Systems in Southeast Asia, Bangkok: Agricultural Development Council, 1979.

management beyond the individual farm when the delivery of water through irrigation is by its nature a monopolistic enterprise, no matter which group controls it. In the Near East, most irrigation is governmentally controlled because of the few major sources of supply and perhaps also because of its scarcity. Under certain circumstances, market forces through competitive pricing may well improve yields, however, if not water supply.

The evidence on the relative efficiency of public versus privately sponsored irrigation is in conflict. Publicly managed irrigation worked well in Korea, but it worked poorly in Afghanistan and the Sudan. Private (community-based) irrigation has been efficient in Bali and the Philippines, but many of the private tanks of Sri Lanka fell into disrepair. In Turkey, public/private irrigation spawned a wide range of private and effective enterprises that manufactured irrigation land-leveling equipment, expanded the light industrial base of the region, and serviced the irrigated farming community. A similar situation occurred in the Lower Moulouya in Morocco. In the Bicol, it has not yet happened.

The dichotomy between public and private is in some sense false. Community-based systems are often nongovernmental, but many are sanctioned by the government, adhere to government regulations, and receive credit or commodities from government sources. In some cases, they may be functionally equivalent to local government. On the other hand, some parastatal groups may act with a singular degree of autonomy and reflect local concerns. They may weigh, in some complex manner, the public good with efficiency of operations. The degree of autonomy of parastatal groups, or conversely the extent of the private nature of nongovernment organizations, may be influenced by the mode of investment--either direct or indirect--or by the degree to which local leadership, parastatal or private, is able to reflect and meet local needs. Whether publicly or privately controlled systems result in more effective management or sustainability of systems over time is uncertain. The results of the impact evaluations, and the literature in general, are ambiguous on the question of public or private irrigation. Clearly, there seem to be other factors that are critical in determining how effective irrigation systems are.

The relationship between the public and private responsibilities shifts depending on the function to be performed and the intent of the action proposed. Montgomery argues that the government is the protector of the public good, or equity, but that popular (private) management is most effective under four circumstances: when local knowledge is required; when decisions must be made frequently but not routinely; when too quick a response is required for a bureaucracy, as in response to a crisis such as a flood; and when changes are required in

cultivation practices that need local concurrence.[118] Chambers has stated," In general government should unambiguously avoid doing that which communities can do for themselves in their own interest, but should intervene when exceptional problems are beyond a community's power to overcome."[119]

The attempts to introduce market forces into irrigation sometimes do not work, as illustrated by water user and other fees that reflect actual costs. "In spite of repeated World Bank recommendations in favor of a cost-based fee schedule for water use in projects financed by international sources, observers have not yet found a case where these charges have both amortized the full capital and operating investments and reflected the actual volume of water delivered to the field."[120] In fact, even official covenants included in World Bank loans calling for increases in water charges or charges that reflect actual costs have been ignored. In 11 of 26 cases cited by the Bank, the covenants were not fulfilled. There are often political ramifications to increasing charges. In Madagascar, for example, political problems prompted a reduction in water charges by 30 percent.[121]

Government efforts to foster the general welfare have sometimes outlived their usefulness, but the change in public/private relationships often becomes difficult. In northern India, for example, a rigid, bureaucratically controlled set of water distribution rules was established by the British, the purposes of which were to ensure some water everywhere, to avoid famine, and to guard against local corruption.[122] It now becomes difficult to change such patterns even though conditions have shifted and more private autonomy or local control is perceived to be needed.

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[118]John D. Montgomery, op. cit.

[119]Quoted in Frances F. Korten, Building National Capacity to Develop Water Users' Associations: Experience From the Philippines, World Bank Staff Working Paper No. 528, 1982.

[120]John D. Montgomery, op. cit.

[121]World Bank, Water Management in Bank-supported Irrigation Project Systems: An Analysis of Past Experience, Report No. 3421, April 16, 1981.

[122]Richard B. Reidinger, "Institutional Rationing of Canal Water in Northern India: Conflict Between Traditional Patterns and Modern Needs," Economic Development and Cultural Change, 28, October 1974.

Although irrigation seems suited under certain circumstances to either public or private control, "drainage is increasingly accepted as a collective or systems-wide responsibility";[123] thus, in larger systems, it is generally performed by government. On the other hand, public laws such as the Canal and Drainage Act in India were not enforced, although private norms and sanctions generally worked.[124]

The decentralization of highly focused agency-based systems is in some sense an attempt to move toward more localized if not private and participatory systems, ones more responsive to local irrigational needs. This has been a major effort in some countries including the Philippines under the National Irrigation Administration. How successful this has been in a variety of cultures where the emotional, educational, social, and financial gaps between the civil servant and the farmer are already so great is a subject worthy of considerable attention. This gap between the government and the beneficiaries has been termed "cognitive distance."[125]

In fact, most systems supported by donors involve a mix of both public and private institutions. This occurs in both large and small systems. Larger tanks and dams and major water courses are often state controlled, but the operations of the tertiary canals are usually in private, locally organized group hands. What may be more important than the public-private dichotomy, which in any case is unlikely to be absolute, are the interrelations between the two--how each is organized to deal with the other. The situation is made more complex by the shift in responsibility of certain functions over time. Thus, in some societies there is a shift between the role of the irrigation headman from representing the local community to one in which he represents the lowest rung of the state power

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[123] John D. Montgomery, op. cit.

[124] Ibid.

[125] The phrase is from Chambers, quoted in David C. Korten and Norman T. Uphoff, "Bureaucratic Reorientation for Participatory Rural Development," National Association of Schools of Public Affairs and Administration, 1981.

elite.[126] This shift parallels a more general change in the status of the headman in some societies.[127]

Technological Choice

The choice of technology seems on the surface to be the easiest to solve of the developmental dilemmas in irrigation. It is, however, extremely complex and cannot be separated from other irrigation issues. Technological choice has often been thought of first, followed by the economic justification for the use of the hardware, and lastly, the institutional form through which it will be managed. This has patently been inadequate, for the connections between a variety of issues make technological choice in part dependent on other factors, and in part forces a chain of events which, circularly, affects the performance of the technology.

One important element of technological choice has been slighted in this paper--tubewell construction as an irrigation strategy. Aside from Bangladesh, it was not covered in the impact evaluations. Under certain hydrologic and economic circumstances, it may be an attractive investment strategy and should not be ignored. In some areas, such as in parts of India, (private) tubewells seem to be a means to avoid the uncertainties of poor water delivery (public) from gravity systems. Small well construction in Korea, however, did not seem to be effective, and in parts of the country the landscape is littered with wells abandoned when effective gravity systems were introduced.

Technological choice in irrigation may be circumscribed by the degree to which a system is independent of externally required hardware, agronomic technology, or hydrological or economic factors. Insofar as a chosen technology is not available within the community, forces are mobilized to supply it from the outside; to train those inside in its use; and to establish an institution, usually also on an external model, to ensure that the hardware functions, that the knowledge from training is used, and that economic systems are set in motion to allow the irrigation network in some manner to repay at least a part of its costs and account for its maintenance. Social and

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[126]Robert C. Hunt and Eva Hunt, "Canal Irrigation and Local Social Organization," Current Anthropology, Vol. 17, No. 3, September 1976.

[127]See, for example, J.S. Furnivall, Colonial Policy and Practice: A Comparative Study of Burma and Netherlands India, Cambridge: Cambridge University Press, 1957.

cultural factors also strongly influence technology and its appropriateness, and should be one element in evolving design criteria.

Insofar as irrigation systems are designed by those expatriates or members of the local urban elites who have received advanced training, it is likely that the technology will reflect that training and be sophisticated in nature. The type of such technology thus affects the full range of the operations of the irrigation system.

Expensive physical technology virtually requires the use of the highest forms of agronomic technology so that yields will justify the costs of the infrastructure. These in turn may prompt consideration of more sophisticated water measurement devices if, as many donors request or even demand, an effort is made to price water.

All of these types of external dependence in turn require training of three different groups: the implementing agency, the farmers, and the extension or other service personnel, and in the case of the first and last groups, may also affect their organizational structure and staffing. Thus, the issue of the choice of technology cannot completely be separated from the size of the system, its hydrographic requirements, its agronomic potential, the capacity of the managing organization, the training of the farmers, the costs of such technology, or the preferences of the donor community.

A variety of technologically appropriate and inappropriate irrigation methods are cited in the evaluations. The simple bunding techniques of Somalia and the hand tubewells of Bangladesh were both suited to the economics of the small farms and the paucity of the training of the farmers.

In the Philippines, the Small-Scale Irrigation project rapidly became uneconomic as electricity, powered by diesel fuel, became so expensive that the farmers began to have trouble paying for both the amortization of the pumps and the costs of operating them.[128] Subsequent to the evaluation, the pumping technology was abandoned in a later project supported by AID. In Korea, on the other hand, the costs of running electric or diesel pumps were also very high, but the price that farmers received for their paddy was about three times that of the Philippines. The economic returns to the farmer were still substantial. In the Bakel perimeters in Senegal, the pumps chosen were deemed inappropriate for the irrigation

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[128] Philippines Small-Scale Irrigation, op. cit.

purposes.[129] Pumping systems, however, have the advantage of relatively quick installation, while gravity irrigation, cheaper to operate once installed, is slower to build and takes more land out of production. Impact evaluation teams were surprised by elevated aqueducts in Turkey and Korea, for the technology required and the expense of their construction seemed out of proportion to the benefits from the system. Yet such sophistication may have been appropriate, for it became unnecessary to recompense farmers for the rights to land, which otherwise might have had to be expropriated, and obviated the need for expensive, continuous maintenance of unlined canals. The economics of lining canals with reinforced fiberglass, for example, is still under study in Malaysia. Whether the construction of the 90-kilometer diversionary canal to connect Rahad to the Nile River might have been economically justified by anything but the potential of the area to produce crops for export and thus earn foreign exchange is open to speculation. The economic alternatives in irrigation need to be carefully examined. They are important, but not the only variables.

In Sederhana, the impact evaluation noted the general appropriateness of the simple technology to the size of the systems and the sophistication of farmers, but the planning for the project failed to note that this simple technology, so suited to the needs of the national economy, might not in fact be suited to the donor agency, which could not adapt to the needs of the host government and farmers because of its own administrative system and the oversight required by its own regulations. In Bangladesh, the technology did seem suited to the economies of production, farm size, and need. The administrative system, however, that supplied the credit for the pumps could not cope with the novelty of the project design: the need to provide credit to farmers who otherwise would not have qualified for such advances under normal banking procedures there.

Many specialists have commented on the desirability of encouraging farmers to conserve water through establishment of water-user fees based on actual use rather than area irrigated. Although the goal may be desirable, the practicality of a technology that requires individual monitoring devices on each farm (and the canal structures to make such a system work) seems questionable in most instances. The five types of technology for delivery of water have important design and cost implications. Continuous flow rotational irrigation (to one farm or a block of farms), farm priorities (to the first settlers), market irrigation (water to bidders), and demand irrigation are

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[129] Project Review for Bakel Small Irrigated Perimeters, op. cit.

located on a scale from more simple to more complex, and from less to more expensive. They also range from less to more efficient in their use of water if managed effectively.[130]

It should be noted that not all donors are oblivious to local, traditional, technological sophistication. The Asian Development Bank, perhaps in response to local Balinese officials, is supporting a project in Bali that improves the operations of the traditional communal irrigation system called subak. It does so, however, by substituting a concrete measuring device for water that is a replica of the old wooden one; this allows the villagers to continue to allocate water in a traditional manner but provides greater durability. Included in the project was the building of small temples at appropriate weirs. This traditional practice was incorporated in the project as part of the infrastructure, an innovative element in donor policy. It should be noted that mosques were included in the Egypt project and in the Helmand Valley. They were not, however, an integral part of the irrigation system, although they were, of course, part of the social fabric.

As in other aspects of irrigation planning, an interdisciplinary approach to technological choice is necessary and should consider the total farming and family productive system. Technology should be flexible to the maximum degree and allow for phased construction and investment. Planners should remain cognizant of the existing level of training of the users and operators, and their potential for improving their skills. Flexibility of technology may imply greater costs, and economic analyses should accurately reflect the implications of technological costs for both construction and operations and maintenance. Technology choice should reflect the record of the methods chosen in terms of reliability of such systems.

Modern technology should not always be considered to be the most efficient means to achieve irrigation. Traditional weirs or diversionary structures may have to be rebuilt frequently, but even the process of rebuilding, although seemingly wasteful, may strengthen group solidarity so that what may seem to be economic inefficiency may more than be made up in institutional effectiveness. Some have argued that traditional technologies may be efficient in technological terms alone. For example, one author noted that the continuous-lift water

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[130]The typologies are from Easter and Welsch, op. cit.

wheels of Hellenistic Egypt were as efficient as modern pumping systems.[131]

Perhaps the most blatant misuse of technology documented in these evaluations was in the Jordan Valley.[132] AID supplied some $6 million of irrigation sprinklers, because they were of American source and origin and perhaps because they were part of an effort by the donor to spend up to a stipulated level. The result is that most of the sprinklers, some six or seven years later, still sit in Jordanian warehouses; few have been sold even though credit is available. The sprinklers were suited neither to the economy nor to the agronomic needs (field crops were more adapted to drip irrigation) of the farmers, who purchased some inexpensive plastic hose and engaged in drip irrigation. A small sprinkler irrigation project in Nicaragua supported by AID through CARE also failed,[133] perhaps because of a similar problem with choice of technology. Another case of an economically inappropriate technology was the experimental solar pump project of Senegal, and one evluation called for the termination of funding to the project.[134]

Although not an inherent part of irrigation systems but of technological importance is the related issue of mechanization of irrigated agriculture. In Turkey, the system seems to have been eminently productive--indeed, mechanization was aimed at the needs of leveling and drainage--but in the Rahad, the goal of 100 percent mechanization is causing major problems. Egypt also planned for mechanization of much of the land. The assumption of labor shortages or economies justifying mechanization should be examined with great care.

The levels and nature of the skills and costs associated with the operations and maintenance of mechanized farming are also important considerations.

It is not perhaps in the supply of a given technology that donors can be of longer range assistance, although this is no

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[131]See Axel Steensberg's commentary in Hunt and Hunt, op. cit. For a detailed discussion of Chinese and Arab water wheels, see Joseph Needham, Science and Civilization in China, Vol. 4, Physics and Physical Engineering, Part II, Mechanical Engineering, Cambridge: Cambridge University Press, 1970.

[132]David Sharry, op. cit.

[133]Checchi and Company, op. cit.

[134]See Project Review for Bakel Small Irrigated Perimeters, op. cit.

doubt important in the short term, but rather in the building of institutional capacity so that implementing agency organizations can effectively evaluate and indigenously develop adaptive technologies to solve local problems that change over time.[135] This may be, in fact, the hallmark of developmental success. Whether a higher level of technology can reduce or complicate managerial and institutional problems in host societies is an unresolved issue that should be addressed.

Perhaps the most discussed aspect of irrigation today, the area in which most improvement must take place, is not technology, in which the problem is choosing the right mix for the individual circumstances. Rather, it is in the management of irrigation.

6. Management Capacity

Management in irrigation systems includes a multitude of functions, relationships, operations, and attributes at all levels, from the nation to the farm. It has generally been neglected, because the virtual romance with engineering and agronomic technology pushed this art into the background. It has been rediscovered relatively recently. Management operates within an institutional framework, formal or informal.

Carruthers has recently noted "that 'Lack of Good Management' is the primary reason why so many [irrigation] projects fall below their full potential,"[136] and the continuum chosen here to characterize irrigation reflects this concern. Yet irrigation management is a complex concept that operates vertically within an institutional hierarchy and horizontally among peer institutions or individuals, from the national to the farm level, between donor and recipient, and may include the operation of agronomic systems, physical infrastructure, natural resources, or institutional relationships. Management is a process that generally involves the husbandry of resources and skills and includes effective problem-solving, evaluation, analysis, coordination and cooperation, and the effective generation of motivation. To state simply that management should be improved has the equivalent force of, and expectations from, saying that people should be moral.

The problems of better management, therefore, first must be defined more sharply to serve our analytical purposes and,

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[135]This comment was suggested by a paper prepared for other purposes by David Korten, USAID/Manila.

[136]Ian Carruthers, OECD, op. cit.

thus, project design. As in earlier portions of this paper, we will begin with the farmer and work up the institutional ladder, considering in the process as well the donor's management style and capacity.

In starting with the farmer, it is important to begin with his perceptions and expectations about irrigation, cooperation with his fellow water users, and the role of government. Management of the program, and finally the donor agency and the effects of its management procedures on the process, are treated. Some specific attributes of management, such as those associated with maintenance, will be reserved and treated separately. Individual, independent farm management, required of all farms whether rainfed or irrigated, is excluded as it does not necessarily require an institutional association.

Management of the Water: Perceptions and Associations

Farmer Perceptions

Management at the village level, whether internally generated or externally imposed, is based on a variety of perceptions and attributes, rarely alluded to in AID project documentation, that profoundly affect the process of water allocation and use. Such attributes influence expectations about the efficacy of farmers' cooperating to share water and the role, benign or malignant, of government in irrigation. Thus, management is rooted in experience and culture.

If, for example, there is a strong, pervading distrust of government in the village, this will affect both how villagers perceive government programs and, in turn, how the bureaucracy treats the villagers. Style and expectations will also affect who receives technical and managerial training, and how those who acquire these improved skills will use them at the farm level. They will also influence the nature and scope of informal payments for access to adequate water that sometimes may evolve into corruption. If farmers can or must appeal to local political figures to receive their water allocation or an extra supply, then group solidarity is undercut.[137]

Physical location within an irrigation system influences perceptions of how water is used and distributed at the farm

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[137]This seems to be the case in the Gal Oya project in Sri Lanka. See Hammond Murray-Rust, "Gal Oya Water Management Project Trip Report," Colombo: Agrarian Research and Training Institute, January 20, 1983.

level and who will receive what from the system. The adjudication of competing demands among individuals or groups of farmers in some traditional cooperative arrangement or bureaucratic structure is also often the product of the particular local environment.

Although it can allocate the supply of water, no present irrigation bureaucracy, no matter how vast, can execute the flow of water onto a farmer's fields. This is the function of the farmer, who may also be expected to construct the tertiary or quaternary ditches that lead to the irrigated fields. The farmer's previous experience in irrigation, the scarcity of water either for the main or subsidiary crops, custom and peer usage, and his location within the irrigation network may influence whether water is used optimally or wasted.[138] These expectations may be affected by the physical position of the farm at the head of the system where, if water is available, that area will normally be assured of a supply, or at the tail, where water availability becomes a more speculative issue. A study demonstrated that 30 percent of India's irrigation had tail-end problems. In the dry season, the tail-end farmer had a 25-percent reduction in productivity compared to 6 percent for those at the head.[139] Another commentary on India noted that head/tail yields varied from 1.54 tons of paddy at the head to 0.22 tons at the tail.[140] In Egypt and Pakistan there were also serious tail-end problems.

The use of water is also affected by the technology. The smaller, community-based or traditional systems are less complex in design if not in methods of allocation, use local materials and are thus less expensive to build and less expensive, in capital costs if not in labor, to maintain. In some

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[138]Professor Gilbert Levine notes, "The perennial problem of defining 'waste' arises, especially considering the major irrigation activities in the humid tropics. We have relatively little data on actual 'waste,' i.e., water not used productively--even though much of that production may be outside the nominal system area. The Gal Oya (Sri Lanka) is a good case in point, where the nominal 45,000 acres in the Left Bank--suggesting substantial 'waste' of the water--when considered with the encroached and other lands using the water gives a very different picture" (personal communication). Evidence from the Philippines also implies that the unofficial area irrigated may be larger than the statistics indicate.

[139]John D. Montgomery, op cit.

[140]Robert Chambers, "Irrigation Management: Ends, Means and Opportunities," op. cit.

instances, such as in some ISAs in the Philippines, costs and land are saved by simple technology--water flowing from unlined ditches across the fields of one farm to reach another. This is common elsewhere in Asia. This requires group solidarity and interdependence, not only in growing the same crop (as, for example, the water requirements for paddy and sugarcane vary), but often the same variety of crop, or at least ones with the same maturation period.

Irrigation literature is replete with examples of cases where the farmers at the head of the system, near the water source or distribution outlet, manipulated the water supply, thus ensuring the adequacy of their own water. This, of course, results in those at the tail end of the system, almost by definition the poorer farmers on less productive land, receiving less than an adequate share. Some traditional systems have recognized this problem of equity and have reallocated land so that every farm has one field near the head, one at the middle, and one at the tail, thus guaranteeing that every farm family will have at least one field that receives sufficient water.[141] One system pays the irrigation operator by giving him land at the tail-end, thus ensuring that everyone will get water before he does. Equity in irrigation is not simply a matter of land size or tenure or the availability of water but, equally important, its timely distribution. Critical also is equal access to both capital and improved technologies.

An irrigation system does not necessarily ensure that water will reach the farmers' fields, nor does it guarantee that they will get it when they need it. The link between the main or lateral canals and the farms is sometimes a bureaucratic no-man's land: beyond the specified authority or concern of the agency-based system or of the national or regional water authority, but of limited interest or value to a farmer, especially if irrigation is viewed as crop insurance alone. The farmer may feel that irrigation water is unlikely to improve his lot substantially, and that indeed irrigation may increase his expenses faster than his income. If this happens, the potential users may become dubious about providing labor for tertiary canal construction. Because of cultural or historical factors, they may also regard such construction as a government responsibility. It is significant that the Sederhana authorities reformulated their scope of activity to include construction of tertiary canals when the farmers there were reluctant

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[141] East-West Center--A.I.M. Conference discussion.

to engage in building them[142] and that in the Pakistan project a similar event occurred.[143]

The farmers' perceptions of water requirements are not necessarily based on agronomic reality, but perhaps on something more tangible to them: security, or risk aversion. Their rule may be: use what water is available when it is there, because you may not have a chance to get enough the next time around. This often accurate perception of the whimsical and unpredictable nature of water availability, based on extensive past experience, is an example of pragmatic water management. Unfortunately, it may neither make objective agronomic sense nor conserve a scarce resource. Such attitudes undercut training for farmers in water conservation and theoretically valid water management techniques, those that both donors and implementing water agencies sometimes like to propose. What is required to change these attitudes is a virtually guaranteed, reliable supply of water over time and at the right cropping time. It is only then that these perceptions may begin to change.

Irrigation is often viewed as eliminating the uncertainty of variable water availability, but in fact, given the relatively poor performance of irrigation in developing countries, it could cogently be argued that irrigation substitutes one form of uncertainty for another. Irrigation also does not necessarily reduce the variability of production, although it does raise the general average of productivity. The caprices of nature are supplanted by the whimsy of man, for poorly designed systems, improper distribution mechanisms, and inefficient regulations that virtually require or encourage corruption may all compound the uncertainty of water delivery.[144] It is evident as well that such unreliability encourages crime--the theft of water and damage to or destruction of canals in order to get access to it.

Better farmer management of water, it is sometimes asserted, will come from imposing water-user fees, for if the farmer is forced to pay for it, it will be used with more care. This subject, far more complex than it appears, will be examined later.

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[142] Sederhana: Indonesia Small-Scale Irrigation, op. cit.

[143] The On-Farm Water Management Project in Pakistan, op. cit.

[144] Daniel W. Bromley, Improving Irrigated Agriculture: Institutional Reform and the Small Farmer, World Bank Staff Working Paper No. 531, p. 29.

If there is some question of the efficacy of water fees, there seems little dispute that better farmer management of irrigation will come from more intimate farmer involvement in the planning of systems as well as in their operation. Farmer complaints about rationalization of canal layouts or water distribution usually flow from bureaucracies that plan irrigation with the physical system in mind, but the farmers' knowledge and needs ignored. Donors often give tacit support to this approach by not checking on the reality of designs.

Water User Associations

Farmer involvement in distributing water at any stage is normally the result of an organization that is intended to enforce, either through peer pressure or sanctions, adherence by users to the locally prescribed irrigation rules of the game.[145] In small community-based systems there seems to be a generally perceived need for these associations; in larger agency-based systems they are sometimes excluded, ignored, or incorporated into the larger bureaucratic structure. This was true in Egypt.

Too little attention has been paid to these institutions. "The institutional environment in which irrigation takes place has received little analytical attention by those concerned with irrigation."[146]

The lack of attention to effective water management can be devastating. As a report on Indonesia noted:

> ...but the development and organization to use water more effectively has lagged. Similarly, the operation and maintenance of the entire canal system has not developed well enough to assure that capital invested in the canals will return the projected

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[145]Note the difference between Thailand, which does not enforce fines (Abha, op. cit.), and the Philippines, which does (East-West Center--A.I.M. Conference discussions). Others dispute the rigorous dichotomy between the situation in these two countries.

[146]Bromley, op. cit.

benefits. There are also serious questions regarding the quality of new and rehabilitation structures.[147]

The organization of water users into associations to allocate the supply of irrigation water; to determine rational use of water, labor, cash, or material requirements to keep the system going; to elect or appoint local inhabitants to control local distribution; and to settle disputes seems ubiquitous in community-based systems. These groups vary greatly, however, in type and authority. They may, as in Bali, be deeply imbedded in the religious and sociocultural gestalt of traditional society; or, as in Korea, they may become a simple appendage to an effective bureaucratic structure, the function of which is the delivery of water, the collection of water charges, and an increase in aggregate production. Some farmers there indicated that they were not asked to join an irrigation association, but were told by the local government authorities that they were members. In Egypt irrigation cooperatives are appendages of the ministry charged with land reclamation.

The situation is different in the Philippines. The ISAs, as well as local irrigation groups sponsored by the National Irrigation Administration, are juridical persons: they are registered with the government and are legally empowered to own resources and borrow funds. The traditional zanjeras, in contrast, have no legal status, although the authorities have encouraged them to acquire it, because the traditional exercise of water (or land) rights is not recognized under Philippine law.[148] Lack of such titles and recognition has been a major irritant in the Muslim regions of the Philippines for generations.

The participatory extent and nature of water-user associations seem to vary even within projects, and not all the impact

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[147]Albert J. Nyberg and Dibyo Prabowo, Status and Performance of Irrigation in Indonesia and the Prospects to 1990 and 2000, IFPRI, IFDC, and IRRI, Working Paper No. 4, Rice Policies in Southeast Asia Project, 1982. The report notes that it is imperative that water management and operations and maintenance become effective, but then, alas, it bases its projections on an ephemeral world. "In all of the projections in this report, it is assumed that repairs, operations, and maintenance will ensure that the systems be maintained, that service areas do not decline, and that the water is distributed equitably. Furthermore, it is assumed that additional expansion can occur and that efficiency will be improved." Dr. Pangloss is alive and well.

[148]East-West Center--A.I.M. Conference discussion.

evaluations deal with this issue. The Sederhana report omits discussion of participation, although by implication there seem to be traditional associations, of at least an informal nature, that cooperate to supply labor. The ISAs of the Philippines are participatory although their organization, as might be expected, reflects traditional elite standing in the villages. The zanjeras manage to allocate labor and impose fines effectively,[149] while the northern Thai irrigation systems rely more on social stigma. In Pakistan, water-user associations, stipulated in the project, were not effectively established, and there is even some question whether water course associations (to mediate disputes along one channel) were formed, at least throughout the range of the vast project area. In the Bicol, farmers were generally passive and government interest in formation of associations was to get management of that part of the project out of the government's budget. This was also true in the Gal Oya project in Sri Lanka.[150]

There is a marked difference between organizations whose primary purpose is to distribute water, and those devoted to other ends. To be effective, water-user associations must have virtually compulsory or complete membership, otherwise they cannot accomplish their objectives. This makes them quite different from other local institutions, which generally need to be voluntary to be successful.[151]

There is a gradual change in participation as one moves from smaller to larger systems and in fact the continuum of irrigation systems, from community-based to agency-based, reflects this shift. In Thailand, for example, as the Lam Nam Oon project illustrates, although the government manages the major outlets, some one-hundred farmer associations were supposed to be formed under the project. At the time of the evaluation, none had been formed and the government allocated water directly.[152] In large, complex networks, it is likely that even if such associations existed, they would soon become subsidiary to and dependent upon the bureaucratic entities managing water in the main canals. The evidence from the Bicol is

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[149] Ibid.

[150] See Hammond Murray-Rust, op. cit.

[151] Donald C. Taylor, "Agricultural Development Through Group Action To Improve the Distribution of Water in Asian Gravity Flow Irrigation Systems," Teaching and Research Forum No. 1, the Agricultural Development Council, Singapore: Singapore University Press, 1976.

[152] Lam Nam Oon, op. cit.

that the authorities did not take participation seriously and did not take the perceived needs of the population into account in the planning of the project.

One important function of water management is to deal with disputes arising from land, water scarcity and allocation, and shared costs and labor requirements. The subject of dispute settlement is rarely dealt with in the AID literature, and even less so in the impact evaluations. One positive aspect of water-user associations is that they tend to keep the settlement process in the local community, where arbitration rather than litigation is the normal practice. Thus fines or repayments of any sort tend to recirculate funds within the group itself, which is probably desirable. The imposition of modernized, centrally administered judicial systems on traditional societies has a tendency to force funds outside of the community (fines and legal costs are paid to the state), thus reducing local assets. This opens the avenue to corruption, which does not benefit the local population.[153] The potential negative effect of localized fiscal authority is that those elites with either social or economic status can use such authority to entrench further their own superior position in the community.

The issue of corruption is one about which discussion is most often avoided. Corruption is, of course, culturally defined: in some societies the use of modest sums to grease the social or bureaucratic wheels (for food, drink, or cigarettes for water attendants) is quite distinct from periodic payments to ensure delivery of the normal water supply or additions to it, rakeoffs on construction or rehabilitation, or not meeting construction specifications. Corruption might be considered the supply of goods, services, or funds to achieve purposes to which one is not otherwise entitled, or to which one is entitled but would not otherwise receive. An article on corruption in irrigation in India documents in detail the diverse potential for such activities.[154] Anecdotal comments by some familiar with the practices attest to the article's accuracy. Opportunities for corruption are often strong motivational factors in accepting irrigation responsibilities. One study hypothesized that the incentive to take executive responsibility for irrigation lies in the possibility of

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[153]For a stimulating discussion of corruption, see Robert Wade, "The System of Administrative and Political Corruption: Canal Irrigation in South India," Journal of Development Studies 18 (3) (1982).

[154]Ibid.

"differential control of the deployable surpluses of the system," a seeming euphemism for corruption.[155]

The extent of the problem and its intensity seem to vary directly with the distance from local management and authority: the closer management is to the water user, the smaller the amounts of corruption involved. This is not surprising, considering that the potential pie is limited, as incomes there are less.

Based on the literature more than on the evaluations, it is possible to hypothesize that the closer the management of the water is to the farm, the greater the chances are that the farm will benefit in spite of the general lack of formalized engineering and management skills that exist at that level. Allocation of water and dispute settlement are more effective at that level and even corruption is more endurable than when authority is more remote. Although this subject needs further study, it is likely that this dictum also applies to water payments and the responsibility for overseeing the work of ditch attendants, gatekeepers, or irrigation supervisors. If, therefore, supervisory authority is responsible to those at the local level, e.g., local groups can hire and fire canal attendants, it seems more likely that this authority will be more responsive to local needs.[156]

If it is generally agreed that water-user associations in some form are vital to effective irrigation systems, there is a diverse and growing body of opinion that they should be in place before construction or rehabitation of systems. In the Philippines, organizers from the National Irrigation Administration assist farmers in forming groups six to nine months before construction begins.[157] Frances Korten notes four lessons from the Philippine experience:

1. Water-user associations must have clear authority and responsibility

2. Existing organizations should be used

3. Water-user associations must make substantial contributions to the costs of system development

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[155]Hunt and Hunt, op. cit.

[156]See E. Walter Coward, "Irrigation Development: Institutional and Organizational Issues," in Coward, op cit.

[157]Bagadion and Korten, op. cit.

4. Water-user associations must be developed prior to construction[158]

The need for establishment of such organizations before donor funding is also mirrored in a General Accounting Office report on AID-supported projects in Southeast Asia.[159]

It is also evident that farmer involvement through associations in the planning stage has resulted in avoiding costly errors in design of canals.[160] There is every evidence that discussions with farmers by project design staff, either of implementing agencies or donors or preferably both, at the earliest stage would yield practical improvements in the systems and probably cut operation and maintenance costs.

Management of the Program

In any bilateral or multilateral assistance program, donors must first negotiate programs with some central governmental organization. This may be a ministry of planning or some economic or foreign assistance coordination board or entity. It is likely that management of an irrigation program will be delegated, however, to some agency or ministry that has responsibility for agriculture, irrigation, or both. There is coordination at the top--that is, a government as a whole decides it will request or accept assistance in irrigation--but how does the responsible recipient organization, called here the implementing agency, coordinate at the working level to achieve project purposes? Effective irrigation, as has been noted, is a complex of a variety of factors, all of which are necessary for its success. Better water distribution alone, given the escalating costs of new construction or rehabilitation, cannot make the investments economically effective or recover the costs to the state or individuals. A variety of other factors must be included, and each nation has addressed the issue of coordination in a somewhat different manner, each with varying degrees of efficiency.

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[158]Frances F. Korten, op. cit.

[159]General Accounting Office, "Irrigation Assistance to Developing Countries Should Require Stronger Commitments to Operations and Maintenance by Donors and Recipients," 1983 (draft). The report covered projects in Indonesia, Thailand, and Sri Lanka.

[160]Mark Svendsen, "Irrigation Collective Behavior in Three Philippine Irrigation Systems," Bangkok: Kasetsart University, August 17-21, 1981.

Competing Demands, Competing Institutions--The Search for Cooperation

An implementing agency in any given nation operates within its own political and administrative culture. The donors can only ignore this milieu with peril to achieving their program purposes. It is imperative that donors understand the dynamics of the internal and external relationships of the implementing institution. Governments have often recognized that the traditional means of coordination or cooperation were not sufficient to make irrigation pay. Sometimes governments have attempted to improve irrigation by relying on established but strengthened institutions; creating new, focused organizations; authorizing umbrella agencies; or funding coordinative mechanisms.

In Thailand, the Royal Irrigation Department, a virtually autonomous body within the Ministry of Agriculture and the only entity of the Thai government (with the exception of the Royal Air Force) that is honored by use of the appellation "Royal," is an old established group. It is this organization that builds dams, constructs main canals and irrigation systems, and has a special esprit that is related both to its patronage and its considerable engineering capacity, which it has stressed. To achieve program purposes in the case of Lam Nam Oon, the project called for coordinating mechanisms that would bring together, in a manner unusual for Thailand, the Royal Irrigation Department and other elements of the Ministry of Agriculture with other ministries. Thailand has sometimes been called a "loosely structured social system,"[161] in reference to interpersonal relations, and whatever the absolute or comparative validity of that argument, it could be said that Thai institutions seem to follow similar patterns. Cooperation and coordination have often been difficult. The rewards of the irrigation department lie in construction, not in fostering farmer organization or coordination, and thus it is not surprising that so little was accomplished in these other fields.

Other countries have also employed existing institutions but have developed variant administrative structures. In Pakistan the Federal Agriculture Department established a Water Management Cell to help coordinate the project, and also on-farm water management directorates in provincial agricultural departments. In Korea, the irrigation project was managed by the Agricultural Development Corporation, a branch of the

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[161]John Embree, "Thailand--A Loosely Structured Social System," American Anthropologist, 1950. For commentary, see Hans-Dieter Evers, ed., Loosely Structured Social Systems: Thailand in Comparative Perspective, Cultural Report Series No. 17, Yale University, Southeast Asia Studies, 1969.

Ministry of Agriculture and Fisheries. In Korea, there is very close coordination, through the county government at the lowest level, as well as at the apex, among infrastructure, research, and extension groups.[162]

The Philippines tried a different approach. Recognizing at that time that the National Irrigation Administration (NIA) specialized in dams and generally larger gravity flow systems, the Philippines government established the Farm Systems Development Corporation, part of the purpose of which was to inaugurate small irrigation systems, basically using electric pumping, and to organize water-user associations called ISAs. Organizationally, it was an effective approach because of its young, dedicated, Peace Corps-like staff. Technically, however, problems developed, and as administrative coordination with the relatively weak extension service was strained, and cooperation with the NIA eventually collapsed, the NIA expanded its scope to include fostering irrigation and associations. In Turkey, the government established TOPRAKSU to deal with irrigation in the farm context, as other organizations involved in major dam and canal construction lacked interest at the farm level.[163]

Other nations have attempted a completely different concept: the establishment of a large government or parastatal organization that would not only build irrigation systems, but would provide other agricultural and social services. Examples include the Lower Moulouya Development Authority in Morocco, the Rahad Corporation in Sudan, EARIS in Egypt, the Jordan Valley Authority, the Helmand Valley Authority in Afghanistan, and the Bicol River Basin Development Program Office in the Philippines. These organizations, and there are others not included in the impact evaluation series, had a number of immediate advantages. They were large and new and therefore were prominent in the government's and public's eyes. They had relatively large budgets, political influence at the highest level, attracted both good local staff and donor support, and were less restricted by bureaucratic precedents and inertia. By their broad administrative mandate, they had authority to plan or perform many tasks in geographic areas that line ministries had attempted but could not accomplish well because of their national, thus diffuse, mandate. These organizations seemed the ideal solution to bureaucratic ineptitude. They sometimes were, in effect, the equivalent of local governments.

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[162] Korean Agricultural Research, op. cit.

[163] Turkey Irrigation, op. cit.

The question must be asked, however, not only how effective they were, but what the simple creation of these innovative mechanisms did to the capacity of the line ministries to perform their tasks. The ministries lost personnel, authority, political visibility, and probably donor support as well. In the Bicol, the situation was different, for the program office did the planning, but the line ministries were responsible for implementation, as was the case in the Egypt project. The impact evaluations did not examine this issue nor the generic effectiveness of such organizations, and probably could not do so in the time available. It is, however, a problem that should be studied to improve future project design.[164]

To the cynical observer of both implementing agencies and donor institutions, the bureaucratic purposes of both organizations are first, to spend their allotted budgets, and second, to do so as wisely as possible. Obligation of funds becomes a critical hallmark of success. We will return to this problem in discussing donor organizations later, but for implementing agencies, their bureaucratic rewards and those of their individual staffs are thus in the construction of irrigation or drainage systems. Moreover, the former is preferred because it obligates more funds and produces more visible results, for this is what the key staff have been trained to do and where annual budgets are quickly absorbed. There are three value orientations of staff that are both spurious and detrimental to poverty-focused rural development activities and that apply with equal validity to both operating agencies and donors alike. They are (1) expenditures equal results ("Those who move the most money are the heros..."), (2) education equals superiority, and (3) projects equal development.[165] These attitudes create a gap between the irrigation planners (indigenous and foreign) and the intended beneficiaries of their efforts.

Thus, because of background and training, national goals, bureaucratic procedures, and the annual budget cycle, attention is paid to construction of physical infrastructure, not the building of farmer-related institutions such as water-user associations. To the ultimately cynical, it is in construction that salaries may also be most easily supplemented.

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[164]It is for this purpose that the Office of Evaluation started an impact evaluation series on "integrated area development." Nonirrigation area development projects in this series are the Hacho project in Haiti and the Bong and Lofa County projects in Liberia. Others are planned. The completion of this series may help to define further this issue.

[165]Korten and Uphoff, op. cit.

Not only does the budget cycle prod construction, but the fiscal year and the donor budget cycle prod it more quickly. There is then little time or inclination for extensive consultation with farmers in planning projects, ascertaining problems or constraints, or even considering existing community-based or rudimentary irrigation that may already exist within the perimeters of the area to be irrigated. There is even less time to do so if, as we believe, water-user associations should be formed at the earliest stages of planning and well before construction.

The stress on water management for such groups thus becomes one of concentration on storage facilities, main canals, pumping stations, or other important and politically obvious and relatively expensive infrastructure. The means, infrastructure, may become the end, and obtaining the largest aggregate yields may be relegated, in some cases, to an important but subsidiary role. Improving farm income is rarely a consideration, for it can logically be argued that this is beyond the competence or scope of work of the organization. One article argues that, much as the United States had problems with the Bureau of Reclamation and the U.S. Army Corps of Engineers, the planning and evaluation functions of irrigation should be in a different group than that of construction.[166]

If training is proposed, it will probably be training for the organization's staff, primarily in building better infrastructure and secondarily for better management of the entity itself. Only then, if ever, is consideration given to training for farmers, and it is most likely to be in the agronomic aspects. Training for organization is rare.

As one paper suggested:

> In many development projects the identification of institutions responsible for implementation is seen as a residual decision to be made after the selection of technological and economic innovations have been determined. Further, institutions are often perceived, by extension of engineering and economic concepts, as "infrastructure," as necessary constructs to provide delivery or supporting facilities and services which the existing social environment does not and, by implication, cannot provide.

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[166]Easter and Welsh, op. cit.

> This assumption has not withstood the lessons of experience.[167]

Donors have often been willing allies of this approach, sometimes using local institutions to attempt to change social structure, but sometimes not even inquiring whether small or existing traditional irrigation systems exist in the region. Even if they do, they have not seemed concerned to ascertain whether such systems have something to offer in terms of successful traditional practices, whether they reflect local social problems, or whether they could effectively be incorporated into the major scheme without losing all of their identity. Project papers and impact evaluations are often silent on these issues, although with increasing interest in rehabilitation of existing irrigation systems and with a new emphasis on water management as a major constraint to achieving maximum yields, there is added consideration of some of these factors among most donors and increasingly among implementing agencies. The Bicol evaluation does deal with the haphazard incorporation of at least 26 traditional irrigation associations into the major systems with their loss of identity. A project planning document that simply assumes that a new or revitalized institution will radically transform social structure or administrative practice should be treated with considerable skepticism.

Sound organizational structures and sensitive staff are only partial solutions, for many staff members recognize that there are bureaucratic limits beyond which they cannot go. Yet, issues other than irrigation influence the effectiveness of even the largest and most powerful of these entities. Silting can cut the effective life of reservoirs, yet the authority may not be able to stop devastation of watersheds; poor pricing policies may discourage production, and a lack of related rural infrastructure and markets may mean that produce cannot be stored, sold, or transported. At Rahad, silt entering the Sudan from Ethiopia is reducing the life of some of the infrastructure by 10 or 20 years. Some projects attempt to alleviate these problems. The Bicol program has a watershed protection component in it. Even if implementing agencies may not be able to affect directly counterproductive national or rural development policies, they can lobby for this improvement.

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[167]Janice Jiggins and Guy Hunter, "Institutions and Culture: Problems of Criteria for Rural and Agricultural Development Projects," Overseas Development Institute, Agricultural Administrative Unit, Occasional Paper No. 3, Institutions, Management, and Agricultural Development.

Donors may play another useful role in encouraging such efforts.

The Donor Process

As the implementing organization is beset by problems of budgets, annual obligations, fiscal years, rewards for capital expenditures, and a lack of incentives to be conscious of farmer needs or institutions, these issues are mirrored in donor organizations.

It may be argued that AID as designer of irrigation projects is in both a somewhat more and less advantageous position than the multinational donors. The latter publicly acknowledge that they do not design projects; they review and help improve the project design of implementing agencies. If there is a lack of sensitivity to farmer irrigation needs, they might argue, the solution is to improve the capacity of implementing and planning organizations to design proposals more effectively. AID can offer no such comment, for even when the project is proposed by the implementing agency, it is usually designed by AID in conjunction with that agency and AID's consultants, and then reviewed and often substantially altered by the review process in Washington, in which the implementing agency has no role.

Let us begin with the putative beneficiaries of projects. It is unclear either in most project papers or evaluations, other than those in the impact series, whether AID design or evaluation staff ever discussed the proposed project ideas with the farmers themselves. It is assumed, only occasionally accurately, that the implementing agency fairly represents the beneficiaries, but the bureaucratic imperatives of each organization, the time constraints in project design, the presentation of proposals, the development of annual budgets, and Congressional presentations all press for quick solutions to problems that may be both more profound and complex and may not reflect farmer perspectives.[168] The rewards, as all AID staff are aware, are in managing large and growing portfolios and in maintaining efficient obligation rates and small pipelines. These mechanistic concerns overwhelm the real interest of some small percentage of AID staff in the farmers themselves.

The paucity of qualified irrigation staff in AID, both in the field and in Washington, can only sometimes be ameliorated by astute academic or commercial consultants, for these talented people need peers in AID with whom to interact, and

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[168]East-West Center--A.I.M. Conference discussion.

internalization of development lessons is far more tenuous if the concepts come from outside. It is possible that per dollar obligated, there may be less staff in AID trained in disciplines related to irrigation than in any other field. The need for donors to improve their own capacity to manage irrigation projects is thus acute.

In addition to more qualified individuals in the wide variety of scientific and social science disciplines that relate to irrigation, there is the added need to employ such individuals in an interdisciplinary manner that encourages the breakup of compartmentalized project documents, where social and engineering realities are rarely examined together. A project paper should neither be a motley collection of only distantly related essays by separate authors, nor should it be a novel, for this is not the place for fiction, but it rather should integrate thoughout, from its very conception, the skills of a diverse group of specialists, some of whom, at least, understand the local cultural environment.

Donor management also suffers from donor competition among themselves for desirable projects, and this in turn further stimulates a bandwagon effect that leads to more pronounced programmatic fads among a variety of institutions, profoundly affecting implementing agencies. Fads by their nature are ephemeral and by the time an irrigation system is operational, the noneconomic rationale under which it was supported may have entirely shifted. Donor coordination and complementarity is a necessary aspect of development assistance.

7. Maintenance, Decay, and Rehabilitation

The effective productive life of irrigation infrastructure is limited--often by more than the internal rates of return in project papers might indicate--but the deterioration and ultimate death of such systems can be hastened through poor design, environmental degradation, a lack of operational skills, and inadequate preventive maintenance. Thus, gross inefficiencies in the system result, and transfiguration through rehabilitation is required if production or income targets are to be met. Unless the chain is broken, the spiral continues upward, at each turn requiring more extensive, and expensive, rehabilitation.

As one impact evaluation mentioned:

> The problem, it appears, is rooted in a vicious circle of faulty physical facilities which provide inadequate water services, resulting in problems of collecting service fees from farmers who claim depleted harvests. This forces O&M [operations and

> maintenance] staff to double up as bill collectors in addition to maintaining the systems; neglect in maintenance leads to further deterioration of the facilities.[169]

As with the physical infrastructure, the environment undergoes a similar process. Lack of preventive maintenance, the care of the watershed, or lack of adequate attention to drainage results in filling of dams or salinity of the soil, destroying the livelihood of the people and rendering the project useless. Walking on the thin, crusted salt that had turned once fertile fields into wasteland in parts of the Helmand Valley poignantly illustrates the false economy of poor drainage. Yet similar illustrations can be drawn from dozens of sites of far greater international significance for agricultural potential. Responsibility for these degradations are mixed, but it is often a responsibility which national governments, implementing organizations, farmers, and donors must share.

Rehabilitation should not primarily or even necessarily be considered as evidence of the failure of maintenance.

> Even the best-maintained systems eventually reach a point where it becomes more economical to invest in wholesale rehabilitation than in continued piecemeal maintenance.... One of the major mistakes made at this point (when rehabilitation becomes desirable) is that of seeing the rehabilitation as a restoration of the system to original specifications.... The fact is that by the time rehabilitation is considered, conditions within the command area are almost inevitably different than those prevailing when the system was first designed. Land-ownership patterns may have changed; holding sizes may be different; administrative and drainage reservations may have been encroached upon; canal networks may have either expanded, contracted, or been realigned (officially or informally); water tables may have built up changing seepage and percolation rates, and so forth. It is crucial, therefore, that the system be redesigned to fit current reality. Rehabilitation should be approached as an opportunity to bring the system back into harmony with its context rather than as a shameful admission of failure to maintain it.[170]

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[169] Philippines: BICOL Integrated Area Development, op. cit.

[170] M. Svendsen (personal communication).

Maintenance

The question of maintenance is clearly a problem of management, as well as economics. Perhaps basically, it is also a matter of responsibility: who or what institution has the responsibility to care for the system? In traditional systems, completely private in nature, responsibility is unambiguous: it rests with the users. Because much of the technology is primitive and weirs of stone or brush must often be rebuilt every year after the monsoon, group efforts are effectively organized to deal with the annual crisis. Some argue that because of the crises, these groups are effective. Thus, the incentives for maintenance are apparent where the responsibility and the benefits are localized.

The costs to farmers in labor and material are not inconsiderable. In some Thai and Philippine systems the annual labor requirements alone (calculated on land irrigated) may average over 10 percent of all days in the year; in addition, there is material to be provided. These costs are also beyond the considerable labor necessary for upkeep of farm ditches and small channels. The Indonesian situation is similar for they are traditional systems before they receive government assistance through the Sederhana project.

With government intervention, the responsibility shifts to some degree. Once systems were installed in the ISAs in the Philippines with government encouragement, complete responsibility for the maintenance and operation of the pumps and canals fell to that group, which often was hard pressed to meet the costs without levying such heavy charges on the members that they fell further into debt or had to lower the amount of fertilizer used, thus decreasing yields and income.[171]

In Korea, the responsibility shifted absolutely, with an arm of the government bureaucracy taking over the management and charging the irrigators for the expenses. In the Sederhana project in Indonesia, the government undertook to keep the weir and diversionary canals in order, while the farmers were responsible for the rest of the system.

As the systems change from community-based to agency-based ones, the locus of responsibility seems to fall more on the government both because the government seems prepared to take it and the farmers seem to expect it. The absence of water-user associations in the Pakistan On-farm Water Management project and in the Lam Nam Oon project in Thailand, as well as in the major schemes elsewhere, may relate to this shift in

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[171] Philippines Small-Scale Irrigation, op. cit.

attitude, although in the Pakistan case there seems to be a lack of such a tradition.

Although conclusive evidence is lacking, it seems apparent that as the responsibility for maintenance shifts to an element of a bureaucracy that is responsible not to the farmers at the local level, but to the higher echelons of their administrative structure, concern for more than perfunctory performance of duties seems to diminish, and the opportunities for corruption increase.

Related to the switches in responsibility for management are changes in the allocation of resources to maintain the system. In many societies water is traditionally free, and the imposition of water-user fees is regarded as inappropriate by the irrigators and politically inexpedient by the bureaucracy. In these cases, the central treasury can provide these costs indirectly from general revenues or through low farmgate pricing policies. Yet it is also clear in many societies, including the United States, that there seems to be a greater reluctance to provide funds for operations and maintenance than for the construction of physical infrastructure. "There seems to be substantial evidence that as the area of irrigation increases within a country the per unit area allocation of operations and maintenance money decreases. This is clear from the Philippines, Sri Lanka, and Colombia...."[172] In Thailand, as irrigation budgets expanded, the percentage of the budget devoted to operation and maintenance declined--from 7 to 2 percent.[173] The reasons are apparent: maintenance was far less glamorous, has been more difficult to justify than capital costs, and donors have been more reluctant in assisting in the supply of such local currency funds. If budgets for a whole irrigation department shrink, it is likely that the residue will increasingly be devoted to staff salaries in preference to actual maintenance. This is, of course, a bureaucratic truism.

Until comparatively recently, donors have looked upon local, continuing costs as a local responsibility. As it has become evident that governments no longer seem willing or able to undertake the supply of adequate funds for these activities, donors have changed their procedures. Now, many, including AID, the World Bank, and the Asian Development Bank, are prepared to provide some of these expenses. In the Dominican Republic, there is now an AID-supported project that solely

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[172]Gilbert Levine (personal communication).

[173]Thailand/USAID, Irrigation Development Options and Investment Strategies for the 1980s, Water Management Synthesis, Special Report No. 3.

provides maintenance for rural roads. In some countries, such as Burma, the World Bank has specifically encouraged other donors to supply local expenses for maintaining projects. In others, the proliferation of donor activity, and thus of donor-supported projects, is so great that it places strains on the ministries concerned, and indeed on the limited funds that are available to the government to supply local costs.

It is, however, generally expected that local costs will be borne by the local community and that one efficient way, which will also save water, is to charge for it. Where water charges are levied, they are allocated by a variety of different methods. There are at least six methods for collecting water charges: (1) direct charges for measured flow; (2) direct charges per share of stream or canal flow; (3) direct charges per acre irrigatated; (4) indirect charges on crops marketed or agricultural commodities supplied; (5) development rebates or promotional water charges; and (6) general land or property tax.[174] The one generally advocated by economists is on the basis of water actually used, thus conserving scarce water resources. This requires, however, expensive and relatively complex water-metering systems that are certainly the exception rather than the rule in developing countries. This also requires considerable expense in construction and training. Other methods are imposition of a flat fee, as in Burma where in 1982 a national annual water tax was declared at about $1.50 per acre in all government-irrigated or flood-protected land. In Turkey, fees are levied by area under irrigation that is cultivated, and in some other societies on the basis of actual yields. In any case, the general donor experience seems to indicate that water-user charges are normally difficult to impose, and are never equal to the actual costs of the water, including the amortization of the capital investments.

In general, however, a hypothesis worth testing is that whatever method is adopted, the closer to the user the user charges are kept, the more the systems are likely to be efficient. Funds thus recirculate in local areas and can be used directly to maintain the systems. The modest surpluses, when they exist, can be used to feed or entertain farmers who work cooperatively to keep up the system. This helps strengthen local solidarity and provides an element of esprit to the community.

The problem of drainage is somewhat different, for unlike irrigation, it is not a perceived and apparent good to many farmers, at least not for a number of years. Drainage ditches

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[174]Easter and Welsch, op. cit.

take scarce land out of cultivation for no obvious immediate gain, and farmers at Lam Nam Oon, for example, have been reluctant to give up land for this purpose,[175] although drainage has been provided for in overall irrigation planning. The result was that drainage ditches were not constructed. In the Helmand Valley, it was the government that decided not to install adequate drainage to save funds. The tragedy in this case was that the donor acquiesced to this policy. It might have been better objectively not to have funded the project than to have funded it inappropriately, whatever the immediate political implications might have been. It is ironical that in some cases, if drainage is included in the original project, the economics of the added costs and land taken out of circulation makes the project difficult to justify. If the project is working and drainage problems occur years later, there is both political pressure and a favorable economic rate of return, given the sunk costs, to proceed with rehabilitation.[176]

Maintenance is at the heart of the sustainability of irrigation systems. It seems most appropriate and advantageous to keep the responsibility for it, insofar as feasible, in the community that benefits from the system. An irrigation system will be more likely to be sustained when funds are not a product of bureaucratic largess, since government entities notoriously are subjected to competing requests for funds, and maintenance is the least spectacular (even if most important) of budgetary allocations. The General Accounting Office has called for a greater commitment to maintenance both by AID and recipients.[177]

Maintenance, then, is a critical issue that must be addressed in some locally appropriate manner in project design.

Decay and Rehabilitation

The decay of systems can in part be attributed to poor maintenance of the irrigation works themselves, but it sometimes is related to facts beyond the irrigated perimeters. Environmental destruction of watersheds has led to silting of reservoirs and the premature senility of irrigation systems. More and more, efforts turn to the protection of the river's

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[175]D. Steinberg, Field Notes, 1978.

[176]Gilbert Levine. He notes further, "It is not clear that in many cases this is not an effective strategy" (personal communication).

[177]General Accounting Office, op. cit.

watershed, not only the exploitation of the river valley. The Citinduy project in Indonesia is one example, but others are more complex. Destruction of forests in Nepal has led to severe flooding and silting of the rivers in Northern India, thus creating international problems for which there is little precedent in finding solutions.

Faulty design may also be a factor in the process of decay. Some implementing agency staff have cogently argued that most engineers are not trained in irrigation techniques and engineers are thrust, so to speak, over their heads in water works, where problems are bound to occur. Others also maintain that inadequate subcontracting to unqualified private firms as well as corruption in those firms and collusion with unscrupulous implementing agency staff contribute to the problem. The literature abounds with examples of poor design because engineers did not bother to talk with the farmers, who understood the hydrological dynamics of their own small areas. If, indeed, water-user associations know in advance that they will be required to pay in part for the system, it is more likely that they will demand to be heard at the design stage, and many mistakes could be avoided.

Decay can take place not only because of inherent problems with the system, contracting, the environment, or because of natural aging, but also because of war or health factors. The abandonment of hundreds of tanks on the dry zone of Sri Lanka half a millenium ago and the resulting depopulation of the region may have been the result of malaria, which the building of tanks encouraged, as well as the destruction from south India. The Jordan Valley was devastated in the war with Israel.

Rehabilitation is one major option for an irrigation or an agricultural strategy. It is this approach that the AID Asia Bureau strategy advocates.[178] There is considerable justification for this approach: lower costs, relatively quick returns on investment, general use of good lands (new irrigation in many areas is on marginal land as the better areas are already irrigated), and a population familiar with the requirements of the system. It may not be, however, the universal panacea, and care must be taken for there is likely to be no magic key to success. One article notes, "Improved watercourses in Pakistan's Punjab tend to reach their previous state of neglect in one to three years."[179] The need for continuous maintenance of rehabilitated systems is evident. When systems fail to provide a reliable supply of water, the farmers sometimes break

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[178]Lowdermilk and Svendsen, op. cit.

[179]Easter and Welsch, op.cit., citing Renfro (1982).

into the system to gain access to it and the implementing agency loses control over water supply. Rehabilitation, therefore, should not begin with construction but with efforts to build water management and maintenance capacity. Too often the effort begins with construction to original blueprints, with complete neglect of the social, institutional, and managerial dimensions.[180]

Rehabilitation of small systems and their inclusion in large ones is a type of halfway house between addiction to massive building and withdrawal into simple rehabilitation. The incorporation of older, traditional systems is not always possible because the improved technology of irrigation requires different approaches, but few governments seem interested in trying to maintain traditional structures where feasible. The result is a loss of already validated institutional experience at the local level, and a further stifling of local incentives as a shift is made to agency-based systems. The construction of high dams for hydroelectric power that will also have implications downstream for broadening irrigation is such an important and exciting prospect for improving food production that unfortunately both national agencies and donors have neglected to consider those systems that exist. In part this may be the result of the arrogance of the technological disciplines of bureaucracies, of urban elites, or of social or economic class. Evidence exists that little thought was given to adjusting irrigation to include, in some beneficial manner, those working, traditional systems. Although farmers may have benefited from an assured supply of water, they may have unnecessarily lost social cohesion in the process.

8. The Effectiveness of Irrigation Programs

Concern with policy choices and the impact of irrigation projects on the irrigators should no longer detain us from considering the process of formulating projects and how that process affects the operations of the projects themselves. Here, once again, we must move beyond the impact evaluations and consider as well the experience of other donors and the views of academicians and members of implementing agencies. If in architecture it has been said that form follows function, in irrigation the hypothesis might be that the function and style of donors influence the forms that irrigation systems take.

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[180]David Korten, USAID Manila, has noted this phenomenon (personal communication).

out of 14 projects there was no economic justification, as the internal rate of return was lower than 12 percent, and in seven projects the return fluctuated between -9 and 5.5 percent.[182]

The World Bank evaluated 40 projects in 22 countries. It found that only nine of 40 projects were within cost estimates, and 25 were more than 20 percent more expensive, while nine had doubled in cost. Twenty-four projects had time overruns of more than 20 percent and an additional five took twice as long to complete. Nineteen of the projects exceeded their economic rate of return, but this was due to higher crop prices in more than half the cases. Rice projects had a higher economic rate of return (27 percent) than nonrice projects (15 percent), but cost overruns on rice projects averaged 77.1 percent, compared to 33.8 percent on nonrice irrigation. The cropping intensity for rice was 132 percent, but for other crops it was 82 percent.[183]

A variety of individuals, representing diverse viewpoints, have commented on the donor problems in general. These issues are by no means inclusive but they indicate, in no particular priority order, a variety of questions.[184] Many, if not all, of these problems are equally applicable to host country implementing agencies.

-- Assumptions about the speed with which irrigation systems will reach full capacity are too optimistic.

-- Designers of irrigation projects are often various kinds of engineers who have never irrigated anything (and have no agronomic knowledge).

-- Design should start at the farm but rarely does.

-- More consideration should be given to a complete technical agronomic package including the capacity of the extension service, if any.

-- There is a need for better feasibility studies of soil mechanics, agricultural potential, climatic conditions, and hydrology. These studies must be integrated into the presentation or proposal.

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[182]Inter-American Development Bank, "Summary of Ex-Post Evaluations of Small- and Medium-Scale Irrigation Projects Partially Funded with IDB Loans," Office of the Controller, Operations Evaluation Office, Report GU-1433, May 1982.

[183]Malone and Mahatanankoon, op.cit.

[184]Adapted from Bromley, op. cit.

-- There is a lack of analysis of the optimal size of irrigation systems.

-- Donors know little about local social systems and power structures and indeed local institutions, including traditional irrigation systems.

-- There is little donor coordination, and donors sometimes compete for good projects.

-- There are few rewards in donor agencies for institution-building and social analysis; rewards are for obligation rates and physical construction.[185]

Not included in this daunting list are the problems that develop between donor and recipient; the dynamic relations involving both organizations may be mutually supportive, but when they are, this enthusiastic coordination may push project development too rapidly without other considerations being given due weight.

Related to the design process is the issue of the project paper or proposal as a sales document, whether from the implementing agency to its own government and a donor, or from the donor field office to its headquarters. This sales aspect often takes two forms: (1) making use of particularly attractive phrases or slogans that do not change the nature of what was proposed, but rather repackage it, wrapping it in the aura of development chicness; and (2) ensuring that the internal rates of return are as optimistic and as high as possible. These might be called "The Mod Syndrome" and "The Pangloss Ploy." They are by no means limited to irrigation.

Project proposers know the immediate interests of the hierarchical bureaucratic structure, public or private, bilateral or multilateral. It is relatively easy for an astute development practitioner or academician to take an irrigation project and repackage it as one that fosters human rights, equity, exports, institution-building, participation, aggregate production, the private sector, improved market forces, technology transfer, or foreign exchange savings. It may, in fact, assist some or even many of these purposes, but the emphasis in presentation may also shift depending on what is fashionable.

Many irrigation projects suffer from unrealistic economic analyses, and sometimes these deficiencies are even obvious to the noneconomist. Overoptimistic rates of cropping intensity; inattention to alternative forms of income and employment

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[185]For a confirmatory view, see Korten and Uphoff, op. cit.

(livestock, rainfed agriculture, etc.); higher-than-average yields or farm prices; the availability of fertilizer, seed, credit, or marketing structures; or government commitment to continuing extension or maintenance all appear with alarming frequency. Even when economic forecasts are discounted, there is still a tendency to expect construction or operations to begin too soon and to be completed too early. When AID had a three-year limit on projects, all projects were to be completed within this period; with a five-year limit, they will take five years. The bureaucracy has a tendency to respond with more alacrity than careful thought.

There is also the category of the "pious hope" in project design: that institutions or governments will be interested in or have the capacity to monitor results or potential problems, like health and the environment, and be prepared to provide funds for such activities or for repair and maintenance after the project ends. Skepticism might well be justified based on the record. In AID parlance, the "assumptions" column of the logical framework, which is normally given the least attention, requires the most careful analysis.

Irrigation is not equity-neutral. It is at best a reaffirmation of the existing social and economic distribution of assets, but more often, it will tend to exacerbate differences in both income and social prestige. By the time that water begins to flow in a system, those who get an assured supply and have more land will receive more income. Equally important, they will regard their allocation as "legitimate," and it then becomes almost impossible to change.[186] Thus, equity issues must not only be built into the design if AID or the host country considers them important, they must also be considered early enough so that water allocation can be determined before commitments are made. There is further need for the U.S. government to determine whether it wishes to be associated with an inequitable water distribution system, with any political repercussions that might have. This calls for detailed social analysis early in the design process, preferably at the project identification document stage.

If, however, a rethinking of the implementing agency or donor design process is required, as evidence clearly indicates it is, then it cannot be accomplished by fiat. It is necessary to build up a system of rewards and sanctions, together with an incremental learning process coordinated with action research that will provide evidence of the effectiveness of the new

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[186]Hotes, op. cit.

approach in tangible terms. It needs a commitment to the process of improved design that has been heretofore lacking.[187]

The Monitoring Process

Many of the monitoring activities have already been alluded to in other portions of this paper. The purpose here is to bring together comments that have been made in other fora to determine how monitoring might be improved.

Monitoring, or the oversight activities of both donor and recipient during the course of the project, has come in for criticism from each group about its own organization and about the activities of its counterpart. There is first the general observation that too little of it gets done by either group. These attitudes seem widespread, yet the irony is that in the impact evaluation that dealt with this issue, it was found that the use of the "fixed amount reimbursement"[188] in the Sederhana project in Indonesia delayed the project because of the donor's close monitoring. Whether there might have been worse problems without it is an issue, but the question of the effectiveness of centralized control of project implementation, including obligation rates, is a theme that transcends monitoring to pervade all aspects of AID organization and indeed most organizations in any nation that have a headquarters and field operations.

Monitoring, especially in the field, is not a subject that can be left to contract personnel alone, as it sometimes seems to be. The responsibility cannot effectively be delegated, even if it legally may be. There is evidence that it must be continuous, not sporadic, and focused as much on the farmer as on the cooperating institution.

The contract function, whether for technical assistance or for locally authorized construction, has come in for considerable criticism. The donor contracting process for technical assistance, construction, and material ofen leads to long delays. (In the Lam Nam Oon project, finding an appropriate technical assistance organization took so long and was so far behind schedule that local Thai authorities began a process of

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[187]For a helpful discussion of the issue see Korten and Uphoff, op. cit.

[188]Because of the nature of the fixed-amount reimbursement system, there is a tendency for it to lead to concentration on construction alone, which after all is simply a means to achieve certain other ends.

land consolidation that many felt was inappropriate for that area, no matter how successful it had been in the central plains.) Problems in the bidding on, shipment of, and arrival of material have delayed projects, sometimes through more than one cropping season. Training often begins long after project approval, thus forcing key personnel to begin activities on the project when it is coming to an end, instead of having pre-project training that would bring such individuals back into work at critical times when they might affect its implementation positively.

Other aspects of monitoring involve the implementing agency. There, suggestions have been made that centralism has also plagued those groups and that subcontracting has often been poor.[189] Private contractors have their own firm's interests rather than those of the intended beneficiaries in mind, and may try to cut costs, alter designs, and, in general, service their own needs. Insofar as they are informally assisted in doing so by the local branches of the implementing agency, corruption is the natural product. The absence of continuity of personnel is one issue that others have periodically addressed, but about which little has been done.

Monitoring issues have assumed greater importance in recent years in AID, and these evaluations of earlier projects point out the need for further activities to improve the system. Implementing agencies, which may not have paid as much attention to monitoring as they might have, should consider this issue. Both types of organization should recognize, however, that although there is likely to be more glamour in project design and preparation, which after all allows capital expenditures, sufficient funds must be maintained to enable monitoring to proceed effectively. In AID, this means freeing project managers in the field from many of their bureaucratic responsibilities in the capital city and providing them with sufficient funds to achieve these purposes. During periods of personnel cuts and fiscal stringency, the needs remain the same, even if the means to attain them become more difficult to garner.[190]

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[189]East-West Center--A.I.M. Conference discussion.

[190]An imaginative monitoring program has been adopted by the World Bank and the NIA. Although relatively expensive, it promises economic returns over the long run. See Ronald Ng and Francis Lethem, "Monitoring Systems and Irrigation Management: An Experience from the Philippines," World Bank, September 1982.

Research

There is always the temptation in academic circles, and in donor agencies as well, to note, toward the close of any report, the need for more research. There are few who would argue with this in the case of irrigation, in spite of the wealth of material, even if diffuse, on this subject. Yet there are dangers in irrigation research that should prompt caution in its support and in reliance on the data emanating from it. Chambers[191] lists the biases in irrigation research as the following:

-- Concentration on areas of ease of geographic access

-- Concentration on prominent projects

-- Too much attention to design, construction, and settlement, and not enough attention to management of operations and maintenance

-- Concentration on quantification, when quantifiable issues may not be the most important ones

-- Concentration on researchable issues

-- The paradigm bias--research where there is literature available

-- Diplomatic bias--don't deal with the hard issues

-- Bias by professional or disciplinary field

Depressing as this list may seem, there are opportunities, and indeed requirements, for improved research. The most important is the development of indigenous research capacities in a variety of disciplines in a national setting. To develop adaptive administrative and technical systems in local social and cultural settings requires the training of individuals from those societies, often both in and out of government, and the establishment of close links between local adademic institutions and bureaucracies. If there is one single, longer range activity to which donors can contribute to improve research, it probably lies in fostering such capacities.

More immediately, however, thought might be given to action research--working with existing institutions at all levels both to improve operations and to increase analytical capacity for other irrigation activities. This type of

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[191]Chambers, op. cit.

research reduces the charges of operational irrelevance and academic sterility, and deals with the actual problems associated with irrigation.

Research, then, should be proposed with care and sensitivity to the real, not imagined, issues of irrigation. The future lies in the development of local institutions capable of solving local problems.

The Repayment for and the Sustainability of Irrigation Systems

The issues of the genesis, decay, and rebirth of irrigation systems have basically been covered in previous sections of the report. The purpose here of raising the question of sustaining systems once they have been constructed is to stress the need in the design process for careful assessment of the problem. The inclusion in project design of the designation of the types of activities required to sustain irrigation in a cost-effective and productive manner is often ignored, except for hortatory statements about self-help from the irrigators themselves and the promises of budgetary support by the governments concerned. These well-intentioned statements, although they may be accurate, may also reflect hopes and intentions more than reality. How often are farmers really consulted in the planning process on how they will repay (where required) the costs of the system or continue the required level of maintenance? As responsibility for part of the system is shared by government, so responsibility shifts in sometimes mysterious ways where no group feels that the maintenance of the system is its primary concern.

An innovative approach from China might provide a useful illustration. There, when the World Bank was negotiating an irrigation project, government approval was held up as the authorities noted that they, representing the central government, stood as guarantors of the loan, but that repayment would come from the hsien (county) concerned; therefore, the detailed economic analysis and internal rates of return prepared by the bank had to be reviewed by those who would have to repay the loan to see if repayment was indeed feasible. It might be instructive for both donors and implementing agencies to talk directly to farmers to determine whether they feel the economics of the project, viewed from the farm, are feasible.

Learning from past irrigation experience to improve future projects is a matter of evaluation--those performed in the field to make modifications as the project progresses, as well as those that are conducted after the completion of the effort. In a decade AID has swung from virtually no evaluations to requirements for highly quantifiable (although sometimes spurious) results. In irrigation, with its long gestation periods

and inevitable social, economic, hydrographic, and agronomic changes, perhaps a new approach is needed. "Too often evaluation, if done, is done with reference to the initial conception of the problem--how well and timely did the organization do what it set out to do--rather than deal with the effectiveness of solving priority problems as they become more evident from the accumulating experience."[192]

Sustaining irrigation systems means realistic project design, realistic assessment of returns, and realistic rates and periods of repayment. When governments determine to supply irrigation as a free good, then they must decide, in the face of competing priorities, who will pay and how. Thus we return full circle to where we began: the policy context in which irrigation is planned.

9. Irrigation and Agricultural Triage: Coda

The dilemma of whether to support irrigation projects, the difficult choices associated with the concept of agricultural triage, should not persuade us that effective irrigation is an impossible dream. It should rather serve as an antidote to the disease of seeking spurious and simplistic solutions to the complexities of development problems, of food shortages, and deprived peoples. Seeking for the development millennium is not inappropriate, but expecting that any single intervention in as highly a complex field as irrigation will provide it is a delusion.

This paper is, therefore, not intended to discourage irrigation programming. In spite of its concentration on problems, failures, and incomplete attainment of goals, it is devoted to improving what is clearly a critical productive enterprise. It does not advocate more funds for irrigation, perhaps a disappointment to its advocates, but implicitly argues that we have first to improve what we have done and plan to do before seeking more resources. It is in a sense an inherently optimistic approach, for if irrigational redemption were not possible, so much time would not have been spent in trying to explain how it might be done better.

Reform, however, is not without its traumas, and it will be incumbent on those who propose new interventions in irrigation to demonstrate that the lessons learned from the impact evaluations, from other donor experience, and from the literature have been applied, for people are too poor, funds are too short, and environments are too fragile for us to intervene if

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[192]Korten and Uphoff, op. cit.

the evidence points to failure. It is, thus, our responsibility to improve irrigation programming, for the stakes are very high.

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APPENDIX I

AID IRRIGATION STUDIES

Impact Evaluations

No. 4. Philippine Small-Scale Irrigation, May 1980

David I. Steinberg, Team Leader, Bureau for Program and Policy Coordination
Douglas Caton, Bureau for Program and Policy Coordination
Susan Holloran, Bureau for Asia
Thomas Hobgood, USAID/Manila, Office of Agriculture

No. 12. Korean Irrigation, December 1980

David I. Steinberg, Team Leader, Bureau for Program and Policy Coordination
Robert B. Morrow, Agricultural Economist, Bureau for Near East
Ingrid Palmer, Economist, Consultant
Kim Dong-il, Sociologist, Korean Rural Economics Institute

No. 29. Sederhana: Indonesia Small-Scale Irrigation, February 1982

Susan Holloran, Team Leader, Bureau for Asia
Gilbert L. Corey, Water Management Specialist, Bureau for Development Support
Timothy Mahoney, Anthropologist, Bureau for Latin America
Joseph Stepanek, Economist, USAID/Indonesia

No. 28. Philippines: BICOL Integrated Area Development, January 1982

John G. Sommer, Team Leader, AID/Washington
Rosemary Aquino, Management Specialist, De La Salle University, Manila
Carlos A. Fernandez II, Social Anthropologist, Development Academy of the Philippines
Frank H. Golay, Economist and Philippines Specialist, Cornell University
Emmy Simmons, Agricultural Economist, AID/Washington

No. 31. Sudan: The Rahad Irrigation Project, March 1982

Peter Benedict, Team Leader, Bureau for Near East
Ahmed Humeida Ahmed, Agricultural Economist, University of Khartoum
Rollo Ehrich, Agricultural Economist, Bureau for Development Support
Stephen F. Lintner, Environmental Scientist, Bureau for Near East
Jack Morgan, Agricultural Engineer, Consultant
Mohamed Abdulrahim Mohamed Salih, Anthropologist, University of Khartoum

No. 35. The On-Farm Water Management Project in Pakistan, June 1982

James E. Painter, Team Leader, Bureau for Program and Policy Coordination
Emily Baldwin, Sociologist/Economist, Bureau for Near East
Sandra Malone, Program Operations Specialist, Bureau for Program and Policy Coordination
Ernest T. Smerdon, Agricultural Engineer, University of Texas
Akbar S. Ahmed, Anthropologist, Harvard University
Masud A. Siddiqui, Evaluation Officer, USAID/Pakistan
Mahmood H. Khan, Agricultural Economist, Simon Fraser University

No. 42 Bangladesh Small-Scale Irrigation

Tom Friedkin, Team Leader, Bureau for Program and Policy Coordination
Robert Lester, Office of General Counsel
Herbert Blank, Engineer, USAID/Nairobi
Nizam U. Ahmed, The Program Office, USAID/Dacca

No. 43 Egypt Area Development--EARIS

Pamela Johnson, Team Leader, Bureau for Near East
Ahmed El Dahry, State University of New York, Binghamton
Richard Dekmejian, State University of New York, Binghamton
Eugene McJunkin, Water Supply Advisor, Bureau for Science and Technology
Robert Morrow, Agricultural Economist, Bureau for Near East
Mohey Khattab, Consultant, Delta Business

Hind Khattab, Social Scientist, American University of Cairo

Working Papers

No. 46. Lam Nam Oon: An Irrigation and Area Development Project in Thailand, Robert Muscat, September 1982

No. 47. Productivity, Integration, and Participation: A Brief Look at the BICOL-River Basin Development Program, David Robinson, November 1982

Papers To Be Published

Impact Evaluations

Peru: Land and Water Use in the Sierra

John Wilkinson, Team Leader, Bureau for Program and Policy Coordination
Ray Meyer, Agronomist, Bureau for Science and Technology
Barbara Numberg, Anthropologist, Bureau for Program and Policy Coordination
Cressida McKean, Economist, Bureau for Program and Policy Coordination
Carrie Weil, Research Assistant, Bureau for Program and Policy Coordination

Somalia Soil and Water Conservation

John McCarthy, Team Leader, Bureau for Asia
Cynthia Clapp-Wincek, Institutional Analyst, Bureau for Program and Policy Coordination
Steven Londner, Agricultural Economist, Contractor
Abby Thomas, Anthropologist, Contractor

Special Studies

The Helmand Valley Project in Afghanistan

Cynthia Clapp-Wincek, Institutional Analyst, Bureau for Program and Policy Coordination

An Assessment of the Lower Moulouya Irrigation Project--Morocco

Robert T. Holt, University of Minnesota
Terry Roe, University of Minnesota
H. David Seddon, University of East Anglia

Research Paper

Jordan: Irrigation and Area Development in the Valley
David Sharry

APPENDIX II

IRRIGATION: THE EVIDENCE FROM THE IMPACT EVALUATIONS

Introduction

Irrigation has the potential to increase agricultural yields and thereby help provide solutions to the world's food deficit problem. In the impact evaluations conducted by the Office of Evaluation in 11 countries of the Third World, the key to this global problem has been seen as increased production by the individual farmer. If the individual farmer benefits by the irrigated production system, the reasoning goes, the aggregated yields will increase. The farmer, and supposedly his family, will benefit directly at the same time that more food is made available for sale to the general population. The developmental goal of eliminating hunger would be furthered.

Incentives

Irrigation projects usually require farmers to change the way they farm either through using new inputs (seeds, fertilizer, pesticides) or new practices (land levelling, pumps, machinery). For farmers to accept the risks of changing proven practices, there must be incentives which outweigh those risks. In Pakistan, for example, farmers responded to the lack of incentives and the project managers responded to the farmers:

Pakistan

> Precision land levelling (PLL) was considerably less successful than anticipated, owing in part to small farmers' view that the risk exceeded the likely benefit and their resultant reticence to remove land from production. In addition, PLL was not fully tested due to a GOP decision to de-emphasize it mid-way through the project period in favor of watercourse improvement. (p.v)

Although we talk about incentives to the farmer, the situation is not as clear-cut as that.

Philippines

> With more intensive agricultural practices, more family labor is required to produce crops, reducing the opportunities for off-farm employment. Unless the farm is exceptionally profitable, net family income may be lower, as off-farm employment is discontinued. Thus, an anomalous situation results: farm income rises, but family income drops. (p. iii)

With this concern in mind, a very rough assessment can be made. In seven cases, the incentive structure seemed to favor the farmer but in five cases, little success appears likely with circumstances as they are.

Positive Incentives

Turkey

The project pivoted about profits to farmers from levelling, drainage, and so forth. The potential was substantial, as shown by a study of four farms in Aydin Province in 1971. The average increase in cotton yields was 1500 kilograms per hectare at 3.5TL per kilogram. The average decrease in production costs was 100TL per hectare. The return on the investment, thus was over 200 percent...in the first season. (p.11)

Egypt

Where irrigation water is assured, small farmers on reclaimed land are financially viable and highly productive after an initial "gestation" period. (p. vi)

Bangladesh

Hand tubewells in use appear to more than pay for themselves in a very short time. This is due to the fact that they usually irrigate a third crop which would not have been planted [otherwise].... Side benefits [include] domestic purposes during those months when there is no agricultural use for them. (p. i)

Indonesia

In most of the 29 subprojects visited on Java, Sulawesi and Sumatra, Sederhana's impact on local rice production was substantial despite the difficulties of implementation. On Java, where there is a long tradition of rice farming, production increased substantially at most of the sites visited. On Sulawesi, rehabilitated irrigation systems frequently permitted an additional rice crop each year. Yields increased by as much as 2 tons per hectare. The production of dryland crops also improved. On Sumatra, however, the production impact was not encouraging. At many sites, environmental conditions such as soil and climate did not appear favorable for growing high yielding varieties of rice. The program's emphasis on rice production appeared to be meeting with

resistance both from farmers who could not or did not want to grow high yielding varieties and those who did not want to switch from a profitable cash crop such as coffee to a rice crop which requires a great deal of labor (in short supply on Sumatra) and which they were not accustomed to growing as a principal crop. Local production impact has confirmed an assumption in the Sederhana concept that farmers could make immediate use of additional water. (p. v)

Pakistan

Although farm costs have risen as a result of both inflation and greater use of inputs, larger yields (and increased support prices for most crops) have raised incomes even more. (p. 17)

Somalia

Crop yields at Arabsiyo increased 100 percent during the first 10 years after project completion and are still almost 150 percent more than what they were prior to AID's project (despite the present deteriorated condition of the bunds).... In income terms, the annual returns from the 12 hectares still irrigated by the AID scheme at Ceel Bardaale approximates the total AID contribution of between $200,000 and $250,000.... (p. 2-3, draft)

Where the whole system may not necessarily be to their advantage, farmers with enough information will find the parts of the system which reward their efforts.

Korea

Farmers have shown acute awareness of market forces [as] evidenced by the production of winter vegetables which has become a major rural industry. (p. i)

Lack of Incentives

Peru

A small farmer pointed to two small plots owned by agricultural technicians working at Chicche and said, "Look at that; they lost more crops than I did this year. Why should I do what they say?" (p. 29, draft)

Thailand

In LNO, it appears that farmers would also have utilized less water than was available if it were not for

firm guarantees by project management that the water would actually be delivered when needed during the growing season, and that the government would buy all rice and groundnuts produced, at prices set prior to planting. Available evidence suggests that contrary to the conventional wisdom that Northeast farm labor is underemployed in the dry season, and should therefore have no alternatives to using any water provided by the project, farmers do have other income earning opportunities. Income that farmers earn cultivating with irrigation must therefore exceed income they earn from these other activities to cover the higher level of risk from cultivation. (p. viii)

Philippines

Government policies are clearly focused on increasing total production of rice, assuming increased production will improve the incomes of small producers. Production has increased, but long term, sustained improvement in farmer income will depend on factors beyond irrigation. Increasing the producer rice price, or reducing input costs, would immediately improve farmer income. For the present, government policy responds to urban consumer demands, not those of rural producers. This situation is not likely to change. Faced with this rigidity, farmers may pursue three basic strategies to improve their position: reduce their dependency on rice and the rice pricing system and invest in more profitable crops, diversify farm activity by developing livestock or other farm-related enterprises, or seek more lucrative off-farm employment. (p. iv)

Bicol

Without adequate incentives as well as the means to raise productivity, the performance of the farmers in the Integrated Development Areas may fall short of expectations. This would mean both that regional and national food benefits would not be achieved and that the systems constructed will be unlikely to survive. Farmers feeling trapped in a cost-price squeeze and bickering over the expense of water and turnover costs could lead to a free-riding problem--as those who felt they couldn't afford to contribute to the system costs still tried to get their share of the water. Recipients of the water must see themselves as beneficiaries if they are also expected to continue as participants in the ownership, operation, and maintenance of the systems. Fiscal health may be as crucial to Integrated Development Area success as physical repair of the canals and ditches. (p. D-7)

Sudan

> With respect to cotton, as a tenant, his performance and outcomes raise some serious issues. In general, yields and thus subsequent income are lower than required to break even. This applies at the household as well as at the Corporation level. (p. 7)

It is clear from the negative cases that it is not only the farmers who lose when the incentive system is to their disadvantage.

Sustainability

In continuing to deal with the food deficit problem, one aspect of project success is whether benefits will be sustained after the donor departs. In several instances (Bicol, Indonesia and Peru), the evaluation teams reported it was too early to adequately judge. On the other hand, the evaluation in Somalia took place 20 years after the project was begun and considerable benefits were apparent. Some deterioration has occurred, however.

Somalia

> At the Arabsiyo site, the bunds are filling slowly with silt and probably will no longer provide increased yields in another 5-10 years.

Somalia

> The early increases in Arabsiyo production have not been maintained because of the deterioration in the bunds.... Only one of the (three) major AID scheme structures at Ceel Bardaale remains intact, although lesser structures appear serviceable and maintenance is evident at the four other schemes that followed the AID one. (p. 3-4, draft)

The Turkey project was evaluated some 15 years later and it was found that project innovations had been sustained.

Turkey

> The project introduced new farming methods, commercial crops, farm machinery, and double cropping into the area around Aydin Province. These innovations proved to be self-sustaining. And, by and large, they augmented rather than replaced the goods and services that were in existence before the project. This additive (rather than replacement) character was rather important: it minimized adverse side-effects. (p. 19)

Although the elapsed time since project implementation was not as long as with the Somalia and Turkey cases, project benefits have been sustained in Korea and are considered likely to continue.

Korea

> The projects are economically replicable and sustainable at the Korean rice price and would be viable if both international input and output prices prevailed in Korea. They are also economically possible because of a variety of sunk costs in previous construction and social infrastructure. (p. i)

Sustainability was questionable in six of the cases evaluated. The Egypt and Helmand Valley projects had long enough histories to clearly show the directions in which these projects were headed.

Helmand Valley

> Even if it were not for the Soviet invasion, the problem of salinity caused by poor drainage makes the sustainability of benefits unlikely.

In Egypt, the EARIS project constructed unrealistic levels of infrastructure with inadequate planning for long-term maintenance and inadequate budgeting for recurrent costs. The very autonomy of the EARIS management left the project vulnerable.

Egypt

> The transition from administration of the project areas by EARIS to the line ministries was marked by an almost precipitous decline in services and maintenance. (p. vi)

Like the Helmand Valley and Egypt projects, the likelihood of sustained benefits in the Philippines is questionable for reasons of economics, ecology, and management.

Philippines

> The project's sustainability in terms of real income benefits for small farmers, however, may be a problem. Increased gross incomes from double cropping and high-yielding varieties of rice have been substantially offset by increasing costs of production, debt burdens from capital investments, and persistent technological and water management problems. Of crucial importance is the performance of pumps. Floods, electricity fluctuations and wear and tear have resulted in high maintenance and repair costs; frequent

brown-outs interrupt critical water supply schedules. [Note: in a follow-on project after the evaluation, pump irrigation was abandoned.] (p. iii)

Sudan

Although the Project has just completed its fourth growing season in the more developed southern sections, there are indications of classic problems which might ultimately threaten its social and economic viability. The production system is based upon a standardized family tenancy which is supervised through a Corporation inspectorate system. The system controls product and input prices, water and machine charges, marketing and most decision-making. During these few years cotton yields have in fact declined, and incomes have been lower than required to break even.... In the face of declining incentives to grow cotton, tenants employ various strategies to obtain additional income from other sources. Almost all tenants and laborers maintain livestock and many continue to work away from the projects as wage laborers on other schemes. The added value of off-farm income has not been calculated, but it is understood to be critical to Project villagers who increasingly find it difficult to benefit from Project-derived income. (p. iii)

Thailand

Inadequate maintenance is reflected in scattered signs of physical deterioration of main canal outlets. (p. viii)

Bicol

Sustainability of the Bicol River Basin Development Program will depend on the success with which farmer participation is further encouraged, on farmers' productivity rising sufficiently to offset their higher costs of production, and on creative new leadership and a fresh mandate for the BRBD Program Office in addressing "second generation" as well as lingering "first generation" problems in the region. (p.vi)

Indonesia

Design and construction problems caused a large number of subprojects to require additional improvement after only a few years. The subsequent shift to a more permanent masonry construction reduced maintenance needs. AID technical assistance also contributed to improving construction quality. Under Sederhana I, technical assistance was insufficient, however, to cover the

> wide range of subprojects undertaken. In order to meet certification requirements, consultants were often unable to devote sufficient time to transferring skills. (p. 12)

In addition to the link between adequate incentives and sustainable projects, the role of management in project sustainability becomes apparent. How much does the irrigated production system force the farmer to rely on outside management for water or other resources? Is that management system well enough integrated to continue supplying the farmers with the resources they rely on?

Management

The text of this report identified three types of management issues: water management and farmer associations, interaction and coordination among bureaucratic levels, and parastatals and other bureaucratic mechanisms.

Water Management and Farmer Associations

Farmer associations are organized to provide coordination in water management and for other resources as well. In a project such as the Bangladesh tubewell project, there was little need for coordination among the farmers because each farmer had his own tubewell and did not have to rely on other farmers for his water or other resources. No associations were planned in Sudan or Turkey either.

Sudan

> For the most part, with particular reference to cotton and groundnuts, the cultivator's sphere of decision-making has been reduced to activities such as minor equipment inputs, whether he will personally work in the fields or act as an agent in hiring labor, and what will be the quality of his work when and if he is involved. In this context, the tenant faces a dual role as a farmer and as an employee with the latter role characterizing his involvement with cotton production. (p. 7)

Turkey

> A modular approach to individual participation is optimal. A bit of participation by a farmer--say, a single field--minimizes his risk in the short run and, if successful, maximizes his follow through in the long run. A farmer, to paraphrase a cliche, should not be expected to put all of his eggs into a new basket. (p. 20)

The impact evaluations indicated that farmer associations were formed in five cases and, in a sense, already existed in Somalia. Of the associations formed, one was not working at all, three were working with varying degrees of effectiveness, but the sixth was working within its clearly defined limits at the time of the evaluations.

The Sederhana project attempted to develop water-user associations but with no success.

Indonesia

> The water user associations that were to be formed as part of the program, however, did not appear to be operating and maintaining the systems as intended. Water management practices varied considerably, depending upon the abundance and reliability of the water supply, farmers' experience with management of irrigation systems, and traditional local leadership. (p. v)

Three other evaluations characterize the water user associations as weak and not functioning particularly well.[193]

Pakistan

> Water User Associations (WUAs) provided for in the project design have not taken root so far, although in many cases the watercourse committees formed in order to make the application for improvement have continued to function informally, achieving a reasonable degree of coordination in activities such as periodic watercourse maintenance. (p. iv)
>
> WUAs, planned as the village structure for continued watercourse maintenance, were found not to have been established as effectively as intended, although farmer awareness of the importance of maintenance seems to have increased informal cooperation significantly at project sites except where local factionalism has inhibited it. Ensuring continued cooperation may hinge on establishing such formal structures or, at a minimum, promoting voluntary cooperation through extension or media outreach efforts. (p. iv)

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[193]However, there may be no practical difference between the success of these and the Indonesia case. The differences may be limited to the perceptions and expectations of the teams.

Thailand

The farmer organization (planned but weakly implemented) has proved less important than the price and purchase support arrangements (not originally anticipated) for inducing production response. (p. ix)

Bicol

The need for better understanding of local conditions is exemplified by an unplanned institutional development discovered by the team, namely, the bypassing, often dismantling, of pre-existing community groups in favor of new and larger ones established from above. (Indeed, several government ministries have mandates to set up their own individual farmer associations, leading to the further problem of imposing undue burdens on farmers' time.) (p. 14)

The weak point in the institutional chain is a critical one: the farmers on whose behalf the whole program is conducted have not participated in anything but a passive sense. Although participation was a widely heralded part of the original plan, it is only recently that experimental efforts have begun to engage them in activities beyond the various meetings to which they were summoned in the past to hear officials talk of project plans and exhort farmers to help. The official explanation of the earlier lack of participation is that the ADTs include the elected mayors who are assumed to represent their constituents. However, in comparing the issues raised in the minutes of ADT meetings with the issues raised by farmers in their conversations with us, we found little correlation. At one level mayors may speak for their farmer constituents, but the connecting points are few (they stay in the towns) and the ADT meetings are too perfunctory. (p. 14)

Although there have been difficulties, the Bicol evaluation was able to reflect some evidence of progress.

Bicol

Only recently, through the hiring of community organizers, has active (as opposed to passive) farmer participation been encouraged in some areas, with a correspondingly greater likelihood that they will effectively utilize, maintain, and fully benefit from the new facilities. (p. v)

In Peru, one site which had long had farmer associations learned the same lesson at Bicol: bypassing existing organizations and practices is not the fastest road to success. In other areas that did not have these practices, the Peru project achieved better results.

Peru

> "Maintenance is carried out using beneficiary labor and does not, at this time, appear to be a problem. Whether this will continue to be true in the future depends to a large extent on the strength and vitality of the Irrigators Committees (Comites de Regantes) which Plan MERIS has helped organize. In only one instance, the Chupaca sub-project, is it apparent that these committees are not functioning--the project manager at the site stated that since the people in the area had been irrigating for some 20 years prior to Plan MERIS' arrival, it was difficult to change old habits and that in fact there was little interest on the part of beneficiaries in participating on the Irrigators Committees." (p. 14, draft)

In the Philippines, an organization was formed which was quite successful within a limited sphere and those limitations were probably the source of its success.

Philippines

> The Irrigators Service Association is valid and effective because it has built on existing local leadership and is focused on a specific and immediate goal that is important to the farmer. It is not perceived by the villagers as having a role beyond improved agricultural production, because other organizations at the village level may be more representative of the village as a whole. (p. 10)

Conversely, the religious community at Ceel Bardaale managed the irrigation system as well as most other activities in the area and was also quite successful.

Somalia

> The example of Ceel Bardaale in the area of water management illustrates the need for institutional strengths to build, operate, and maintain flood irrigation systems. By its hierarchical management structure, the community has the required organization to obtain optimal production benefits from its irrigation scheme. (p. vi, draft)

The evidence clearly indicates that building on existing organizations and practices is beneficial, and attempting to bypass them with new organizations leads to trouble.

Interaction and Coordination Among Bureaucratic Levels

From a bureaucratic point of view, the farmer association becomes one end of a chain which links the farmers with agencies and ministries that have responsibility for irrigated agriculture. Here again the results seem to be mixed.

Bicol

> Efforts at institutional coordination and participation have been successful--except at the critical farmer level. (p. v)

As we have seen, progress has been made even at Bicol.

Peru

> Technical assistance is part of the GOP's [Government of Peru] counterpart for the project, and this component has suffered from the imposition of austerity measures on most, if not all, GOP functions. Plan MERIS agricultural development field personnel reported that their budgetary support began to erode in 1982 and that no operating expenses (except for the pay of salaried employees, which comes from a separate budget line-item) had been received during the first three months of 1983.... This situation is bad for morale, but is worse in its impact on the beneficiaries. (p. 25-26, draft)

Pakistan

> Success in generating governmental awareness of the importance of on-farm water management, and in creating an institutional mechanism for meeting the need, was found to be mixed. Federal and provincial commitment to the OFWM [on-farm water management] concept has grown demonstrably but in many areas this awareness and acceptance were found not to have reached the local (district) level to the same degree. (p. v)

Again the problem seems to have been one of successfully linking one end of the chain to the other. But another example provides more promising results.

Philippines

> Local irrigation associations are functioning with support from the national Farm System Development Corporation, the AID-funded implementing agency. (p. iii)

In the Philippines, the association worked successfully because of its integration into the bureaucratic chain.

Philippines

> The irrigation system leadership works with, and is part of, the established local leadership. Existing authority patterns are reinforced in the short run. The irrigation association seems little used for overt partisan political purposes, and its effectiveness does not extend beyond the irrigation system. (p. iv)

Problems also seem to develop when the various participating agencies' work is not well coordinated. In Indonesia, for example, the Ministry of Agriculture was supposed to help develop water-user associations. The Ministry of Public Works was responsible for the construction of irrigation systems.

Indonesia

> Lack of coordination between the ministries has been a concern throughout the program. (p. iv)

In some instances, this lack of coordination becomes outright competition. When competition replaces coordination, the project may well have difficulty in achieving its purposes.

Pakistan

> The planned agricultural extension element was not adequately implemented, possibly partly as a result of competition with an existing extension service. (p. v)

On the other hand, the Korea irrigation evaluation pointed out that a very well-integrated bureaucratic chain can be too efficient for the good of the farmer.

Korea

> The search for production through administrative conformity has set targets that are often fulfilled with little regard for the environmental or human consequences. Serious industrial pollution of water is evident.... Government quotas force adherence to

> policies as well as contributions of labor and time that may have long-run benefits for the farmer, but may cause hardship in the short term. Villagers' involvement in local government is nonexistent. (p. 14)

Parastatals and Other Bureaucratic Mechanisms

A variety of bureaucratic mechanisms have been developed to attempt to provide the coordination necessary to successfully fulfill the projects' aims. For large, complex irrigation projects, particularly in the instances where irrigation was planned for an entire river basin, the parastatal has become a popular way to go. The Helmand Valley Authority and the Rahad Corporation are the clearest examples.

Sudan--Rahad

> The production system is based upon a standardized family tenancy which is supervised through a Corporation inspectorate system. The system controls product and input prices, water and machine charges, marketing and most decision-making.... The Corporation has had to cope with problems of the management of mechanized operations, apparent labor shortages, and tenant dissatisfaction with the low quality of health, education and other village services. (p. iii)

Afghanistan--Helmand Valley

> In response to the urgings of the Export-Import Bank, the [Afghan] Government established the semi-autonomous Helmand Valley Authority to process settler applications, determine plot sizes and farm and village locations, and help the settlers construct their homes, prepare their land, and follow superior cropping and water use practices. (p. B-4)

Although the areas of the sites were smaller, the EARIS project in Egypt was equally ambitious in its bureaucratic approach but the success and failure of the individual sites were nonetheless dependent on factors beyond the control of the semiautonomous, independently funded organization.

Plan MERIS, although not as ambitious as the full-scale parastatals, created a separate entity for project coordination.

Peru

> Plan MERIS' status as a special project has been both an advantage and a disadvantage. The advantage lies in the fact that, in receiving special attention, Plan MERIS has been able to continue much of its work even during periods of severe belt-tightening by the GOP. This, as discussed before, has been true mostly for the AID-assisted portions of the project, and not for the entire project. The influence of a foreign donor has been, in the aggregate, beneficial on project implementation. At the same time, Plan MERIS' special status has resulted in the development of a structure apart from, and in many instances duplicative of, other similar activities within the GOP. Such duplication, especially in the area of technical assistance, seems endemic in Peru--the evaluation team identified at least four entities, including Plan MERIS, which were undertaking extension activities without necessarily any reference to, or coordination among, each other. Individually, furthermore, none of these services seem to be providing adequate support to their client group. (p. 40-41, draft)

By contrast, the Lam Nam Oon project in Thailand tried an entirely different approach to similar challenges. A coordinating committee of the local representatives from each of the participating ministries provides the planning and decision-making necessary to administer the complex project.

Thailand

> Compared with "full scale" area development projects in other countries administered by powerful semi-autonomous authorities, the LNO inter-ministerial mechanism has only coordinating responsibilities and modest project funds other than regular ministry budgets. Despite this apparent lip service to the concept of integration, the coordinating mechanism has resulted in a significantly greater planning and operational cooperation than is normally the case in the provincial workings of the sharply vertical [Government of Thailand] bureaucracy.
>
> Contrary to the natural tendency to move toward strengthening the authority of rural development administrative mechanisms, the modest but undeniable accomplishments of the LNO arrangements point to the advantages of limiting the introduction of organizational changes in the face of powerful bureaucratic traditions. (p. viii)

Environment

The impact evaluations brought up environmental issues in several areas: changes in the area's ecology, irrigation of an entire river basin, and management of agricultural chemicals.

Changes in the Area's Ecology

Bicol

> People have contributed to the problem by steadily destroying the upland forest cover, causing precious topsoil to be washed into an increasingly silted and overflowing river system. Their government, in the past, did relatively little to ameliorate these conditions. (p. iv)

Even in the reforestation sub-project, the Peru evaluation reported problems with destruction of incipient forest cover.

Peru

> A significant portion of the damage to seedlings and saplings can be ascribed to overpasturing by beneficiary-owned livestock and to vandalism. (p. 12, draft)

Korea

> Thought should be given to more traditional though improved rice strains which are less susceptible to disease. (p. ii)

Somalia

> Soil conservation was not a factor at Ceel Baradaale but was in the case of Arabsiyo where the bunds, during the first ten years after project completion, almost totally arrested the loss of soil by impounding the soil-bearing water which also controlled the water run-off and halted the formation of gullies. (p. ii, draft)

Sudan

> The following environmental issues were identified as of potential concern at the time: (a) creation of vector habitat for water-borne diseases (malaria, schistosomiasis), (b) management of agricultural chemicals (insecticides, herbicides, etc.) for crop protection, (c) health aspects of Aflatoxin fungus-related substance on groundnuts, and (d) disruption of migratory routes of native game to and from the Dinder National Park. (p. 14)

As these examples indicate, the project's interaction with the local ecology must be watched closely. In Indonesia and Pakistan, where the same program was applied to a variety of ecologies, there was not enough attention paid to the inherent importance of the interaction.

Indonesia

> The variability of success represented by the sub-projects visited in the course of this evaluation, however, presents some of the limitations which this national problem confronts in specific local environments. (p. v)

Pakistan

> The project design was found not sufficiently flexible to take into account regional variations in soil conditions and topography and in local land tenure arrangements. (p. v)

River Basin

For planning purposes the whole river basin was included in four cases: Bicol, Helmand Valley, Jordan Valley, and Lower Moulouya.

Bicol

> Experience to date suggests that the river basin is a suitable and appropriate unit for development planning. (p. vi)

Helmand Valley

> The water in the Helmand River was one of the Government's prime targets of opportunity for planned development, and it proceeded to exploit this valuable resource. (p. 2)

On the other hand in Egypt, one of the EARIS sites failed because its very success prompted so much irrigation upstream that they could no longer get enough water at the project site.

Management of Agricultural Chemicals

Two cases mentioned this as a problem.

Korea

Pollution of irrigation water which is used for washing and sometimes drinking may be becoming a problem. (p. ii)

Sudan

The extensive use of agricultural chemicals in the project area presents a special public health problem in terms of direct/indirect exposure of crop protection personnel and agricultural workers. Application of agricultural chemicals in addition presents concerns relating to (a) maintenance of safe potable water supplies, (b) impacts to livestock, and (c) impacts to aquatic ecosystems, especially fish in the canals. Improper storage of chemicals also poses a hazardous situation. (p. 15)

Appropriateness of the Technology

In six of the cases, the means of irrigation were stated to have been appropriate.

Indonesia

Old irrigation structures broke down frequently. Heavy rains, for example, often destroyed weirs, causing flooding in nearby fields and washing away expensive fertilizers. Under the Sederhana program, improved technologies reduced these kinds of losses. (p. 5)

Philippines

Throughout the islands, relatively inexpensive pumping systems, either electric or diesel, are the sole economic means to provide irrigation. They rely on surface water and must be placed close to the source because of their limited capacity to lift water. With the prevalence of flooding and the frequency of typhoons, inundation of pumps is common. This causes breakdowns and raises the costs to ISAs. Electric pumps are subject to frequent brown-outs and are often damaged by fluctuations in current, yet the cost of protective equipment is said to be exorbitant. The problem of an unreliable water supply is compounded by hand-dug, unlined canals which waste the water that is supplied, raising electric costs. (p. 4)

Korea

The irrigation systems are well designed. Korea is a difficult environment in which to manage irrigation. Unpredictable and relatively heavy rainfall causes floods or excessive water on the rice-growing alluvial plains. Drainage problems result. The variety of irrigation systems supported under this project called for sophisticated design and management. This impressive engineering and management commitment was essential to project effectiveness. The Korean government had tried simpler water management systems, such as bench terracing and small, shallow wells. They did not succeed. Currently, from upland watershed to on-farm use, overall water management can be characterized as excellent. (p. 6)

Bangladesh

Bangladesh is particularly suited to the use of these pumps. It has an extremely high water table and its climate supports the potential of a third crop in the late winter months if irrigation can be provided. (p. i)

Turkey

The Project introduced new farming methods, commercial crops, farm machinery and double-cropping into the area around Aydin Province. These innovations proved to be sulf-sustaining. And, by and large, they augmented rather than replaced the goods and services that were in existence before the project. (p. 19)

Somalia

The two projects in Somalia were quite different and yet appropriate attempts were made using simple methods to cope with the problem of increasing and sustaining agricultural production in a semi-arid environment. In the Arabsiyo project, earthen bunds (dikes) were placed on hillsides to gather the rainwater run-off and impound it for grain crop use, as well as prevent and retard soil loss and the formation of gullies. At Ceel Bardaale, cement structures and a network of canals constituting a diversion irrigation scheme were used to manage the sudden flows of water in normally dry togs (river beds) and exploit their use of 15 additional hectares of horticultural crops.

In several cases, the concern was expressed that the fit between the technology and the circumstance needed more consideration.

Egypt

Appropriate technologies for water use might alleviate some of the scarcity of water. In desert sites, water conserving irrigation technologies must be given serious consideration. (p. vii)

Thailand

Equitable and efficient water distribution in part of the project area will depend on which of the technical options being tested at LNO is ultimately applied. (p. viii)

Farm Machinery

The Turkey case, where machinery was a key element in the project design and therefore in project success, has already been mentioned as an example of the means of irrigation being appropriate. Provision of machines was also a key element in the Rahad project's design. In Sudan, the evidence seems mixed.

Sudan

Through the Commodity Import Program, AID has supplied mechanical cotton pickers and vehicles to facilitate the mechanization of field operations. The AID project can be judged successful in meeting an equipment need at a critical time in the implementation of the Project. Effective utilization and maintenance coupled with timely delivery of inputs contributed to substantial progress in the development of Project infrastructure. (p. iii)

The mechanization of field operations also results in less project-derived income for both laborers and for merchants who normally benefit from a cash flow. The project mechanization policy is based upon perceived labor deficits and the desire for higher yields through integrated mechanized operations. It is unclear as to the extent of a real labor deficit in Sudan or whether scarcity is regionally created by less attractive project wages. Mechanization will, however, displace labor and might further weaken tenant ties to farm management decision-making. (p. iii)

Results seem equally mixed in Somalia.

Somalia

Through its use of bulldozer to construct the bunds, the AID project influenced what became a general shift from animal draft power to tractors for cultivation, even though the tractors and the POL products and spare parts needed to keep them operating are affordable by only a few relatively well off farmers. (p. iv, draft)

Equity

Distributing the benefits of development equally is impossible; distributing them equitably seems nearly so. In only one case did distribution appear to be even.

Somalia

There is no evidence that the continuing benefits from the project have been captured differentially by any one group. (p. iv, draft)

Several cases showed mixed results.

Bicol

Thus, the immediate impact of increased irrigated rice production upon household welfare is likely to be an enhancement of benefits for those who are already relatively resource-rich, particularly in rice land, moderated by the probability that a healthy dose of redistributed income will go to their resource-poor neighbors. (p. D-12)

Indonesia

In most subprojects, increased production provided landowning families with an increased food supply to consume at home or to barter for other foods. Occasionally surplus production was sold for cash income. Most tenants with stable tenancy arrangements also realized a net gain from increased production, but sharecroppers and landless laborers were sometimes affected adversely. As farm work became more profitable, underemployed members of landowning families assumed many of the new requirements for labor in the improved Sederhana systems. (p. v)

In six of the cases, equity was more clearly a problem.

Turkey

TOPRAKSU's work is known to poor farmers, but in interviews, their phrasing was less "when it happens" and more "if it happens." (p. 19, draft)

Philippines

Although progress has been made in land reform, most farmers remain either leaseholders or share tenants without security. These farmers must still pay for and maintain the new irrigation systems. The landlord reaps the benefits from this share in increased production, without sharing in the costs. The share tenant, the most underprivileged, makes the greatest relative investment of capital and labor. (p. iv)

Pakistan

Because land ownership patterns determine who benefits from watercourse improvements and land levelling, more attention needs to be paid to ways of assuring benefits to small farmers, especially tenants. (p. v)

Peru

The major weakness in project implementation, however, has been in the agricultural technical assistance component, due to a scarcity of GOP resources and personnel. As a result, technical assistance is not reaching the marginal small farmers; instead, as with the credit component, technical assistance is being provided primarily to larger landowners.

Two of these cases indicate that considerable attempts were made but failed. In Bangladesh, an attempt was made to ensure that the poorest farmers also got pumps, but it was not successful.

Korea

Farmers' income did rise by the specified amount on most farms, given the rice support price, but income levels in rural Korea are directly correlated with farm size; thus the project has affected beneficiaries unevenly in spite of an effective land reform. (p. i)

Women have shared in greater household income, but now have a greater agricultural workload due to new cultivation methods. (p. ii)

Private Enterprise

Current policy indicates that private enterprise is not a sector but a way of thinking. Therefore, the evidence presented is diverse and was only available when the team found

private enterprise used in a project to facilitate implementation or private enterprise spin-offs.

Sudan

> ...within the production system, tenants are orienting groundnut production toward private markets. Groundnut marketers have been able to offer an attractive market alternative to the Corporation. Corporation advances, however, are not being repaid due to the Corporation's inability to control groundnut sales. A modified policy of cost recovery for groundnuts, e.g., enforcement of sanctions for nonpayment of advances, coupled with an encouragement for private marketing, could also serve to increase the incentive system of tenants. (p. 16)

Bangladesh

> BADC established a network of zonal and subzonal stores which sell HTW to dealers who in turn sell them to farmers.... Distribution problems have been worked out pretty satisfactorily.... (p. i)

In Turkey where the project had such successful private sector spin-offs, the team came to these conclusions:

Turkey

> The host government should ensure its citizens against the downside risks of project participation, wipe-out possibilities, by contract guarantees, subsidy floors, easy credit, or other means. Such de facto insurance should not be confused with "footing the bill." (p. 20)

In one instance, the team concluded that there was little private sector spin-off (Bicol) but in most of the cases, it was not even mentioned.

Bicol

> Notwithstanding some expansion and growth in the numbers of rice mills, rural banks, and sari-sari stores, efforts to promote private investment in the program area have been limited and unsuccessful. (p. v)

APPENDIX III

PROJECT IMPACT EVALUATION SUMMARIES

A. Philippine Small-Scale Irrigation

In 1976, AID began support of a Philippine Government program to expand village irrigation systems. Since then, over 1,000 systems have been built or rehabilitated. Irrigation provided the opportunity to grow two crops each year, increasing rice production and gross farm income. On-farm employment has grown with the demands of double cropping. Local irrigation associations are functioning with support from the national Farm System Development Corporation, the AID-funded implementing agency. Thus, many of the project's immediate objectives have been met.

The project's sustainability in terms of real income benefits for small farmers, however, may be a problem. Increased gross incomes from double cropping and high-yielding varieties of rice have been substantially offset by increasing costs of production, debt burdens from capital investments, and persistent technological and water management problems. Of crucial importance is the performance of pumps. Floods, electricity fluctuations, and wear and tear have resulted in high maintenance and repair costs; frequent brown-outs interrupt critical water supply schedules.

With more intensive agricultural practices, more family labor is required to produce crops, reducing the opportunities for off-farm employment. Unless the farm is exceptionally profitable, net family income may be lower, as off-farm employment is discontinued. Thus, an anomalous situation results: farm income rises, but family income drops.

National policies are equally important for those moving from subsistence to commercial agriculture. Recognizing that many features of national policy positively affect small farmers, several aspects of Philippine agricultural policy make it difficult for the small farmer to compete. National procurement and price policies are export-oriented, demanding quality standards for rice that most small producers cannot meet. If they do not meet these standards, they do not receive the favorable subsidized price and must depend on lower private prices. Since most cost-benefit project assumptions were based on the government-subsidized rice price, farmer income projections have not been met. Small producers remain in a precarious economic condition. To receive the higher price, farmers would have to make additional investments in post-harvest machinery, while energy and other input costs rise. They often cannot afford it. The national credit system has also

constrained farmer income, not providing adequate and timely credit. Farmers must often rely on usurious private lenders.

Although progress has been made in land reform, most farmers remain either leaseholders or share tenants without security. These farmers must still pay for and maintain the new irrigation systems. The landlord reaps the benefit from his share in increased production, without sharing in the costs. The share tenant, the most underprivileged, makes the greatest relative investment of capital and labor.

Government policies are clearly focused on increasing total production of rice, assuming increased production will improve the incomes of small producers. Production has increased, but long-term, sustained improvement in farmer income will depend on factors beyond irrigation. Increasing the producer rice price or reducing input costs would immediately improve farmer income. For the present, government policy responds to urban consumer demands, not those of rural producers. This situation is not likely to change. Faced with this rigidity, farmers may pursue three basic strategies to improve their position: reduce their dependency on rice and the rice pricing system and invest in more profitable crops, diversify farm activity by developing livestock or other farm-related enterprises, or seek more lucrative off-farm employment.

The irrigation system leadership works with, and is part of, the established local leadership. Existing authority patterns are reinforced in the short run. The irrigation association seems little used for overt partisan political purposes, and its effectiveness does not extend beyond the irrigation system.

Improved farmer income does not necessarily translate into improved family nutrition. Rather, the farmer's priority is to pay for school fees. Social mobility is seen to be a product of education. Women of farm families have neither benefited from nor been harmed by the project. The Philippine Government has, however, been innovative in using energetic female extension workers. Over half of the Institutional Officers are women and their involvement seems to reflect regional patterns of female participation, which vary considerably throughout the islands. Their role could be emulated in other projects and, perhaps, other countries.

AID developed this project as a commodity loan, focusing on engineering components and geographic expansion of irrigation, not on maximum gain to the individual farmer. Although gross farmer income has been improved, net income has not, and the system cannot be sustained in its present form. It is recommended that any future support to the competent Farm Systems

Development Corporation should concentrate on technical assistance to improve and develop the productive capacity of farms in existing irrigation systems, rather than continuing geographic expansion of what is a fragile undertaking.

B. Korean Irrigation

The Korean Irrigation project, to which AID contributed $25.7 million beginning in September 1974, had as its goal assisting Korea to become self-sufficient in rice and barley and raising farm household income in project areas by $412 annually. These targets were to be achieved through the construction of "up to 66" irrigation works of various types. The project was part of a major continuing program by the Korean Government to expand irrigation of paddy and improve the gross discrepancies between urban and rural income, the latter having lagged as planning was concentrated on industrial and export-oriented development. Korea today has virtually 100 percent irrigation to some degree on paddy land. This and other factors have made the Korean farmer the most productive rice farmer per hectare in the world.

Fifty-five projects were completed with AID funds. Rice self-sufficiency was achieved by 1975, soon after the project agreement was signed. Thus, the project made only a marginal contribution to that end, but it will positively contribute to sustaining self-sufficiency. The project did not help achieve improved barley production, which has been declining steadily due to the very high government rice support price and the growing demand for wheat in urban areas. Farmers' incomes did rise by the specified amount on most farms, given the rice support price, but income levels in rural Korea are directly correlated with farm size; thus the project has affected beneficiaries unevenly in spite of effective land reform. Average rice yields in project sites increased 2.0 metric tons per hectare, or 1 metric ton on the average farm of one-half hectare.

Overall, the project was successful in improving yields of rice. The project was a single-focused effort on irrigation alone and did not require any technical assistance. Its success was dependent upon a complex of other factors that were in place, including a high degree of engineering and administrative competence, delivery of extension services, agricultural inputs, and a high rice procurement price (more than double world prices). The projects are economically replicable and sustainable at the Korean rice price and would be viable if both international input and output prices prevailed in Korea. They are also economically possible because of a variety of sunk costs in previous construction and social infrastructures.

Farmers have shown an acute awareness of market forces and are tied into the urban economy because of improved transportation, education, and information. This is evidenced by the production of winter vegetables, which has become a major rural industry.

The success of the project was achieved with little decision-making participation by the rural population, which is mobilized into a variety of organizations each of which demands time, money, and labor without commensurate meaningful involvement in planning. Farm Land Improvement Associations are not cooperatives, but bureaucratic means by which to deliver water and collect fees. They are very efficient.

Women were not mentioned in the project design and have experienced both gains and losses. They have shared in greater household income, but now have a greater agricultural workload due to new cultivation methods while continuing very labor-intensive housework. More children are going to school, and their labor participation has declined.

Irrigation recipients view their lives as having improved with irrigation, although that alone was not the single causative factor. With increased income, additional education becomes the first priority of the families, with the purchase of household amenities second. Improved nutrition is not regarded as important. Education is viewed as an average of social and physical mobility, enabling the recipient to leave the farm for urban employment. Farmers do not want their children to follow in that occupation.

This results in an overall aging of the farm population, and has important implications for the future of the rural sector. A prolonged industrial recession, which Korea may already have entered, could bring numbers of migrating youth back to the villages as urban jobs are reduced; these are likely to be the least educated and the least entrepreneurial. This recession could mean that the Korean Government will likely be under pressure to lower the support price of rice. The Korean farmer is dependent on "high technology" farm practices, including powered equipment and heavy use of purchased inputs. Since the average farm size is very small, and consequently total production per farm is low, it is doubtful that the government's policy of using urban-to-rural transfer payments to equalize rural and urban incomes for small farmers will continue to be successful if urban incomes continue to grow.

Lessons Learned

Korean rural development, which includes irrigation but also encompasses reforestation, cooperatives, and the Sae-maul (New Village) Movement, as well as high price supports, has been successful in the Korean context. Korea may, however, be sui generis. Its reliance on the availability of other inputs, the sunk costs in infrastructure, the authoritarian nature of decision-making and lack of participation, and the unequal benefits to women preclude it as a model for AID programming without substantial modification.

Good water control and successful irrigation provide a means to increase and stabilize the levels of farm production. Irrigation can be cost effective under certain conditions, but such conditions in general are scarce and becoming scarcer.

Pollution of irrigation water, which is used for washing and sometimes for drinking, may become an issue needing study. Emphasis on the newest high-yielding variety rice strains has been overstressed. Thought should be given to use of some of the more traditional, though improved, rice strains that are less susceptible to disease.

As the "North" countries have been exhorted to provide greater support to the "South" nations for mutual benefits, so within a country the urban sector may have to support the rural population for increased food production and national policy reasons in cases where irrigation may not be economic in the short term.

C. Sederhana: Indonesia Small-Scale Irrigation

As part of an AID effort to assess the impact of its assistance in the irrigation sector, an interdisciplinary team conducted an evaluation of small-scale irrigation in Sederhana in May-June 1980. The following is an abstract of the completed report which has been published in the AID Project Impact Evaluation Series.

When the Sederhana Irrigation and Reclamation Program was initiated by the Government of Indonesia (GOI) in 1974, it signaled a new focus to long-standing efforts to increase rice production. Sederhana was designed to rehabilitate or construct small, technically simple irrigation systems, each serving fewer than 2,000 hectares. The program was to be rapidly implemented throughout the vast Indonesian archipelago with a minimum of detailed planning. With improved systems to increase the supply, reliability, and coverage of irrigation water, it was intended that farmers would increase their rice production and their incomes, and the country would benefit from a corresponding decline in rice imports.

Participation by AID in the Sederhana program began in June 1975 with the authorization of a $20 million loan that was increased to $23.7 million in 1976 (Sederhana I). AID support of the Sederhana program was consistent with its mandate for rural development and assistance to the rural poor. Areas totaling 550,000 hectares were targeted for development, and AID assumed 40 percent of the total projected project cost. The primary purpose of AID support was to improve the institutional capacities of Indonesian agencies responsible for implementing the program. The Ministry of Public Works (MPW), specifically the Directorate General of Water Resources Development, was responsible for the construction of the irrigation systems. The Ministry of Agriculture (MOA) was to help develop farmer water-use associations, supervise farmers in the construction of tertiary canals and farm ditches, and provide extension services. Lack of coordination between the Ministries has been a concern throughout the program. The agricultural or farm-level aspects of Sederhana--development of water-user associations, water management and system maintenance as well as extension services for inputs and advice on cropping patterns--have constantly been playing catch-up with construction, the more visible aspect of the program and the one which commands the lion's share of the funds. In 1978, additional funds totaling $29.5 million were committed to continue and extend the activities of the Sederhana program (Sederhana II). AID approved Sederhana II before any funds from the original project had been spent to reimburse actual construction of irrigation systems.

The project proved difficult to administer. Although about 600 subprojects were completed or underway by June 1980, only 52 had been certified for reimbursement by AID under Sederhana I. The slow rate of reimbursement was due to startup problems, to design and construction faults that required work to be redone, and to the fixed amount reimbursement (FAR) method used by AID to fund the program. Under the FAR method, a pre-agreed payment for each subproject took place only after construction was completed and certified by technical consultants to be satisfactory. It was argued that this method would eliminate the problems of cost overruns, support the entire program rather than individual subprojects, and allow AID disbursements to continue at the pace of project implementation until the funds were exhausted. Since the Sederhana program had hundreds of subprograms scattered throughout Indonesia, certification became a time-consuming and cumbersome activity. While it did appear to assure certain construction standards, it probably did not meet the need for more substantive technical assistance in the design and construction of so many small systems in diverse physical and social environments. The few technical assistance consultants were left with little time to concentrate on transferring skills and knowledge to their Indonesian counterparts.

Most of the irrigation systems that had been reimbursed under Sederhana I were well constructed. The water-user associations that were to be formed as part of the program, however, did not appear to be operating and maintaining the systems as intended. Water management practices varied considerably, depending upon the abundance and reliability of the water supply, farmers' experience with management of irrigation systems, and traditional local leadership.

In most of the 29 subprojects visited on Java, Sulawesi, and Sumatra, Sederhana's impact on local rice production was substantial despite the difficulties of implementation. On Java, where there is a long tradition of rice farming, production increased substantially at most of the sites visited. On Sulawesi, rehabilitated irrigation systems frequently permitted an additional rice crop each year. Yields increased by as much as 2 tons per hectare. The production of dry land crops also improved. On Sumatra, however, the production impact was not encouraging. At many sites, environmental conditions such as soil and climate did not appear favorable for growing high-yielding varieties of rice. The program's emphasis on rice production appeared to be meeting with resistance both from farmers who could not or did not want to grow high-yielding varieties and those who did not want to switch from a profitable cash crop such as coffee to a rice crop which requires a great deal of labor (in short supply on Sumatra) and which they were not accustomed to growing as a principal crop. Local production impact has confirmed an assumption in the Sederhana concept that farmers could make immediate use of additional water. The variability of success represented by the subprojects visited in the course of this evaluation, however, presents some of the limitations which this national program confronts in specific local environments.

In most subprojects, increased population provided landowning families with an increased food supply to consume at home or to barter for other foods. Occasionally surplus production was sold for cash income. Most tenants with stable tenancy arrangements also realized a net gain from increased production, but sharecroppers and landless laborers were sometimes affected adversely. As farm work became more profitable, underemployed members of landowning families assumed many of the new requirements for labor in the improved Sederhana systems.

Overall, although rice production has increased, so too have per capita consumption and population. Indonesia continues to import more rice than ever before. If this production is to keep pace with population, the Sederhana program must continue to improve its effectiveness. From the Sederhana experience between 1975 and 1980 the team drew the following lessons which may contribute to future development efforts:

-- Programs with many subprojects designed for rapid implementation inevitably confront trade-offs between quantity and quality. A centralized design and approval process permits rapid and high-volume design work, but depends upon accurate site survey information to ensure appropriate results. Increasing local participation is beneficial if it can improve site survey information and encourage farmers to become involved in making the project successful. Decentralizing the design process and working to increase local participation can improve the effectiveness of implementation, but reduces the number of subprojects that can be undertaken.

-- Coordination of the construction and production aspects of a project is difficult but essential to success. Where coordination is necessary to achieve project results, AID should not assume it will occur automatically, but should realistically assess the incentives for various institutions to perform as expected.

-- The balance of technical and capital assistance needed depends on the maturity of the project and the various technical difficulties that it presents. Technical assistance is more important in the early stages of a project to prevent costly errors and to help establish a cadre of skilled and experienced personnel within the government ministries. It is also essential in remote areas where isolation exacerbates administrative and technical coordination.

-- Farmer participation is essential to sustained progress in agricultural development, particularly in diverse and scattered project environments. Experience indicates that including farmers in the planning and implementation of subprojects can improve the selection of sites, alleviate right-of-way problems, and foster more active water-user associations for effective operations and maintenance. Farmer participation is the most effective means to ensure that farmers invest in a system that requires their care and skill to sustain.

-- Farmers indicate that the greatest value of the irrigation system is reliability of water supply. While production increases are also valued highly, farmers prefer stable yields to yields that vary from a bumper crop one year to a bad crop the next. The greatest benefits of a small-scale irrigation system, then, are those that first ensure water security and then build water management activities and other production increases on that solid base.

-- Without baseline data or a well-conceived evaluation system, assessing the progress of a project is difficult. The nature of benefits expected from a project and their value of the beneficiaries should be clearly stated at the outset and some indicators should be chosen to measure those benefits as the project matures.

-- Programs such as Sederhana can provide substantial benefits for the rural poor, but cannot achieve redistribution of the wealth. Other national development efforts such as land reform can complement agricultural development and permit broader distribution of its benefits.

D. Philippines: Bicol Integrated Area Development

As part of an AID effort to assess the impact of its assistance in the area development sector, an interdisciplinary team conducted an evaluation of area development in the Philippines in July 1981. The following is an abstract of that completed report which has been published in the AID Project Impact Evaluation Series.

The Bicol River Basin is both endowed and punished by Nature. The same can be said of its treatment at the hands of Man. Nature has provided a verdant rice bowl and ample exploitable water, but it also lashes the region with fearsome typhoons which cause flooding and destruction to people and crops alike. People have contributed to the problem by steadily destroying the upland forest cover, causing precious topsoil to be washed into an increasingly silted and overflowing river system. Their government, in the past, did relatively little to ameliorate these conditions, to tame the waters for human benefit, or to overcome the region's poverty. Yet people, through government, have recently initiated efforts to control and exploit the waters, to provide road access to hitherto isolated areas, and generally, through the Bicol River Basin Development Program, to promote and invest in development.

The goal of the Bicol River Basin Development Program is to raise the socioeconomic level of the region's people to the national average by 1990 and to sustain it at that level thereafter. To this end, AID has made two grants and five loans--for a total of $30.4 million--to the Government of the Philippines, which has itself invested approximately $75 million. Collectively, the program's major objectives are to:

-- Introduce double rice cropping and increase per hectare yields through improved irrigation, drainage,

water management, general farm practices, and marketing;

-- Construct and maintain new road systems;

-- Increase not only donor and Philippine government investments but also private sector agribusiness and rural manufacturing investments;

-- Improve land tenure arrangements;

-- Enable upland farmers to utilize more productive and environmentally sound land use practices, and improve public forest land management; and,

-- Improve sanitary environment and household water supplies and increase local government financial support of health, nutrition, and population programs.

To this ambitious agenda was added a set of institutional innovations calling for decentralized decision-making, local people's participation, and a multisectoral and integrated area approach. Area planning and project design are done by the Bicol River Basin Development Program Office, with project implementation handled by government line ministries, monitored and coordinated by the Program Office. An elaborate system of committees has been established to ensure cooperation and coordination at various bureaucratic levels. The effort has been widely publicized.

The impact of the Bicol Program to date is limited, though not unpromising. Although it has been in existence for eight years (since 1973), most of that time has been spent in laying the groundwork, designing projects, raising resources, and initiating project implementation. A large staff and institutional infrastructure have been put into place and numerous plans and studies have been produced. The major action has now passed from planning to implementation. Among the projects, most of the secondary and feeder roads are built and passable, if not yet fully surfaced. Approximately one-third of the AID-supported irrigation and drainage facilities have been completed. An agro-forestry pilot project has been initiated in the ecologically critical upland areas. Ninety-four out of 400 village health aides have been trained and fielded. The people of the area generally anticipate better lives once the projects are completed, though considerable grumbling can be heard in some areas where project setbacks or delays have occurred and where proposed irrigation system changes and management arrangements are proving contentious. (The delays have generally been due to rapid inflation requiring rebidding on physical infrastructure contracts, exacerbated by the time-consuming requirement that most contracts be approved in Manila.)

The early impact of the roads project appears to be positive. Access has increased substantially, traffic growth on many roads is considerable (if not always enough to justify their high quality surfacing), market days are more frequent, more buyers are coming directly to the farmgate, marketing margins are improving, and access to education and health facilities has also improved.

One may also anticipate favorable impacts from the new irrigation system, which will permit improved yields and additional areas under double cropping. However, profitability to individual farm families and to landless laborers in their employ will depend on water use fees, input costs, and farmgate paddy prices. If the returns to farmers fail to exceed their costs by a sufficient margin, the potential of the new system will clearly not be realized.

When the irrigation and access road costs are measured against the value in current prices of the additional rice to be produced, or compared to current irrigated rice land prices, the Bicol program's cost-effectiveness appears low. In the future, however, with growing population pressure on land resources, the investment is likely to appear more cost-effective.

Notwithstanding some expansion and growth in the number of rice mills, rural banks, and sari-sari stores, efforts to promote private investment in the program area have been limited and unsuccessful.

Efforts at institutional coordination and participation have been successful--except at the critical farmer level. Only recently, through the hiring of community organizers, has active (as opposed to passive) farmer participation been encouraged in some areas, with a corresponding greater likelihood that they will effectively utilize, maintain, and fully benefit from the new facilities.

The importance of the Bicol River Basin Development Program (BRBDP) lies in its ambitious melding of three major themes in current development thinking: (a) a concerted focus on a geographically discrete area; (b) a systematic integration of various sectoral services consistent with the reality of integration at the farm level; and (c) a redistribution with growth, out of concern over the gap between rich and poor. As such, the BRBDP represents an impressive effort. Experience to date suggests that the river basin is a suitable and appropriate unit for development planning. It also suggests that integration is most useful as a planning device, if not necessarily as an implementing procedure. While economic growth seems assured, the returns with respect to redistribution are not yet in.

Sustainability of the Bicol River Basin Development Program will depend on the success with which farmer participation is further encouraged, on farmers' productivity rising sufficiently to offset their higher costs of production, and on creative new leadership and a fresh mandate for the BRBDP Program Office in addressing "second generation" as well as lingering "first generation" problems in the region.

The lessons of the BRBDP are as follows:

-- Integrated area development can be planned and its implementation coordinated through the BRBDP model; however, if the initial impetus is not to wither, continuing and consistent national-level support is needed for sustaining program priority, decentralized authority, and high quality program leadership.

-- Although hyperbole in selling an integrated area development program may be considered necessary to elicit initial domestic political support and donor funding, it will cause increasing problems for the program over time. Because implementation inevitably takes longer than expected and produces unexpected negative as well as positive byproducts, hopes raised excessively may easily turn to disappointment and lead to erosion of future support.

-- Early and active beneficiary participation is both possible and crucial to success. Rather than automatically imposing new organizations, recognizing and strengthening existing ones, formal and nonformal, may enhance and speed participatory efforts.

Perhaps the most important lesson of the BRBDP is that cited by the program's first director: "We must look beyond mere physical construction; that can always crumble. What we must really do is work for changes in attitudes of the people, to help them believe in their potential to achieve a better tomorrow. That will be the ultimate mark of success."

E. Sudan: The Rahad Irrigation Project

As part of an AID effort to assess the impact of its assistance in the irrigation sector, an interdisciplinary team conducted an evaluation of irrigation in Sudan in February 1981. The following is an abstract of the completed report which has been published in the AID Project Impact Evaluation Series.

A major part of the Sudan's program of economic reform is the continued development of underutilized water resources and

arable land. The Rahad Irrigation Project is a key element in expanding the production of export crops through fully mechanized irrigated agriculture. Nearly complete in terms of irrigation works and land preparation, this $400 million investment has as its objectives (a) intensive utilization of government investments in Nile water management; (b) production of medium staple cotton and groundnuts; and (c) improved welfare of up to 100,000 herders and subsistence agriculturalists through increases in incomes, employment, and social services. The Rahad Project is intended as an eventual model of full mechanization and 100 percent intensive rotation of cash and subsistence crops guided by government management.

The AID contribution to the overall Rahad Project began in February 1973 with an $11.0 million loan. This loan supplied heavy equipment and spare parts for construction of the irrigation works and for land preparation. It also provided technical services for the procurement and management of equipment. Recently, through the Commodity Import Program, AID has supplied mechanical cotton pickers and vehicles to facilitate the mechanization of the field operations. The AID project can be judged successful in meeting an equipment need at a critical time in the implementation of the Project. Effective utilization and maintenance coupled with timely delivery of inputs contributed to substantial progress in the development of project infrastructure.

Although the Project has just completed its fourth growing season in the more developed southern sections, there are indications of classic problems which might ultimately threaten its social and economic viability. The production system is based upon a standardized family tenancy which is supervised through a Corporation inspectorate system. The system controls product and input prices, water and machine charges, marketing and most decision-making. During these few years cotton yields have in fact declined and incomes have been lower than required to break even. The Corporation has had to cope with problems of management of the mechanized operations, apparent labor shortages, and tenant dissatisfaction with the low quality of health, education, and other village services.

In the face of declining incentives to grow cotton, tenants employ various strategies to obtain additional income from other sources. Almost all tenants and laborers maintain livestock and many continue to work away from the Project as wage laborers on other schemes. The added value of off-farm income has not been calculated, but is understood to be critical to Project villagers who increasingly find it difficult to benefit from Project-derived income. The mechanization of field operations also results in less Project-derived income for both laborers and for merchants who normally benefit from a cash flow. The Project mechanization policy is based upon

perceived labor deficits and the desire for higher yields through integrated mechanized operations. It is unclear whether a real labor deficit exists in Sudan or whether scarcity is regionally created by less attractive Project wages. Mechanization will, however, displace labor and might further weaken tenant ties to farm management decision-making.

Tenants have indicated the need for several changes. First, a greater degree of tenant decision-making is desired. This is reflected in the tenants' interest in growing groundnuts--where there is freedom to market outside Corporation auspices--and in producing sorghum. Restriction on growing sorghum, the village's basic staple crop, has created a dependence on an inflated private market. The integration of sorghum, vegetables, and livestock into tenancies of more manageable size would meet a number of tenant demands.

The Rahad Project was conceived as a community providing a full range of services to its inhabitants. Severe limitations on available local currency have meant that schools, health facilities, and social services have either not been provided on an equitable basis to all eligible communities or, due to inadequate budgets, have not performed at a satisfactory level. The Rahad Corporation is taking measures to accelerate coverage by increasing its social development budget. Tenant dissatisfaction is compounded by what is viewed as a sluggishness in meeting recruitment promises for a better way of life.

A diversified economy including adequate off-farm economic opportunities, a mix of occupations and skills, and a rich religious, political and educational life will all be needed to retain the semblance of community. Sustainability of the Project will require a permanent population, adequately motivated, with a level of initiative to improve community welfare through community-based participation in conjunction with Corporation guidance.

F. The On-Farm Water Management Project in Pakistan

The On-Farm Water Management (OFWM) project was evaluated during October 1981 by a team of AID staff and American and Pakistani contract staff, assisted by USAID staff and short-term contract help. During three weeks of field work, the team visited project sites and met with federal, provincial, and local officials in three of Pakistan's four provinces; the fourth province, Baluchistan, was excluded because of conditions related to an influx of refugees from the conflict in neighboring Afghanistan.

The OFWM project was designed as a five-year pilot project to demonstrate the feasibility of increasing food production

and rural incomes by reducing irrigation water losses in village watercourses, improving the use of water through the precision leveling of fields, and training farmers, through agricultural extension, in improved farming practices. The project was initiated in FY 1976 with a $7.5 million loan to the Government of Pakistan. A second tranche of $15 million, planned for FY 1978, did not occur due to the temporary cessation of the entire U.S. assistance program to Pakistan following Congressional passage of the Symington Amendment.

As a result of the two-thirds cutback in the U.S. contribution, implementation of the OFWM project did not reach its planned level. However, Pakistani participation in the watercourse improvement component exceeded expectations with the result that 1,300 of a planned 1,500 watercourses had been improved as of June 1981. Conversely, only 14 percent of a planned 425,000 acres of farmland were precision leveled and the extension element was not implemented to any appreciable degree. About two-thirds of the project implementation occurred in the Punjab and most of the rest in Sind; there was some limited implementation in the Northwest Frontier Province and in Baluchistan.

Findings and Lessons Learned

As a result of watercourse improvements, water losses were reduced and more water was made available to farmers on a reliable basis. The result was significant agroeconomic benefits including expanded crop area, increased cropping intensity, greater emphasis on cash crops, increased use of fertilizer, and rising crop yields per acre with resultant increases in net farm incomes. As a result, popular demand for assistance with watercourse improvement has increased markedly since the inception of the project and remained high at the time of the evaluation.

Most improved watercourses visited showed greater than expected evidence of maintenance and farmer interest therein, although it is unclear whether this will be continued over time. Maintenance is critical to sustaining benefits from watercourse improvement but is dependent on community cooperation. Water-user associations, planned as the village structure for continued watercourse maintenance, were found not to have been established as effectively as intended, although farmer awareness of the importance of maintenance seems to have increased informal cooperation significantly at project sites except where local factionalism inhibited it. Ensuring continued cooperation may hinge on establishing such formal structures or, at a minimum, promoting voluntary cooperation through extension or media outreach efforts.

Success in generating governmental awareness of the importance of on-farm water management and in creating an institutional mechanism for meeting the need was found to be mixed. Federal and provincial commitment to the OFWM concept has grown demonstrably, but in many areas this awareness and acceptance was found not to have reached the local (district) level to the same degree. Neither has the project produced needed changes in the curricula of academic institutions, which must supply the trained personnel for further on-farm water management improvement efforts.

The project design was found not sufficiently flexible to take into account regional variations in soil conditions and topography and traditional local land tenure arrangements. Because land ownership patterns determine who benefits from watercourse improvement and land levelling, more attention needs to be paid to ways of assuring benefits to small farmers, especially tenants.

Inadequate baseline data collection and monitoring during project implementation hampered precise documentation of project benefits. In the case of the OFWM project, the absence of such baseline data appears not to have prevented its replication, owing to clearly perceived benefits by participating farmers and resultant growth in demand for watercourse improvement. However, to the extent that alternate approaches to on-farm water management technology are tested and the most cost-effective modes sought, better data collection will be essential.

Precision land levelling (PLL) was considerably less successful than anticipated, owing in part to small farmers' view that the risk exceeded the likely benefit and their resultant reticence to remove land from production. In addition, PLL was not fully tested due to a Government of Pakistan decision to deemphasize it midway through the project period in favor of watercourse improvement.

The planned agricultural extension element was not adequately implemented, possibly partly as a result of competition with an existing extension service and partly due to AID's choice of the Fixed Amount Reimbursement (FAR) mechanism for project financing. Though effective for public works activities, the FAR appears to be less effective for promoting project activities, such as agricultural extension, which lack fixed unit costs; its use for such project components needs to be reconsidered.

The cost of watercourse improvement exceeded planned levels due to price escalations and failure to take into account provincial government overhead costs. Encouraging financial participation by farmers in watercourse improvement could

reduce project costs or spread benefits further and might increase their commitment to contributing to and maintaining improvements.

The quality of staff in the host country implementing agency is a key to successful project implementation. Recruitment and retention of such staff necessitate appropriate personnel standards, regularized positions, and a strong training program well integrated with project needs. Full achievement of improved on-farm water management requires, in addition to watercourse improvement, farmer training in efficient water usage and better cropping practices through extension which, in turn, requires a cadre of well-trained agricultural extension agents whose skills may be in demand elsewhere. The establishment and maintenance of an effective extension staff thus means attention to adequate pay levels, specialized training, and appropriate coordination or integration with existing agricultural extension services.

G. Egypt Area Development

The Egyptian American Rural Improvement Service (EARIS) project, supported under the Point Four[194] foreign assistance program between 1952 and 1963, launched what remains Egypt's most successful land reclamation project. Altogether, EARIS reclaimed 37,000 acres of lake bottom and desert lands in three sites, built 13 complete villages and 64 satellite villages, and resettled 7,500 landless peasant and laborer families. Each settler received a house, 3-5 acres of reclaimed land, and a gamoosa (water buffalo) on a 40-year repayment schedule. EARIS' major accomplishment as a model for land reclamation was to put the necessary inputs--land, water, and credit--in the hands of the Egyptian farmer. It demonstrated the viability of small-scale agriculture on reclaimed land, the feasibility of bringing both lake bottom and desert land into production, and the adaptability of the Egyptian peasant to new social and economic situations. The model was not extended on a widescale basis as had been anticipated because of political shifts in the 1960s and the move to state farms on large tracts of reclaimed land.

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[194]In his inaugural speech, President Harry S Truman set out four major courses for action in his administration; as the fourth course, he indicated, "We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas" (January 20, 1949). What thus became known as the Point Four program was administered by the Technical Cooperation Administration.

The largest of the three sites, Abis, 12 kilometers from Alexandria, is the most successful. The 30,000 acres reclaimed from Lake Mariut are maintained by an extensive system of drains and round-the-clock pumping. Nine villages were built and settled by 6,000 families beginning in 1955. Today, farm income and wealth have risen dramatically in the project area. Estimates for net agricultural revenues range from £E1,300 to £E2,200 per household, up from £E185 in 1962. Average holdings of large animals have increased from one to nearly four per household. The value of the agricultural land reclaimed has soared to £E4,000 per acre, some £E96,000,000 for the cultivable acreage in Abis. Individual and cooperative investments have permitted farmers to intensify land use, to exercise control over the marketing of farm products through retail outlets in Alexandria, and to perform processing operations, such as cheese-making and milk-cooling, which add value to their agricultural products. Approximately 25 percent of cropland is devoted to high-value vegetable production largely directed to Alexandria's markets. In addition wheat, barley, rice, and berseem are grown at levels of productivity comparable to or higher than levels on the Old Lands.

The physical signs of prosperity can be seen in the villages: roofs stacked high with agricultural produce, streets covered with wheat about to be threshed, television antennas, and additions to houses. In a sample of 50 households in one of the towns in Abis, 49 had added a room to their houses, 45 had painted the houses. Almost all have a radio, more than half a television. Trucks and cars owned by farmers are commonplace. Literacy has also increased significantly. When the first settlers arrived, only 20 percent of the household heads were literate. Today, 53 percent of the younger generation in the sample area can read and write.

The two desert reclamation sites of Qoota and Kom Osheim in the Fayoum, totaling 7,000 acres, have not fared as well. While the land reclaimed is potentially highly productive, severe shortages of irrigation water mean that only a fraction of the land is currently in production. Spontaneous private land reclamation up the feeder canals is withdrawing, legally and illegally, the areas' water allocation. Some of the 1,600 settler families have abandoned their farms. Many of those who remain depend upon the remittances from sons who migrate periodically to Cairo to work as semi-skilled laborers.

The evaluation drew the following lessons from this mixed picture of development:

1. EARIS succeeded as a project because it coincided with Egypt's top political and developmental goals. The full Egyptian participation in planning and implementation that followed from this commitment meant that, despite two

interruptions in American assistance to Egypt (1956-1958 and after 1967), the planned physical infrastructure was fully constructed by the Egyptian Government.

2. EARIS was established as a semi-autonomous, independently funded organization. This autonomy facilitated the implementation of the project. However, the transition from administration of the project areas by EARIS to the line ministries was marked by an almost precipitous decline in services and maintenance.

3. The construction of unrealistic levels of infrastructure, the lack of planning for long-term maintenance, and inadequate budgeting for recurrent costs have meant that virtually all of the infrastructure built by the project--roads, electricity, potable water systems, sanitation systems, health clinics and schools--has deteriorated.

4. Where irrigation water is assured and farmer choice is permitted, small farms on reclaimed land are financially viable and highly productive after an initial "gestation" period.

5. Proximity to an existing population, in the case of the successful Abis site, provided free dairy and poultry markets for high-value vegetable products. And, most important, this proximity fostered economic diversification and offered access to additional employment, education, and services. The development of some infrastructure, such as schools and health facilities, could have been planned much more gradually to capitalize on existing nearby services.

6. Water management has proved to be the single greatest constraint to productivity on these New Lands. In the case of lake bottom lands, drainage problems reduce productivity. On the desert margin, basic supplies are inadequate as upstream farmers use water allocated for downstream sites. The problem appears to be one of water management rather than an overall water shortage. To date, the desert margin communities have sought bureaucratic and legal redress in an unresponsive setting. A responsible local administration, areawide planning, and appropriate technologies for water use are all required. Water management deserves extremely close attention in any New Lands activity. In desert sites, water-conserving irrigation technologies must be given serious consideration.

7. On-site population increase has absorbed many project benefits. Land holdings will, inevitably, be fragmented. The second generation is seeking opportunities off the land. More attention should have been paid to a diversified economic base which might have helped to provide for future generations. On the national scale, land reclamation and resettlement cannot be considered a response to the land pressure caused by a growing

population. To absorb Egypt's current population growth on New Lands, the team estimated that a project of similar scope would have to be constructed every 22 days.

8. American assistance did make a difference. American funding served as a catalyst to support and focus Egyptian interest and technical skills in land reclamation. American equipment led to the mechanization of Egyptian reclamation techniques. American approaches to training--hands-on and practical--influenced a generation of Egyptian techniques who still refer to the "EARIS school."

H. Bangladesh Small-Scale Irrigation

This project is an example of appropriate technology constrained by institutional weaknesses. In 1976, AID entered into an agreement with the Bangladesh Government to provide hand tubewells (HTW) to farmers throughout Bangladesh with small landholdings. The Bangladesh Krishi Bank (BKB) and the Government's Integrated Rural Development Program were to handle distribution through credit and cash sales. A joint Bangladesh-AID Implementation Committee was to provide overall project direction.

The project attempted to take advantage of a technology already widely accepted in Bangladesh and adapted to its particular climatic and geologic conditions. The HTW is simple to install and maintain, and makes use of the cheap labor available in the countryside. Most important, the HTW is inexpensive and, with credit available, would be affordable by the target population--farmers who own less than three acres.

Institutional weaknesses plagued the project from the beginning. The initial project design did not adequately address some very important problems. These included the importation of iron for manufacturing the pump in Bangladesh, the exact design of the pump, the production of the pump by local foundries, and the distribution system--particularly the credit system which was to ensure distribution to the poorer farmers. As will be seen, most of these problems have been worked out, but only after significant project delays.

HTWs in use appear to more than pay for themselves in a very short time. They permit the farmer to irrigate a third, dry-season crop that would not have been planted but for the availability of the water that these pumps supply. Bangladesh is particularly suited to the use of these pumps. It has an extremely high water table and the land will support a third crop in the late winter months if irrigation can be provided.

Most distribution problems have been worked out satisfactorily. The Bangladesh Agricultural Development Corporation (BADC), now the project's primary implementing agency, has established a network of zonal and subzonal stores which sell the HTWs to dealers who in turn sell them to farmers. Problems with the sale and distribution system chiefly concern the lack of spare parts and the inadequacies of the credit system.

Although some questions have been raised about pump design and production, they are not significant. It has been argued that other designs would be preferable. While these arguments have some merit, they do not detract from the fact that some 180,000 pumps are in use. Most HTWs are used primarily for agriculture during that part of the year when the third crop is growing. The rest of the year, they may be stored or used for domestic purposes.

The Small-Scale Irrigation Project (SSIP) was designed to distribute HTWs to farmers who owned three acres or less. To ensure that the target group was reached, a paperwork system of certifications and documentation was created. The paperwork proved to be a hindrance to distribution and did not achieve its purpose of limiting credit or cash sales to the smallest landholder. More than just a paperwork problem, institutional inadequacies with the farmer credit system (along with farmer biases against using that system if it required, as it did, his land as collateral) made the primary beneficiaries those farmers who owned three to seven acres. Although poor by most standards, these farmers are at the higher end of the landholding scale in Bangladesh. An interesting side effect of the project is the recent development of a market for second-hand HTWs. Sold at a lower price, these used pumps are gradually making their way down to the poorest farmers.

An obvious result of the project has been increased farmer income. A third food crop is being planted by owners of HTWs. In a country as severely overpopulated as Bangladesh, this is a significant achievement. It is not known with any certainty just how much additional food is produced, but the additional source of nutrition cannot be discounted. In addition, to a limited extent farmers are producing a "cash" crop in their third season. Although it is too early to say how extensive this trend will be, it was clear to the team that the farmer was willing to modify his cropping pattern in some cases to take advantage of high prices for certain cash crops.

There are side benefits of HTW ownership which were not anticipated in the original design of the project. Chief among these is the large amount of potable water produced by the pumps. The use of this water results in a decrease in dysentery and stomach ailments. Finally, we should note that women are working in the fields for the first time, operating

hand pumps. Whether this is a positive good remains to be seen.

I. Helmand Valley Project in Afghanistan

The development of the Helmand Valley in Afghanistan was begun after World War II by the Afghan Government to exploit the water resources of the Helmand River. These resources were considerable, as the Helmand watershed drained roughly the southern half of this arid country. The Afghan Government chose a private American firm as the contractor to construct irrigation works and roads in the Helmand-Arghandab region. In the mid-fifties, the Afghan Government's goals for the project were expanded, and they began to look for outside assistance with the financing.

Because the previous work was done by a U.S. company, American prestige was involved in the Valley even before the U.S. Government had any role in the project. The importance of this was magnified by Cold War concerns, and the U.S. Government was drawn into assisting the Afghans with multi-sectoral development in the Helmand Valley. Over a 30-year period, U.S. aid of $60 million was invested there. Afghan and U.S. investment resulted in net farm incomes rising dramatically because of regularized water supply and introduction of high-yielding varieties of wheat. By 1975, the average incomes had increased by many times what they had been 10 years earlier. Although incomes were still fairly low by national standards, the Helmand Valley still probably had the highest incomes of the agricultural areas in Afghanistan. Nevertheless, in some parts of the Valley, this was a decline from even higher average incomes, due to deteriorating farming conditions caused by drainage and salinization problems. The evidence clearly indicates that the seriousness of these problems threatened the sustainability of the benefits achieved.

After a brief period when the United States was not involved in the Valley, AID renewed its assistance in 1974 with a drainage project. Although very successful in the areas where drains were built, only a small percentage of land needing drainage received attention before work was interrupted by the Soviet invasion in 1979.

Very considerable gains in total production had been achieved with over 100,000 hectares brought under production in the Helmand Valley. Nonetheless, the increased quantity of crops produced, particularly key crops, was not ever large enough to have a significant impact on the country's export situation.

Although the United States was responsible for providing some social services in the Valley, they never received much priority and, therefore, were not well integrated with other activities. Accordingly, their impact was not significant and the sustainability of any benefits achieved unlikely.

The U.S. assistance to development of the Helmand Valley did result in positive benefits. However, when those benefits are balanced against the very high costs, the value of the investment is questionable. If work on drainage could be continued or resumed in the near future, positive sustained benefits from increased incomes could be achieved. Without drainage, the deteriorating farming conditions due to salinization will seriously undercut the increases in income in large parts of the Valley.

Lessons Learned

1. Mixing goals of export production with resettlement programs moves a project in two different directions at the same time, making it extremely difficult to achieve either goal.

2. An area development project centered on a production project must consolidate the gains made in production before any positive social impact can be sustained.

3. For benefits from social services to be significant and sustained, they must be given high priority (although not necessarily from the beginning of the project), and they must be integrated into the project.

4. For successful nomad settlement programs, three conditions must exist: (1) economic incentives great enough to convince them to give up their traditional way of life; (2) adequate social services to assist them in the transition and to act as additional incentives; and (3) communication of agricultural information, creatively integrated into the project (farmers do not get information only from extension agents), with enough resources to reach even very small farmers.

5. There may be a tradeoff between efficiency and participation--the fewer people involved, the less time something takes. (This says nothing about quality, which could be considered an attribute of either, both, or neither.) Conversely, if wider participation is a goal, more time should be allocated.

6. There's no getting off cheap. Irrigation programs are enormous and expensive. If AID is involved in <u>any way</u>, its

"project's" success is dependent on the success of the entire effort. No success can accrue to AID for a well-designed and well-implemented portion of a project which fails as a whole. If provision is not made at the beginning for all essential elements, AID risks getting further and further involved in a haphazardous effort with no prospect of final success.

J. Peru: Land and Water Use in the Sierra

The Improved Water and Land Use in the Sierra Project (called Plan MERIS, after its Spanish acronym) was evaluated during March 1983 by a team of AID staff, assisted by USAID staff, Government of Peru (GOP) personnel, and a short-term Peruvian contractor. The evaluation took place over a three-week period and involved research and meetings in Lima and field visits to project sites in the Cajamarca and Mantaro valleys, where Plan MERIS is being implemented. During the field trips, the team met with Plan MERIS personnel at the region and project level, as well as with Agrarian Bank representatives and personnel from related Government agencies.

Plan MERIS was designed as a five-year effort. Improved water and land use in the Sierra was to be achieved through an increase in productive land areas, crop yields, and the efficiency of water use; expanding cropping alternatives; and reducing soil erosion. The project was to be targeted to small farm families, typically farming less than two hectares of land. To achieve its objectives, Plan MERIS encompassed several components, among them (a) construction of irrigation and drainage works for up to 27 sub-projects; (b) a special fund in the Agrarian Bank for sub-lending to participating farmers for investments in on-farm land development; (c) a complementary afforestation and reforestation program; and (d) strengthening of personnel and institutional capacity through technical assistance and training. The project implicitly left agricultural extension and development activities to the GOP. Total project costs were set at $21 million, comprising an $11 million loan by AID and a $10 million contribution by the GOP.

The project has not been implemented as planned, in spite of a two-year extension to the original five-year project life. Delays in implementation can be traced to (a) the transfer of project responsibility within the GOP at project initiation, causing a delay in staffing of the regional offices; (b) slower than anticipated completion of sub-project feasibility studies; and (c) GOP delays in approving the purchase of construction machinery, equipment, and materials. As a result 17 sub-projects will have been constructed, rather than the 27 initially envisioned. Also, project beneficiaries have been reduced from an anticipated 21,737 farm families to some

11,261. Total irrigated hectares have been reduced from a projected 27,900 to an estimated 13,443.

Similarly, disbursement of the credit component has been much slower than anticipated, reaching less than 1 percent of the beneficiaries. The major weakness in project implementation, however, has been in the agricultural technical assistance component, due to a scarcity of GOP resources and personnel. As a result, technical assistance is not reaching the marginal small farmers; instead, as with the credit component, technical assistance is being provided primarily to larger landowners.

In spite of project shortfalls, in completed sub-projects more water is now available to farmers on a reliable basis for crop and pasture irrigation. As a result, some significant long-term production and economic benefits are likely to derive from this project, at least for the owners of larger holdings. While small farmers also benefit from the availability of water, because of the above-mentioned shortfalls they are likely to reap fewer benefits from the project. A significant benefit accruing to all farmers, however, is a decrease in the risk of catastrophic failure associated with a lack of rainfall.

While the project's physical works appear to be well-designed and construction costs per hectare are relatively low, the credit component was poorly designed, given the intended target group. Thus, although this type of irrigation project has the potential for reaching significant numbers of beneficiaries and extensions of land, a special effort must be made to reach small farmers with creative forms of financial assistance.

The national water tariff structure currently in effect in Peru is unlikely to produce the revenues necessary to make water system maintenance self-financing. Additional resources from the Government's general budget are, thus, likely to be necessary to adequately maintain the systems.

Where a host-country government is in financial straits, as are many of the AID-assisted countries currently, counterpart activities are likely to suffer from a lack of resources. If, as in Peru, an agricultural development effort suffers from a lack of adequate personnel and resources, AID should consider financing the costs of agricultural extension.

Beneficiary involvement from the early stages of project design and implementation is also a key to success. This involvement is also critical to survival of the irrigation system, through periodic maintenance and improvements, as well as to the success of ancillary project efforts.

Irrigation projects always seem to cost more and take longer to complete than anticipated. Given this experience, the design of such projects should allow for longer disbursement periods. Or, missions should be allowed to fund several follow-on projects of the same type, each within a shorter disbursement period, until a body of experience develops with which to get larger donors interested in this type of project.

On the whole, the Plan MERIS-type scheme is extremely well suited to the small-farmer agriculture conditions prevailing in much of the developing world. It must be recognized, though, that water is a necessary but not sufficient factor. Small-scale irrigation projects should not be engineering projects with technical assistance and services appendages. Rather, they should be technical assistance and services projects based on a relatively assured source of water for irrigation.

K. Somalia Soil and Water Conservation

Ceel Bardaale, a religious cooperative, and the Arabsiyo valley are two sites in northwestern Somalia that AID chose as the focus for activities to demonstrate improved soil and water conservation technology in the region between 1963 and 1967. It is a region with only a 5 percent arable land area that is subject to long rainless periods and possesses no year-round surface water flows. The objective was to introduce improved methods that would halt the erosion caused by the uncontrolled run-off of floodwaters, as well as conserve water for crop production.

The two projects were quite different and yet appropriate attempts using simple methods were made to cope with the problem of increasing and sustaining agricultural production in a semi-arid environment. In the Arabsiyo project, earthen bunds (dikes) were placed on hillsides to gather the rainwater run-off and impound it for grain crop use, as well as prevent and retard soil loss and the formation of gullies. At Ceel Bardaale, cement structures and a network of canals constituting a diversion irrigation scheme were used to manage the sudden flows of water in normally dry togs (river beds) and exploit their use on 15 additional hectares of horticultural crops.

The demonstrational purpose of both projects was a success. The introduction of a diversion scheme at Ceel Bardaale led to the community's constructing four additional schemes which opened extensive new areas for cropping. In the Arabsiyo valley, the mechanized construction of bunds that was introduced by AID in the southern end of the valley led to follow-on mechanized bunding by the FAO and under the current World Bank Northwest Region Agricultural Project. Land tenure at the two

sites presented no immediate problems since land is held, bought, and sold as though the farmer held title, although the Government actually has title which gives it an important instrument in enforcing its agricultural policies. Lack of title, however, may act as a major deterrent to farmer credit. (Soil conservation was not a factor at Ceel Bardaale but was in the case of Arabsiyo where the bunds, during the first 10 years after project completion, almost totally arrested the loss of soil by impounding the soil-bearing water which also controlled the water run-off and halted the formation of gullies.)

Crop yields at Arabsiyo increased 100 percent during the first 10 years after project completion and are still almost 150 percent more than what they were prior to AID's project despite the present deteriorated condition of the bunds. Yields on the average 10-hectare farm increased from 6 to 27 quintals, or realized a net gain of 21 quintals. That this yield increase has been due almost entirely to the greater availability of water seems clear from consistent reports of the past and present general unavailability of other agricultural inputs, i.e., improved seeds, fertilizers, pesticides, and extension services. The Arabsiyo project continues to contribute to ameliorating Somalia's overall grain deficit. In income terms, the annual returns from the 12 hectares still irrigated by the AID scheme at Ceel Bardaale approximate the total AID contribution of between $200,000 and $250,000, although there has been a shift from the original citrus (oranges) production emphasis to qaat. Qaat, a shrub the leaf of which has mildly stimulating properties, is the principal cash crop in the northwest. Similarly based current values for Arabsiyo's estimated 1,900 project hectares range from $147,000 to $217,000. For individual farmers at Arabsiyo this meant, at the time of project implementation, a quadrupling of the value of marketable surplus, i.e., from $16.80 to $75.60.

The early increases in Arabsiyo production have not been maintained because of the deterioration in bunds. The nature of this deterioration has been such that particular farms have experienced more precipitous drops in production than others, which has skewed the distribution of project benefits. There is no evidence, however, that the continuing benefits from the project have been captured differentially by any one group. Maintenance activities by the Arabsiyo farmers were limited to early efforts to keep cattle from walking on the bunds and spotty repair efforts of serious breaches, but these activities have been neglected over time. Only one of the major AID scheme structures at Ceel Bardaale remains intact, although lesser structures appear serviceable and maintenance is evident at the four other schemes that followed the AID one. Through its use of bulldozers to construct the bunds, the AID project influenced what became a general shift from animal draft power to tractors for cultivation, even though the tractors and the

POL products and spare parts needed to keep them operating are affordable by only a few relatively well off farmers.

No identifiable project impact was found to have occurred on the relative social status of individuals within the bunded Arabsiyo communities, nor on the role or degree of participation of women. At Ceel Bardaale, the AID scheme and four follow-on schemes encouraged the growth of an effective management hierarchy which followed along traditional (male) lines, and in this sense may have contributed indirectly to limiting women's status and participation.

Community participation in the Arabsiyo project lacked any central direction and farmers did not contribute to the construction of bunds, but some participation was evident. For example, negative community reaction to early project plans to construct bunds across neighboring farms forced a change to construction only within individual farm boundaries. At Ceel Bardaale, the community leadership played a key role in negotiating the AID project and directed participatory activity that included labor and storage facilities. The increased production of citrus and foodgrains has not produced any significant change in dietary preferences, nutritional status, or consumption patterns of the people at the two project sites, and periods of food scarcity still occur. The projects had no impact on access to health and education services.

The edict recently issued by the Somali Government to end the production of qaat has major implications for agricultural production and income in the northwest. The Government was doubtlessly motivated, at least in part, by the entirely commendable desire to see food production increased in order to reduce the country's large food import dependency. It is not, however, clear what food crop alternatives can have a market value equal to that of qaat. Many of the large number of semi-nomadic farmers in the region do, however, have an alternative to farming, i.e., the livestock herds that they keep as fall-back insurance when farming brings low returns.

The example of Ceel Bardaale in the area of water management illustrates the need for institutional strengths to build, operate, and maintain flood irrigation systems. By its hierarchical management structure, the community has the required organization to obtain optimal production benefits from its irrigation schemes. Conversely, the lack of any management direction at Arabsiyo has permitted the bunds to deteriorate with corresponding decreases in production benefits. Arabsiyo also provides an example of an unforeseen negative project effect on production wherein farmers have apparently abandoned traditional crop rotation systems for greater cropping intensity because of the assurance of the water provided by the bunds. However, with deterioration of the bunds, water

impoundment is much less than before, thereby reducing the advantages of intensive cropping, while the benefits of a rotational system to soil fertility and conservation have been lost in the process.

The two projects also provide interesting contrasts regarding commitment. Arabsiyo provided no financial, planning, or labor contributions to the AID project while these contributions were made to some degree at Ceel Bardaale. The result was no community replication or organized maintenance program, whereas Ceel Bardaale built and maintains four additional irrigation schemes.

These experiences support the thesis that projects undertaken without involvement in the form of financial, planning, or labor contributions on the part of the beneficiaries decrease the likelihood that they will be able or willing to commit capital and non-capital resources for non-traditional purposes, such as replication or maintenance. The examination of Arabsiyo, including inquiries into the present World Bank project, leads one to conclude that before making further investments in bunding, donors need to take a long-term perspective on the medium- and long-term policy implications of bunding on such issues as the integration of livestock and crop production, as well as the affordability of agricultural mechanization versus animal power.

The apparent absence of any impact on nutritional status and the continuation of food scarcities in a region of increased food production clearly points up the necessity for the right policy and institutional basis to improve consumption patterns, provide nutritional education, and assure food security.

One important reason for the success of both Ceel Bardaale and Arabsiyo was the continuity provided by AID technical assistance. One U.S. technician was the project manager throughout the life of both projects. He interacted with local leaders and farmers to be responsive to community desires and also managed to keep the originally scheduled work moving ahead. The continuity in local leadership provided in the case of the Ceel Bardaale community by its leader was similarly important in assuring the replication of the technology introduced by AID.

APPENDIX IV

PROCEEDINGS OF THE

AID IRRIGATION EVALUATION CONFERENCE

May 3-6, 1983

by

Allen G. Turner
Devres, Inc.

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I. INTRODUCTION

The importance of irrigation in solving the world's food deficits by increasing crop yields has not been underestimated by various donor sources. Although the U.S. Agency for International Development's (USAID) investments have been modest compared to other donor agencies such as the World Bank, there has been a substantial amount ($3-4 billion) of financial and technical assistance provided by USAID to various countries, mainly in Asia and Africa.

> Donor-supported irrigation systems have improved production but seldom have they equaled expectations in accordance with anticipated schedules, and even more rarely have they continuously realized their potential.[195]

Assessing the effectiveness of AID's irrigation projects and the potential for improving results was the purpose for a series of impact evaluations conducted by AID's Office of Evaluation in May 1980 and continuing through March 1983. To date, impact evaluations and studies have been conducted in the Philippines, Indonesia, Thailand, Korea, Bangladesh, Pakistan, Afghanistan, Sudan, Somalia, Egypt, Jordan, Morrocco, and Peru (see Appendix III). The findings of these studies have been analyzed in a sector summary paper written by David Steinberg entitled Irrigation and AID's Experience: A Consideration Based on Evaluations. This paper and the impact evaluation studies summarized therein served as background documents for discussions in the three-day AID Irrigation Evaluation Conference held May 3-6, 1983 at the Xerox Conference Center in Leesburg, Virginia, just outside Washington, D.C. The Conference, sponsored by AID, was coordinated by Devres, Inc., a small-business consulting firm in Washington, D.C. specializing in agriculture and rural development projects and policies.

The Conference assembled 125 participants,[196] including representatives from donor institutions, AID, academics, and host country personnel, with the intent of conducting three days of joint sessions to (a) review the findings of the impact evaluations, (b) discuss common issues and share professional

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[195]David Steinberg, Irrigation and AID's Experience: A Consideration Based on Evaluations, July 1983, p. 10. Page numbers throughout this Conference summary refer to pages in this volume where more detailed treatment of the issues noted can be found.

[196]See Appendix VII for a list of Conference participants.

experiences among colleagues, (c) recommend to AID policy-makers ways of improving the programming, design, and implementation of AID irrigation projects, and (d) discuss and make recommendations on the strategy for AID irrigation and other programs.

The Conference agenda (Appendix V) included a series of plenary sessions, small group meetings, and panel discussions. The varied formats for discussion and presentation were selected for a number of reasons:

- To allow free and active sharing of ideas and perspectives among a wide variety of persons involved in irrigation projects throughout the world
- To develop and share findings and recommendations on selected issues with other Conference participants and with the leadership of AID.
- To present perspectives which, although particularly valuable, were not necessarily widely shared.

The freer and more dynamic interchange which was possible in small groups was focused on eight specific issues, whose general outlines were traced in advance during several pre-conference planning sessions at AID, and were based on issues which had proved significant in numerous past AID projects. Each small group focused on one issue, which its members were free to define within the general outline provided.

The less widely shared perspectives were presented in a series of panels at plenary sessions throughout the Conference. The panelists included specialists who had topical expertise in certain areas and ex officio specialists, who had led impact evaluations of specific AID projects. There was, in addition, a tripartite session divided into the perspectives of donors, host country implementors, and academics.

The various topics considered during the Conference included the role of irrigation in the development context; the questions of when, and when not, to irrigate; the issues of the impact evaluations; the finance, economics, infrastructure, interactions, and management of irrigation projects; and the priority problems of donors, host country implementing agencies, and academics. Conclusions and recommendations were drawn and presented to policy-makers from the U.S. Agency for International Development. The following report summarizes the context and proceedings of the AID Irrigation Evaluation Conference.

II. DEVELOPMENT ASSISTANCE AND IRRIGATION: CONCLUSIONS AND RECOMMENDATIONS ON EIGHT BASIC ISSUES

A. Introduction

1. The policy context

The most sustained discussion during the Conference took place within eight discussion groups, each of which focused on a particular issue, identified and drew conclusions concerning the problems within that issue, and prepared specific recommendations to AID policy-makers on ways to improve AID's activities in the irrigation subsector. In a plenary session on the final day of the Conference, these recommendations were presented to the AID Administrator and many other senior policy makers.

Many of the recommendations called for increased collaboration with host country governments and project beneficiaries in all aspects of the project cycle. This will require greater flexibility on AID's part and that project design be viewed as an on-going process rather than as a blueprint. It will also require, however, increased knowledge of the project's entire context. Analysis needs to be an integral part of project design and should start with the existing farm-level situation. An apparent contradiction between a need for greater flexibility and that for improved analysis has been pointed out. Would not further requirements for analysis merely add to the burden of checks and balances which already exists? In response, it has been emphasized that calling for improved analysis is not advocating more checks and balances. It is calling for a project to look at what it is doing and learn to improve based on what is occurring in the field situation. For example, many of AID's procedures are overly concerned with fiscal years 1985 and 1986, and not enough with the here and now.

The Conference also recommended that, as a fundamental aspect of involving beneficiaries, the cost of irrigation interventions eventually be passed on to them. The concern was voiced, however, that bringing "strict financial discipline" to projects might exclude many people. It is necessary to account for many aspects of the larger picture, including commodity dumping by other nations, government price policies, and others, to ensure that farmers who are asked to pay for irrigation are indeed receiving the benefits from it.

2. Brief summary of the recommendations

a. Introduction

The conclusions and recommendations developed in the small group discussions, each focused on one of eight basic issues, are presented in the following section. To briefly summarize, they fell for the most part in five broad areas of concern:

- o Involvement
- o Analysis
- o Flexibility
- o Integration, and
- o Equity.

Not surprisingly, many of the basic concerns addressed were those facing development planners in any of a great number of fields and the recommendations could apply equally well to irrigation projects or to other development intervention.

b. Involvement

All but one of the eight issue groups developed recommendations calling explicitly for increased involvement on the part of host country participants in irrigation projects -- among institutions, beneficiaries, or both. Greater involvement was called for at all stages in the project cycle from design through post-project management. User organizations should have a role in design, implementation, rate setting and collection, and budget allocation for operations and maintenance. This role in decision-making and management should continue throughout the life of the project, and system management and ownership should be transferred to the local user community as soon as feasible. Host country institution personnel should also be more involved in the design process and their economic and diagnostic skills should be used as much as possible, although specific host-country commitments for changes to facilitate implementation should be included in project design and spelled out in the project agreement.

c. Analysis

The need for more effective analysis in irrigation projects was discussed in all of the eight issue groups. Seven of the groups made specific recommendations suggesting aspects of analysis which demand particular attention (and the recommendations of the remaining group, Financing Irrigation, clearly imply the need for detailed analysis). Finally, determining the way in which economic and other analysis should be done

will require the examination of a great number of factors. Selection of technologies should be based on a systematic review by an interdisciplinary team, with special emphasis given to various interrelated factors. A full analysis of alternatives should be made. This should include assessing social and economic costs at the farm/household production level, as well as an integrated institutional analysis. Throughout the entire project, effective information/monitoring systems should be operative.

d. Flexibility

Related to the concern for effective analysis, half of the issue groups called explicitly for use of analysis results in an on-going process of learning and change during the course of each project. Projects should include mechanisms for improving their capacity to collect and analyze information, learning from experience and self-analysis. The capacity to recognize and react to change should be designed into institutional projects. Regulations requiring perfect foresight of all contingencies should be relaxed. The technology selected for irrigation projects should permit maximum flexibility in design, installation, and operation.

e. Integration

Recommendations by over half the issue groups focused on understanding the larger picture into which projects should be integrated. Elements of the larger picture which were highlighted in the recommendations included the political economy of project objectives, the entire farming system, a great variety of characteristics of the target group, and host country institutional capacity. Recommendations were made on some specific areas where integration is necessary. For example, system design should integrate centralized and decentralized functions at the command area level, and project design should explicitly incude a strategy for linking and influencing appropriate institutions.

f. Equity

Although not addressed directly by all the discussion groups, a number of recommendations made very clear the importance of the equity issue. The Financing group (B) warned that since irrigation is a poor way to achieve income transfer, emphasis should be placed on not making income distribution worse. The Interactions group (F) emphasized the need to maximize the spread effects of investments in irrigation to nonirrigators. The Farmer's Perspective group (G) recommended

that land tenure issues be resolved prior to donor commitment of funds.

B. Financing Irrigation: Who Pays and How?

Recommendation

- Support the principle of equitable cost recovery from all beneficiaries by direct and indirect means, based on benefits received and capacity to pay. Irrigation is a poor way to achieve income transfer. Place emphasis on not making income distribution worse.

Recommendation: Recovery of Costs

Operations and Maintenance (O&M)

- As soon as feasible, full operations and maintenance (recurrent) costs should be recovered through charging the beneficiary in cash or kind for water use.

- Government has the responsibility for recovering costs. However, users organizations should have a role in design, implementation, rate setting and collection, and budget allocation for O&M in order to facilitate collection.

- Sustained, effective operation of the system is essential to collection from users.

System infrastructure costs (amortizable)

- Depending on investment level (cost per hectare) government should explore all collection mechanisms (land tax, general revenue, etc.). The portion assigned to the water user must be based on capacity to pay.

Recommendation

- To encourage sustained self-financing, support transfer as soon as feasible of system management and ownership to the local user community.

C. Economics of Irrigation

Conclusion

- Irrigation objectives are either economic (quantifiable or nonquantifiable) or political.

Recommendation

- Economic analysis needs to be broadened to political economy and requires political candor.

Conclusion

- At a minimum, all projects (if they are to achieve objectives) must make farmers better off.
- If projects are to achieve long-run objectives, they must be sustainable, implying all actors must be financially viable.
- Financial analysis is vital.

Recommendation

- All projects must ensure financial viability of farmers, operating agencies, and governments.

Conclusion

- Many projects are not resulting in increased financial benefits for the following reasons:
  - -- Benefits are overestimated and costs underestimated initially (project viability was dubious from the beginning)
  - -- Projects do not incorporate economic analysis in design
  - -- Recurrent cost problems
  - -- Economic policy (U.S. Government policy is often at cross-purposes to our own development strategy, e.g., P.L.480).

Recommendation

- Create a task force to determine the way in which economic analysis of irrigation projects should be done; assessing inter alia, data requirements, discount rates, the role of food security, political factors,

distribution of benefits (equity), recurrent costs, role of sectoral/regional analysis, intra-household distribution, international subsidies, and taxes.

Conclusion

- Economic analysis of projects is in a sorry state.

Recommendation

- Economic analysis needs to be an organic part of project design so that design choices can be made with the benefit of economic insight.

Recommendation

- Include upgrading of host government economic skills through training, workshops, professional groups, conferences, and related means.

D. Technological Choices

It must be recognized that the project is part of an overall program. Broad planning is needed to outline the program and explore the range of technological choices.

Conclusion

- Project success is enhanced by flexible design, implementation, and operation.

Recommendation

- Technology selected for irrigation projects should permit maximum flexibility in design, installation, and operation. Design should allow for phased investment and construction and for future changes in the farming system including
  - -- Water allocation and improvements in water control at the local level
  - -- Cropping patterns and intensity
  - -- Levels of mechanization.

  Those responsible for implementation and operation should have broader authority to identify and initiate changes in system design and operation to reflect improved knowledge or changes in conditions. Project design and performance should benefit from increased

emphasis on monitoring and evaluation as well as from pilot research and development components in selected portions of the command area.

Conclusion

- Field experience has shown that irrigation projects have been designed with insufficient regard for the interdisciplinary nature of both the management of water deliveries and the efficient on-farm use of water. The quality of management, quantity and timing of labor inputs, micro (farm-level) economics, and the other needed agronomic requirements have often been neglected. This has caused what might appear to be technically safe systems to fail to come anywhere close to meeting expected production goals.

Recommendations

- Technologies should be systematically reviewed by an interdisciplinary team prior to their selection. Special emphasis should be given to the following factors:
  - -- A proven record of satisfactory performance, including economic, under similar conditions
  - -- Accurate (candid) economic analysis, considering especially allocation between capital and recurrent costs
  - -- High reliability under probable operation and maintenance conditions
  - -- Availability and reliability of water and land resources
  - -- Agronomical feasibility.
- Technologies should be systematically reviewed by an interdisciplinary team prior to their selection to assure compatibility with
  - -- The entire farming system
  - -- The target group's socioeconomic, land tenure, ethnicity, labor use, sex role, and educational patterns
  - -- Host country planning, management, technical, and analytical capacity.

E. Rehabilitation/Improvement Strategies

General recommendation

- Look at possible generic problems with the process of system design/redesign to determine reasons for need for frequent rehabilitation.

Conclusion

- Comprehensive diagnosis of system problems and their causes must precede redesign and rehabilitation.

Recommendations

- Make comprehensive diagnosis of system problems. Move from symptoms to causes.
- Increase emphasis on training in the broad range of skills needed for such diagnosis.

Conclusion

- Operations and Maintenance (O&M) lies at the heart of most rehabilitation/improvement problems and often is not specificially addressed in the solutions.

Recommendation

- Projects should specify how O&M will be executed and financed and how necessary training will be provided.

Conclusion

- Information is available in rehabilitation/improvement situations which we often fail to use because we do not design projects that can learn from experience.

Recommendation

- Relax regulations requiring perfect foresight of all contingencies.

Conclusion

- Too often rehabilitation/improvement projects are designed with inadequate attention to mobilization of local resources, including financial, material, informational, labor, and entrepreneurial resources.

Recommendation

- Increase emphasis on community mobilization for rehabilitation and O&M. This can be supported through
  - -- Pricing policy
  - -- Flexible user charge policy
  - -- Reorienting bureaucratic procedures to permit community involvement
  - -- Collaborative efforts, with the government providing technical services and farmers providing labor, local information, and contributing to construction.

Conclusion

- Rehabilitation projects too often adopt original project objectives.

Recommendation

- Rehabilitation projects should reassess the original objectives of the project to be rehabilitated.

Conclusion

- Potential for increasing productivity from private sector (community) systems through rehabilitation/ improvement is currently underexploited.

Recommendation

- Consider increased emphasis on assistance which benefits private sector (community) systems in countries where this subsector is significant.

F. Interactions of Irrigated and Nonirrigated Strategies

Conclusion

- Farming households often rely on a mixed strategy for maximizing food security and income, including rainfed agriculture, irrigation, and off-farm employment. The availability of labor within the households and within the community as well as food preferences and availability are important factors. Farm families are joint production and decision-making units which involve resident and nonresident family members.

Recommendation

- Emphasis on agricultural productivity should be coupled with emphasis on income generation for farm families. Prior to investing in specific irrigation projects, AID should assess the incentives for prospective farm families in terms of labor inputs and fully analyze alternatives in terms of income-generating activities.

Conclusion

- It is not possible to generalize whether development of either irrigated agriculture or rainfed farming is "better" economically, socially, or otherwise, because situations differ greatly. What matters is to increase the household's income and ensure its stability.

~~Recommendation~~

- Irrigation investments should not be made without analysis of existing enterprises and family goals to determine if significant improvements can be made in the "present situation" in preference to introducing "massive" change. AID should only support programs after a full analysis of alternatives. This is generally not the case now. In any case, service systems must be put in place to improve productivity and reliability.

~~Conclusion~~

- Host countries are placing emphasis on and committing considerable financial and human resources to investments in irrigation and river basin development.

~~Recommendation~~

- AID should support projects which maximize the spread effects of these investments to nonirrigators, such as adjacent livestock enterprises, rainfed cultivators, secondary market towns, related industries, and labor.

Conclusion

- The validity of investment choices in irrigation and rainfed agriculture and feasibility studies depends on improved data derived from farm-level analysis and experience.

Recommendation

- o AID should support on-farm testing of various rainfed agriculture and irrigation practices and pilot farms which involve farm families.

Conclusion

- o Implementing a mixed agricultural strategy requires a variety of skills from the farm to the national policy level.

Recommendation

- o AID should support the necessary training and manpower development.

Conclusion

- o Investments in irrigation cannot be considered in isolation. Among factors to be considered are national food objectives, productivity and reliability opportunities and constraints, the legal framework of land and water tenure, costs and returns per household, implementation complexities, numbers of households affected, and levels of primary and secondary incomes generated.

Recommendation

- o AID should assist host governments in their efforts to formulate national policies with respect to the appropriate mix of investments in irrigated, rainfed, and range land, and the allocation of and availability of human resources. It should be recognized that participation in policy dialogue may require some level of investment.

G. ~~Water As One Input: The Farmer's Perspective~~

Conclusion

- o Benefits and costs to farmer and planner must be identified.

Recommendations

- o Planners must initiate meetings with farmers to determine needs/objectives for inclusion in project design, costing, implementation.

- Social and economic costs must be determined at the farm/household production level.

Conclusion

- Land tenure affects farmer motivation, and consolidation into economic-sized units is needed.

Recommendation

- Land tenure issues must be resolved prior to donor commitment of funds.

Conclusion

- Farmers should have a role in decision-making and land management of systems.

Recommendation

- Farmer role in decision-making and management must continue for the life of the project through appropriate groups.

Conclusion

- Equitable distribution of water is needed.

Recommendation

- Arrangements for distribution of water and settlement of water rights issues and mechanism for adjudication of disputes will be made prior to commitment of funds.

Conclusion

- Mechanisms must exist or be developed to provide inputs that farmers cannot provide.

Recommendation

- Ongoing farmer services must be provided through appropriate mechanisms (new or existing) prior to donor commitment of funds.

H. Organization and Administration of Irrigation Systems: The Design Perspective

Conclusions

Certain major problems are commonly encountered with each of the functions for management:

- o Preparatory physical, social, and fiscal site-level planning
  - -- Inadequate inventories of soil and water
  - -- Time constraints (parachute teams).
- o Mobilization of local resources
  - -- Failure to maintain communication up and down
  - -- External oversubsidization (stimulates free riding)
  - -- Unclear/incomplete assignment of roles and functions.
- o Construction--upgrading (including logistics, supplies, and quality control)
  - -- Failure to orchestrate lead times for various activities
  - -- Tied procurement procedures constrain management flexibility.
- o Operation and production (allocation, distribution, and administration of water; conflict management; development of contingency plans; and provisions of complementary inputs and services for crop production)
  - -- Overcentralization of authority
  - -- Overly loose organization--discipline, conflicts of authority outside of irrigation system itself
  - -- Inadequate functional coordination with institutions
  - -- Rigidity of management structure
  - -- Poor on-going planning of activities.

- Maintenance
  - -- Same problems as with construction and operation and production
  - -- Fee collection, cost recovery.

Recommendations

- AID project design should include host country commitment to achieve critical organizational, institutional, procedural, and other changes that will facilitate implementation of project and should be spelled out in the project agreement.
- A "rolling design" should be applied to management and organization, since they are dynamic processes. This is accomplished through
  - -- Evaluation
  - -- Communication
  - -- Effective information and monitoring systems
  - -- Incentives to use the above.
- System design should integrate centralized and decentralized functions at the command-area level. (The "command area" may be one small pump.) The ideal is a user-driven system with common administrative functions centralized.
- Functions must be clearly and completely assigned to discrete units within the organization.
  - -- Use existing host country structures as much as possible for functions and services.
  - -- Do not replicate unnecessarily.
- The development of management capability of personnel should be stressed in irrigation projects, as management functions span many disciplines.

I. Strategizing and Planning for Ongoing Institutional Development

Conclusion: At the local level

- Do not develop new institutions unless it is necessary.

Recommendation

- o In relationship to local water-user assocations, there is a need to analyze carefully existing organizational forms and, where appropriate, build and strengthen these rather than create new organizations. (When new roles are introduced, farmers may require training to fulfill these roles.)

Conclusion: At the middle level

- o There is a crucial role for intermediate institutions in legitimizing and proposing institutional changes through influence rather than control.

Recommendation

- o Project design should explicitly include a strategy for linking and influencing appropriate institutions and getting other institutions (friend or foe) involved in problem identification and solving (e.g. bureaucracy development, research, financial analysis, and policy setting).

Conclusion: At the national level

- o Host country institutions tend to act as caretakers who "administer" irrigation systems instead of acting as managers who are actively engaged in an on-going problem-solving process.

Recommendation

- o Projects should include mechanisms for improving their capacity to collect and analyze information, learning from experience and self-analysis.

Conclusion: At the national level

- o There is a lack of overall explicit host government and donor policy for irrigation. Because irrigation is a host country activity, their personnel should be more involved in the design process.

Recommendation

- o AID should collaborate with host country institutions to develop comprehensive host government and donor strategies to serve as a framework for irrigation development and mangement.

Conclusion: At all levels

- Institutional design is a long-term process, not an instant blueprint. Redesign is based on trial and error. Host country and donor efforts to strengthen existing institutions may not always be the best strategy. In some cases, perhaps an institutional vacuum may be desirable (e.g., to make room for a private voluntary organization, private or other institution).

Recommendations

- Design into institutional projects the capacity for monitoring, feedback, and evaluation, and the capacity to recognize and react to change.

- The design process should include a multidisciplinary institutional appraisal which will be done incrementally and integrated with the biological, physical, and legal aspects.

Conclusion: At all levels

- "Software" (e.g., training, monitoring) is underappreciated and therefore often undersupported.

Recommendation

- Specific institutional develoment interventions should form an integrated analysis of the institution at the design stage. (For example, the project design should include "software" recommendations stemming from the analysis. This "software" may include training, monitoring, and support for intermediate organizations. In many cases, this may require grant funding.)

Conclusion: At the donor agency level

- Donor project personnel are often too short term to help stimulate processes for successful institutional development.

Recommendations

- Donor agencies should reevaluate personnel policies, training, and operational procedures to stimulate continuity, institutional memory (ours and theirs), feedback, and self-analysis.

- Donors should use project design as a training opportunity.

III. SUMMARY OF THE DISCUSSIONS AND PANELS

A. Irrigation: When and Why

The first afternoon of the Conference, participants were divided into six small groups to discuss the circumstances under which AID should or should not undertake irrigation projects. The discussions were quite successful in raising a great diversity of issues and questions. Although many of these continued to be discussed throughout the Conference, eventually resulting in specific recommendations, the purpose of this initial small group session was to begin the flow and interchange of ideas.

In general, participants felt that a preliminary consideration should be the defining of AID's objectives--economic, geopolitical, or social--and their relation to relevant host country policies and objectives (pp. 38-40, 48-49). Following this, it is necessary to examine if and how irrigation fits into the existing environment. The following questions were among those felt to be most relevant: Will an irrigation system respond to the country's social needs? How would irrigation fit within existing and potential future farming systems? Would there be adequate demand for the food grain or commodity to be produced? How committed have both the governments and farmers been to similar projects in the past? How experienced are the implementing organizations? How effective has the institutional environment been? (pp. 66-67, 76 ff.) Have ecological concerns been resolved? Have available and secure water resources been proven to exist which could in fact be delivered to appropriately sized command areas with an acceptable degree of reliability for improved crop production?

To assess fully the appropriateness of irrigation, the alternatives must be assessed. What potential exists for rainfed agriculture with alternate interventions? What is working or not working within the existing environment? Appropriate options or priorities within irrigation must also be examined. These include choices between new projects and rehabilitation (pp. 50-54), between ground and surface water development (p.61), large-scale versus small-scale (pp. 54-57), and known versus new technologies (pp. 61-66).

Attention must also be given to the impacts a given irrigation project is expected to have. What realistic spread effects beyond the project can be expected? What are the health implications? Will the economic benefits likely to be derived from the irrigation system be sufficient to justify the initial irrigation investment and to sustain its operation and upkeep? Conference participants held that irrigation projects

should be considered as taking place within a sequence of possible interventions, the timing and ordering of which are crucial to their optimum impact.

Finally, a number of points were raised which went somewhat beyond the question of under what conditions might irrigation be most appropriate:

- Is the project likely to be a "smart" project, capable of learning from its own experience?
- Are AID personnel systems (professional development opportunities, incentives, duration of assignments, etc.) compatible with better project design and implementation and with evolving a long-term irrigation strategy in given missions and host countries?

During the presentation of the groups' findings in the day's concluding plenary session, one participant observed that the stipulations proposed would be very difficult to follow in toto and, in fact, were never followed when irrigation was being developed in the United States: "If we ever had had to hold to those recommendations, we'd never have had irrigation in the western U.S." It was felt that designing flexibility into projects to provide for a learning mode could be more effective in reducing irreversible, undesirable consequences. Experiments can be built into projects for learning and, if needed, changing directions.

B. Special Perspectives

1. Past AID experience: the impact evaluations

The second day of the Conference began with a panel of participants, who each had served on an AID Impact Evaluation Team and who shared with Conference participants the perspectives of and lessons gained from AID's experience in Peru, Somalia, Egypt, the Philippines, Pakistan, and Turkey (see Appendixes II and III). One of the points stressed was the importance of a thorough understanding, including the appropriate scale for physical infrastructure and the agronomic requirements of the crops to be grown. Other panelists emphasized that effective water management depends on institutional development and effective manpower training at all levels.

Commenting on AID's experience in Turkey, a panelist concluded that the public and private sectors not only can but should be partners in irrigation development. The private sector can be intimately involved particularly when small

systems are considered. The weaknesses of a large public system are often compensated for by smaller private groups nestled within it.

One of the commentators responding to the panel defined "irrigation itself [as] basically an economic activity." It is not an end in itself but rather a means to an end (i.e., crop production). It must be carried out economically to ensure that the end product is achieved. With respect to scale, he observed that size is not necessarily as important in itself as is placing the responsibility for operations and maintenance close to the local users. It was also noted that complex schemes are more likely to fail. Keeping it simple, however, is very difficult when the real situation actually is extremely complex.

The discussion that followed brought out a number of interesting points. A participant felt that there was a need to clarify what was meant by the private sector. Can we include the investments made by communities and by farmers? A panelist remarked that the distinction between government and the private sector is not very clear at the local community level, much as town government and the local farmers co-op are not easily distinguished in rural America. A participant elaborated on the success of the public/private sector cooperation in Turkey, noting the difficulty in isolating the degree to which the discrete project was responsible. It was actually a fluke that the public sector was not able to fund everything, thus opening the opportunity for farmers and the private sector to become involved. A host country participant noted that over 30 years ago, the development of the two Niles in the Sudan was the result of a very successful experience of private sector and government cooperation. He pointed out that it had never been evaluated and was later nationalized.

Clarifying the point that AID's irrigation impact evaluations were of AID projects, the moderator pointed out that one purpose behind them was to internalize the findings into the donor process. That the impact evaluation involves only a month of field work is based on considerations of cost efficiency: one gets in one month perhaps 80 percent of what one would get if six months were spent on the evaluation.

2. Comparative perspective on irrigation: academic and legal

In addition to presenting perspectives from experiences in particular countries, a panel of two economists, an engineer, and a lawyer presented their views, drawn from their many years of experience.

One panelist observed that recurrent budget difficulties are related to two sorts of neglect. Political judgments often fail to tackle long-run considerations and discount recurrent costs. Planning judgments are concerned with retaining budget allowances, thereby neglecting important problems and often operations and maintenance.

Another panelist emphasized the crucial importance of indigenous systems and institutions. In Japan, for example, local farmer and communal organizations played a much greater role than did the central government. One of the ways donors can take this into consideration is to make selection criteria for consultants that require their understanding of the social and institutional problems as well as a command of the language.

Water law systems of many types--traditional, religious, and those of various modern states--are in use throughout the world and in the past have been applied to resolving conflicts and regulating water users. Water law can, however, also be a positive management tool. Numerous problems exist, however, in using water law as a management tool in many developing countries, including "total disrespect for the law," passing costs (e.g., polluted water) to downstream users, inadequate control of groundwater, coordination of ground and surface water, and poorly organized dispute resolution. Left unresolved, these problems can lead to failure of irrigation projects. Effective water law depends on a few basic factors: identification of who owns the water, allocation of the water, effective enforcement mechanisms, and speedy resolution of disputes because of the "fugitive nature of the resource."

The final panelist described a project as entailing a large communication system. The problem is how to encourage the stretching and growth of the membrane of water into the niches where it best belongs. It should be an organic process with growth by attraction rather than by regimentation, much as roots grow to water and branches to sunshine. One of the requirements of effective management is a "middle" system, which secures the supply of water from the main system and delivers it to the farmgate.

3. Priority problems of donors, implementors, and academics

Three discussion groups focused on priority problems related to the design, implementation, and evaluation of irrigation projects. Each was composed of Conference participants from one of three main groups: representatives of donor agencies, representatives of host country implementing institutions, and members of the academic community. Everyone was

urged to keep a fourth major group in mind: the farming community in the Third World. The respective observations of each of the three groups follow.

a. Donor agencies

The discussion in the donor group meeting brought out a great variety of problems facing donor agencies in general and some criticisms focused directly at AID's own operations.

The problem of "structural idiocy," where a series of apparently reasonable discrete decisions produces a clearly recognized negative result, was seen as affecting a wide variety of AID procedures, including the personnel system, contracting, project design, pressure to obligate funds, and evaluation. A related problem is "institutional gridlock," where checks and balances overburden the system and lose their value as management tools. Specific problems were noted which have arisen from these. Perverse incentives have evolved which do not reward development results. AID's current contract and personnel system is inconsistent with the long-term commitments, both of funding and of personnel, necessary for successful irrigation projects. Relationships with host country counterparts (institutions and persons) suffer, and institutional memory is weakened. An adversarial, reactive system of project design and approval has developed between AID/Washington and the country missions.

A further general problem exists in the realistic assessment of projects and the accessing, use, and analysis of data available from both AID and the host country.

Recommendations were made to AID for addressing the most significant problems:

- Change the incentive structure to reward development results (and change personnel systems to support that objective).
- Make procedures consistent with "smart" development.
- Decentralize and provide proactive (rather than reactive) support to missions.
- Recognize and analyze complexity--but link limited projects to strategies. (Do not try to fix every "problem" ahead of time.)

A final admonition was agreed on by all: No matter how "bad" the project, nobody loses but the farmer.

b. Implementing agencies

The discussion by representatives of host country implementing agencies resulted in 16 specific recommendations. Many of these called for wider and more intensive sharing of technological, managerial, and related expertise. Training of and participation by host country personnel should be included at all levels in project planning and implementation. The capability of local host country consultants should be developed. There should be more exchange of experience not only between developing countries and developed countries, but also among developing countries themselves. It was also recommended that technology be transferred appropriately. Consultants employed in projects should be aware of local practices and conditions. Equipment supplied should be usable in the host country.

The implementing agencies group made several suggestions related to the funding of projects. Soft loans should be included to facilitate credit to farmers. Technical assistance for planning and feasibility studies should be in the form of grants. Phased funding should be used for projects too large for immediate funding, and cost overruns should be included. The groups also recommended that integrated rural development projects be funded.

Several recommendations were directed at improving project and donor agency procedures. Bureaucratic red tape should be minimized. In proposing new irrigation systems, problems of existing ones should be considered. Project evaluation should be based not only on internal rate of return, but also on social aspects. Finally, better coordination among donor agencies was called for, including a standardized methodology for planning and appraisal of projects in the same country.

The last point was discussed in some detail following its presentation in a plenary session. A host country participant explained the need for coordination in order to correct the present "overloading" by lending agencies, each with different conceptions and different approaches. Another participant noted that in one African country, the Ministry of Agriculture is coordinating 200 different projects by 30 different donors. The problem is that better coordination increases the power of donors. In one country, noted another participant, the donors were meeting together monthly and a minister ordered them to stop. Coordination tends to appear when it is convenient to everyone and disappear when not. There is also a tendency to underestimate how much coordination goes on informally.

c. Academics

The academic role in irrigation development is focused on teaching and research. Teaching should convey not only the "take-apart" skills of analysis, but also the skills and approaches needed for synthesis. The latter can be fostered through in-service training, where teacher and student are actually involved in interdisciplinary research in "live-field" systems. Using academics, AID should help facilitate joint research activities on irrigation problems between research institutions in developing countries and those in developed countries.

Long-term (two-year) assignments will give one a chance to develop an area of expertise. It is very important, warned one participant, that the United States not stop recruiting young people as academics; those developed countries that have done so will suffer for it.

IV. FUTURE ACTION

During the final session of the Conference, the Assistant Administrator of AID's Bureau for Program and Policy Coordination noted that there has been interest in a policy paper on irrigation in particular. He felt that, given the amount of money AID has been investing in irrigation projects, it may be a good idea. Since the Conference, an official statement of policy has indeed been planned. The Conference participants will have contributed greatly to this if the conclusions and recommendations arrived at during the Conference are well considered by the drafters of the policy statement.

APPENDIX V

IRRIGATION EVALUATION CONFERENCE AGENDA

May 3-6, 1983

Xerox International Center for
Training and Management Development
Leesburg, Virginia

TUESDAY, May 3

11:00-12:00	Check in at Xerox International Center, Leesburg, Virginia Conference Registration
11:30-1:15	LUNCH
1:15-3:00	OPENING PLENARY Welcome Richard Blue Associate Assistant Administrator, PPC/E Agency for International Development Overview of Conference Objectives Frederick Schieck Deputy Assistant Administrator, PPC Agency for International Development The Intellectual Roadmap David Steinberg Irrigation Sector Coordinator Agency for International Development Irrigation in the Context of Development John Bolton Assistant Administrator, PPC Agency for International Development Announcements Cynthia Clapp-Wincek Social Science Analyst, PPC/E Agency for International Development Jayne Millar-Wood President Devres, Inc.
3:15-4:15	DISCUSSION GROUPS (6) Topic: Under What Circumstances Should We, or Should We Not, Do Irrigation?

4:45-5:30 PLENARY
Reports from Discussion Groups
Chairperson: Frederick Schieck
Deputy Assistant Administrator, PPC
Agency for International Development

5:30-6:30 HOSPITALITY

5:30-7:00 DINNER

7:00-? READING

7:30-9:00 INFORMAL SESSION
The Water Management Synthesis II Project
Max Lowdermilk
Irrigation Specialist
USAID/New Delhi

David Freeman
Associate Professor of Sociology
Colorado State University

WEDNESDAY, May 4

7:00-8:00 BREAKFAST

8:45-9:45 PLENARY
Panel Discussion: Issues from the Impact Evaluations

Moderator: David Steinberg
Irrigation Sector Coordinator
Agency for International Development

Panelists:	John Wilkinson	-	Peru Evaluation Team
	John McCarthy	-	Somalia Evaluation Team
	Robert Morrow	-	Egypt Evaluation Team
	Douglas Caton	-	Philippines Evaluation Team
	James Painter	-	Pakistan Evaluation Team
	Thomas Casstevens	-	Turkey Evaluation Team

Commentators: Joseph Ryan
Program Economist, PPC/PDPR/RD
Agency for International Development

Worth Fitzgerald
Water Management Specialist, S&T/AG
Agency for International Development

9:45-10:15 PLENARY
Preparation for Issue Group Discussions
Cynthia Clapp-Wincek
Social Science Analyst, PPC/E
Agency for International Development

10:15-10:30 BREAK

10:30-12:00 ISSUE GROUP MEETINGS (8)

Topics:

Financing Irrigation: Who Pays and How?
Chairperson: A. "Scaff" Brown
Chief, Rural Development Office, LAC/DR
Agency for International Development

The Economics of Irrigation
Chairperson: Jerome Wolgin
Acting Chief, Economic Development
PPC/PDPR, Agency for International Development

Technological Choices
Chairperson: Steven Lintner
Environmental Coordinator, NE/PD
Agency for International Development

Rehabilitation/Improvement Strategies
Chairperson: Mark Svendson
Water Management Specialist,
ASIA/TR/ARD, Agency for International Development

Interactions of Irrigated and Non-irrigated Strategies
Chairperson: Pamela Johnson
Social Science Analyst, NE/TECH/HPN
Agency for International Development

Water As One Input: The Farmer's Perspective
Chairperson: Donald Reilly
Deputy Director, AF/TR/TO
Agency for International Development

Organization and Administration of Irrigation Systems: The Design Perspective
Chairperson: John Wilkinson
Program Analyst, PPC
Agency for International Development

Strategizing and Planning for Ongoing Institutional Development
Chairperson: Dennis Wendell/James Wilson
Project Development Officer, ASIA/PD/SA
Agency for International Development

12:00-1:15 LUNCH

1:15-2:30 PLENARY
Panel Discussion: Comparative Perspectives on Irrigation

Moderator: David Steinberg
Irrigation Sector Coordinator
Agency for International Development

2:45-4:00 ISSUE GROUP MEETINGS (continued) (8)

4:15-5:45 PLENARY
Reports of Findings and Conclusions from Issue Group Meetings
Moderator: David Steinberg
Irrigation Sector Coordinator
Agency for International Development

Announcements

5:45-7:00 DINNER

7:30-9:30 SPECIAL SESSION
Topic: Worldwide Irrigation Experience Applied to Africa
Chairperson: Raymond Love
Deputy Assistant Administrator/Africa
Agency for International Development

7:30-8:30 INFORMAL SESSION
Experiments with Low-Pressure Buried Pipe
David Gisselquest
Water Management Extension Specialist
Agency for International Development

THURSDAY, May 5

7:00-8:00 BREAKFAST

8:45-10:15 ISSUE GROUP MEETINGS (continued) (8)

10:15-10:30 COFFEE BREAK (on way to next session)

10:30-12:00 SMALL GROUPS (3)

Topic: Priority Problems Related to the Design, Implementation and Evaluation of Irrigation Projects

Donor's Group
Chairperson: Richard Blue
Associate Assistant Administrator,
PPC/E, Agency for International Development

Host Country Implementing Agency Group
Chairperson: Benajmin Bagadion
Assistant Director for Operations
National Irrigation Administration,
Philippines

Academic Group
Chairperson: E. Walter Coward
Professor
Department of Rural Sociology
Cornell University

12:00-1:15 LUNCH

1:15-2:20 PLENARY

Reports from Priority Problems Groups
Moderator: Twig Johnson
Acting Chief, Studies Division, PPC/E
Agency for International Development

2:45-4:30 REVIEW GROUPS

Finance and Economics
Moderator: A. "Scaff" Brown
Chief, Rural Development Office, LAC/DR
Agency for International Development

Financing Irrigation: Who Pays and How?
The Economics of Irrigation

Infrastructure Choices
Moderator: Steven Lintner
Environmental Coordinator, NE/PD
Agency for International Development

Technological Choices
Rehabilitation Strategies

Interactions
Moderator: Pamela Johnson
Social Science Analyst, NE/TECH/HPN
Agency for International Development

Interactions of Irrigated and Non-Irrigated Areas

Water As One Input: The Farmer's Perspective

Management
Moderator: John Wilkinson
Program Analyst, PPC
Agency for International Development

Organization and Administration of Irrigation Systems: The Design Perspective

Strategizing and Planning for Ongoing Institutional Development

4:30-5:30 PLENARY
Discussion of Recommendations from Issue Groups
Chairperson: John Bolton
Assistant Administrator, PPC
Agency for International Development

5:30-7:30 DINNER

7:30-9:30 INFORMAL SESSIONS
An Overview of Gal Oya, Sri Lanka
Herbert Blank
Civil Engineering Officer
USAID/Colombo

Landsat Study of the Rahad Project
Daniel Dworkin
Iris International

Water Management Synthesis II Project
Wayne Clyma
Professor
Colorado State University

FRIDAY, May 6

7:00-8:00 BREAKFAST

9:00-10:00 INFORMAL SESSION
Project-specific Monitoring and Evaluation:
An Experience from the Philippines
Ronald Ng
Monitoring and Evaluation Officer
World Bank

Benajamin Bagadion
Assistant Director for Operations
National Irrigation Administration, Philippines

10:00-12:45 PLENARY
Chairperson: John Bolton
Assistant Administrator, PPC
Agency for International Development

Conference Overview
Richard Blue
Associate Assistant Administrator, PPC/E, Agency for International Development

Priority Recommendations
Issue Group Leaders

Response by the Agency for International Development
M. Peter McPherson
Administrator
Next Steps

12:30-2:00 LUNCH

2:00 Checkout at Registration Desk

2:30 Buses Available for Boarding

3:00 Buses Depart for Washington, DC

APPENDIX VI

CONFERENCE INFORMAL AND SPECIAL SESSIONS

During the Conference, participants who so desired were given the opportunity to share their knowledge and experience in a number of informal or special sessions. Three of these are summarized below.

A. Monitoring and Evaluation

An informal session on the last day of the conference examined a monitoring and evaluation system developed for a World Bank project in the Philippines, as an example of how such a system can be established and used as a management tool. It was emphasized that each monitoring and evaluation system must be designed in accordance with the conditions in the country where the project is located. One must build project management information from farmers. The method used in the Philippines was designed to be acceptable to and usable by farmers. Organizers were fielded eight or nine months before construction began. Each organizer used the village as his or her base. (Seventy percent of the organizers were women.) Over a period of many months, rapport would be developed and problems discussed, and eventually the problem of irrigation would inevitably arise. Throughout the process, the organizer acted as a catalyst, not as a leader but as a developer of leadership. All of this was documented to capture the details of the process, which were later used to develop manuals and identify cases to be further used in training. Instead of presenting farmers with a plan, the Philippines projects gave farmers a process for them to use to develop a variety of plans:

- Cropping calendar
- Normal water distribution plan
- Crisis water distribution plan
- Conflict resolution plan
- Maintenance plan
- Rules and regulations.

B. Water Management Synthesis

The first evening of the Conference, one of the universities (Colorado State University) involved in AID's Water Management Synthesis Project presented aspects of its team's recent work. A particular concern has been developing solutions for increasing the reliability and predictability of water delivery at the farm level. A key problem for any specific irrigation system is determining how water is

allocated and how the delivery system is maintained, i.e., the manner in which the benefits and responsibilities of irrigation are to be shared. If the water is running first, before the command area organization is developed, someone will have already gained a superior access to the water, an advantage which he will use to maintain or improve his position as the organization is developed. Choosing a share type based on maximum flexibility given the physical constraints requires truly interdisciplinary analysis integrated with farmer knowledge from the design stage onward.

The Colorado State University group has developed a framework for an interdisciplinary approach with farmer involvement which has been applied successfully. It consists of several modules for guiding diagnostic analysis of physical, technical, and social organizational aspects; identification and ranking of potential solutions; and implementation of these solutions.

C. Africa: A Special Case

One of the evening sessions addressed the special problems facing irrigation planners in Africa. Although no specific recommendations were made, a number of disturbing points arose during the discussion. Although Africa is believed to have considerable untapped potential for irrigation, it was noted that the water resources are not necessarily located near the areas with great food deficits. Moreover, there are areas where considerable land has gone out of irrigation. It was also noted that, unlike Asia, adequate institutional and manpower development is lacking in much of Africa. It was suggested that the value of recessional irrigation, where the natural flooding of river perimeters provides nutrients and moisture sufficient for an annual crop, is not adequately accounted for in planning irrigation schemes which would replace it. Livestock, as well, was felt to require special attention in the African context.

APPENDIX VII

LIST OF AID IRRIGATION EVALUATION CONFERENCE PARTICIPANTS
May 3-6, 1983

Jalil U. Ahmad Water Resources Specialist USAID/Islamabad O/ARD Agency for International Development Washington, DC 20523 (01192) (51) 20201	Civil engineer, water resources specialist; expertise in design, operation, maintenance of water management programs; computer modelling of water and power resource integration; work based in Southeast Asia.
Donald Alford Office of Technical Assessment Congress of the United States Washington, DC 20515 (202) 226-2266	Hydrologist and geophysicist, advising U.S. Congress on technical issues. Experience in the western U.S., evaluating suitability for irrigated agriculture.
Soumaila Amadou Irrigation Specialist Government of Niger c/o USAID/Niamey Agency for International Development Washington, DC 20523 Cable only	Agriculture engineer; Director, Namarigoungou Irrigation Project, Niger.
Glenn E. Anders Agricultural Engineering Officer USAID REDSO/WCA Abidjan, ID Department of State Washington, DC 20520 Tlx: 969-3660	Rural engineer and engineering economist. Designed small farm systems in Costa Rica; implemented water management projects in Rwanda and Mali; designed and evaluated irrigation projects in West Africa. Interest in improving small-scale, non-traditional irrigation systems and their appropriate technologies.

Orlando Aviles Alcantara
Chief, Irrigation
Consolidation Project
Ministry of Natural Resources
c/o John Warren, Office of
Environment
USAID/Tegucigalpa
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Cable only

Irrigation expert; Coordinator of Irrigation Consolidation Project, Ministry of Natural Resources, Honduras.

Ezz-Eldin Awadallah
Senior Under Secretary
Ministry of Irrigation, Egypt
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FPA New York 09527
Tlx: 927-93773

Engineer; Senior Undersecretary, Ministry of Irrigation, Egypt.

Benjamim Bagadion
Assistant Administrator for
Operations
National Irrigation
Administration
EDSA
Quezon City
Philippines
96-23-88

Civil and Irrigation Engineer. Member of Water Synthesis Project Review team for Sri Lanka. Involvement/interest in feasibility, management research, O&M, and development of participation water users associations. Work also in Philippines, Nepal.

Robert Berg
Visiting Fellow
Overseas Development Council
1717 Massachusetts Avenue,
N.W.
Suite 501
Washington, DC 20036
(202) 234-8701

Development management expert; experience as Associate Assistant Administrator for Evaluation at AID.

Anson R. Bertrand
Director
S&T/AG
AID, Room 409-E, SA-18
Department of State
Washington, DC 20523
(703) 235-8952

Agronomist; expertise in soil physics and animal husbandry; experience with major irrigation backstop programs in United States.

Herbert Blank Civil Engineering Officer USAID/Colombo Agency for International Development Washington, DC 20523 Tlx: 954-21305	Civil engineer, water resources management interest; institutional development of technical agencies to improve selection of appropriate technology, applied research, O&M. Experience in Sri Lanka, Sudan, Bangladesh.
Richard Blue Associate Assistant Administrator for Evaluation/PPC/E AID, Room 3720 Department of State Washington, DC 20523 (202) 632-7923	Professor of government; experience with water resources projects in India.
John R. Bolton Assistant Administrator Bureau for Program and Policy Coordination AID Rm. 3942 Department of State Washington, D.C. 20523 (202) 632-0482	Assistant Administrator, Bureau for Program and Policy Coordination Agency for International Development.
Jo Ann Bowman Project Administrator Chemonics International 2000 M Street, NW, Suite 200 Washington, DC 20036 (202) 466-5340	Anthropologist. Performed work in small off-farm irrigation, particularly in Sri Lanka with application to rural development. Interest in social aspects of irrigation and how they relate to non-irrigated areas.
Nyle C. Brady Senior Assistant Administrator Bureau of Science and Technology AID Rm. 4942 Department of State Washington, DC 20523 (202) 632-1827	Senior Assistant Administrator, Bureau for Science and Technology, Agency for International Development.

Albert L. "Scaff" Brown Chief, Rural Development Office LAC/DR/RD AID Rm. 2242 Department of State Washington, DC 20523 (202) 632-8126	Agriculturalist; experience in agricultural, sector technical back-stopping, including sector strategy, project design, implementation and evaluation; interests focus on small system design, management, maintenance, and streambank and hillside irrigation.
George Carner India Desk Officer AID Rm. 3319 Department of State Washington, DC 20523 (202) 632-2076	International affairs specialist; as Desk Officer for India, interest in current developments in irrigation, especially institutional development issues and community management of natural resources. Experience also in Philippines.
Ian Carruthers Reader in Agrarian Development Wye College University of London Ashford, Kent United Kingdom 44-233-812-401	Agricultural economist; applied experience in Asia and Africa.
Thomas Casstevens Special Adviser to the Administrator AID Rm. 3932 Department of State Washington, DC 20523 (202) 632-8863	Political scientist; deals with general irrigation problems with a focus on specific farmer issues and long-term system survival; experience in Turkey.
Douglas Caton Chief, Rural Development Division PPC/PDPR/RD AID Rm. 3889 Department of State Washington, DC 20523 (202) 632-8928	Agricultural economist; experience in Latin America, Asia.

Michael Cernea Rural Sociological Adviser Agriculture & Rural Development Department World Bank 1818 H Street, NW, Rm N-1163 Washington, DC 20433 (202) 676-1774	Rural sociologist; expertise in social organization of irrigated farmers and management, operation and maintenance of irrigation systems; experience in East Asia.
Eric Chetwynd Chief, Regional and Rural Development Division S&T/ND Room 608 SA-18 Department of State Washington, DC 20523 (202) 235-8857	Resource development specialist; expertise in land development and natural resource management through Water Management Systems Project and other projects; project design and management in land tenure and land reform, forestry resources and development, settlement, energy and resource-efficient cities.
Cynthia Clapp-Wincek Social Analyst, PPC/E AID Rm. 3729 Department of State Washington, DC 20523 (202) 632-8342	Social scientist; field experience in Kenya, Malawi, and Somalia; assisting in PPC/E organization and management of impact evaluation program in irrigation. Conference Coordinator.
Wayne Clyma Professor Agricultural & Chemical Engineering Colorado State University Fort Collins, CO 80523 (303) 491-6991	Agriculture engineer; expertise in systems analysis, system simulation and optimization, system design and evaluation, diagnostic analysis workshops, irrigation improvement strategies and interdisciplinary water management research; work experience in Chile, Egypt, Ethiopia and Southeast Asia.

E. Walter Coward
Professor
Department of Rural Sociology
and Asian Studies
334 Warren Hall
Cornell University
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Sociologist; emphasis on rural sociology in South and Southeast Asia; expertise in water management.

Owen Cylke
Mission Director-Designate
USAID/New Delhi
Agency for International
Development
Washington, DC 20523

Lawyer and development administrator. As Mission Director for India, had management responsibility for large irrigation systems programs approach to management and development. Interest in systems approach. Experience in India, Afghanistan, Egypt, and East Africa.

K. William Easter
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Applied Economics
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Agricultural economist; Professor and Head of AID project on economics of irrigation; field experience in India, Thailand, and U.S., including project evaluation; author of several publications.

Rollo Erich
Agricultural Development
Officer
USAID/Bamako
Agency for International
Development
Washington, DC 20523

Agricultural economist; team member on Rahad Irrigation Impact Evaluation in Sudan.

Shirley Erves
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AID, Room 3912
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Economist, Division of Development Planning, Bureau for Africa, Agency for International Development.

Arona Fall SAED Engineer USAID/Dakar Agency for International Development Washington, DC 20523 962-517	Hydraulics engineer; experience with Senegal River Basin Development organization.
Worth Fitzgerald Water Management Specialist Science and Technology Bureau AID, Room 412, SA-18 Department of State Washington, DC 20523 (703) 235-8993	Agriculture economist and engineer; soils and irrigation specialist; interests in irrigation policy, system operation-management; rehabilitation, maintenance, on-site experience in United States, Asia.
John Foster Director, Office of Irrigation and Land Dev. USAID/Cairo Box 10 FPO New York 09527 Tlx: 927-93773	USAID Director, Office of Irrigation and Land Development; work experience in Egypt.
David Freeman Associate Professor Department of Sociology Colorado State University Fort Collins, CO 80524 (303) 491-6991	Sociologist; emphasis on international development issues; specializes in farmer organization at local level and relationships with central irrigation bureaucracies; field experience in South Asia and the United States.
Jerome French Director S&T/Office of Multi-Sectoral Development AID Room 608 SA-18 Department of State Washington, DC 20523 (703) 235-8857	Public administrator in rural development, management. Interest in organizational, managerial, institutional aspects of irrigation, particularly relationship between implementors, system beneficiaries, and user organizations. Also, problems of recurrent costs, system sustainability.

Kurt Fuller Project Manager USAID/Bamako Agency for International Development Washington, DC 20853 Cable only	Agricultural business expert with specialty in irrigation; Project Manager, USAID/Mali; experience with agricultural machinery design, river flood control.
David Gisselquist Water Management Extension Specialist IADS/BARC c/o USAID/Dhaka Agency for International Development Washington, DC 20523 Cable only	Water management extension specialist and economist. Adviser on the management of irrigation research in Bangladesh. Experience also in Thailand.
Gregory Goewey PSC Irrigation Engineer USAID/Quito O/CAP APO Miami 34039 521-100 or 551-543	Irrigation engineer and soil scientist; expertise in irrigation project design, ground water development, computer modelling for improved on-farm water use; field experience in United States, Mexico, Ecuador.
Pablo Guerrero Senior Operations Evaluations Officer Inter-American Development Bank 808 17th Street, N.W. Washington, DC 20006 (202) 634-8140	Economist. Evaluated 14 small-scale irrigation projects in Mexico; prepared summary of evaluations carried out by the IDB office; interest in project evaluation aspects of irrigation, having tested IDB appraisal guidelines for ex-ante evaluations. Work also in Peru, Guatemala, Ecuador.
Stephen Hadley Project Development Officer S&T/MD AID, Room 608, SA-18 Department of State Washington, DC 20523 (202) 632-0436	Project Development Officer, Division of Multi-sectoral Development, Bureau for Science and Technology, Agency for International Development.

Gil Haycock USAID/Colombo Agency for International Development Washington, DC 20523 Phone: 21271 x280 (Sri Lanka) Tlx: 954-21305	Civil engineer; expertise in irrigation and water resources project planning, design, construction, implementation; also settlement and social and agricultural infrastructure; field experience in United States, South America, Asia.
Lane Holdcroft Director, AFR/TR AID, Room 2497 Department of State Washington, DC 20523 (202) 632-8178	Director, Technical Resources, Bureau for Africa, Agency for International Development. Interest in economic feasibility of irrigation projects.
Frederick L. Hotes Irrigation Adviser World Bank, Room N-1147 1818 H Street, N.W. Washington, DC 20433 (202) 676-1762	Civil engineer; expertise in irrigation development policy, technical, economic, financial, procurement, organizational and operational aspects of irrigation and drainage projects; field experience in Europe, Middle East, Africa, Asia, Latin America, Caribbean, and North America.
Chudhary Altaf Hussain Chief Engineering Advisor/Chairman Federal Flood Commission House No. 62, St. 30, F-8-1 Islamabad, Pakistan 51862, Islamabad	Civil engineer; Vice President of International Commission on Irrigation and Drainage; experience with water and power projects in Pakistan, Indus Basin Project.
Roy Hutchens Project Director, International Division General Accounting Office 441 G Street N.W., Room 4132 Washington, DC 20548 (202) 275-5790	Auditor; experience in auditing the operation and maintenance of AID-financed irrigation systems in Indonesia, Sri Lanka, Thailand.

I. M. Ibrahim
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Civil engineer; expertise in crop production and water control; design and implementation of water development projects; experience in Sudan, Egypt.

Jean Jaujay
Caisse Centrale de Corporation Economique
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France

Hydraulic engineer; expertise in irrigation, water management, rice and irrigated crop development; work experience in North and South Africa, Sahel.

Hariadene Johnson
Associate Assistant Administrator
AFR/DP
AID, Room 3913
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Washington, DC 20523
(202) 632-8214

Political scientist and economist. Interest in irrigation strategy, budget, economic and social impact. Experience in Niger (River Basin), Chad (Lake Chad), Somalia (Juba Valley), and Sudan.

Jay Johnson
Director, Central and Coastal West Africa
AFR/CWA
AID, Room 2664
Department of State
Washington, DC 20523
(202) 632-7996

Public administrator. Experience in administration and planning for the NBA River Basin Small Perimeters Project. Country experience in West Africa (Niger).

Pamela Johnson
Social Science Adviser
NE/TECH/HPN
AID, Room 6663
Department of State
Washington, DC 20523
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Anthropologist with emphasis on Middle East; team leader of Egyptian-American Rural Improvement Services Impact Evaluation.

Twig Johnson
Acting Chief, Studies Division
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Washington, DC 20523
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Anthropologist; responsible for impact evaluation series and evaluation of agricultural research.

Jack Keller Professor and Department Head Agriculture and Irrigation Engineering Utah State University Logan, UT 84322 (801) 750-2785	Civil and irrigation engineer. Co-Director of Water Management Synthesis I and II projects. Currently involved in research and evaluation of irrigation, experience in design and implementation in over 40 countries in Asia, Africa, Latin America, and Caribbean.
Brian Kline Officer-in-Charge Somalia/Tanzania/Indian Ocean States, AFR/EA AID Rm. 1058 Department of State Washington, DC 20523 (202) 632-4030	Economist; interest in possible construction of major hydro-electric power plant in Somalia and its implications for irrigation.
Bradshaw Langmaid Deputy Assistant Administrator Near East Bureau AID Rm. 6724 Department of State Washington, DC 20523 (202) 632-9126	Economist; experience with program management; field work in Afghanistan, Egypt, Jordan, Morocco.
Arturo Liebers Director, Water Resources Division Regional Development Corporation Tarija CODETAR P.O. Box 1369 Tarija, Bolivia Tlx: 355-3268	Engineer; expert in water resources management, specifically soil-plant-water relationships; work based in Bolivia.
Stephen Lintner Environmental Coordinator NE/PD/ENV AID Rm. 4440 Department of State Washington, DC 20523 (202) 632-3043	Geographer and environmental engineer; experience with environmental components of AID Near East Bureau projects; field work in Sudan, Iraq, Jordan, Egypt, Syria, Tunisia, Turkey, and Yemen Arab Republic.

Steven Londner 651 Halsey Valley Road Spencer, NY 14883 (607) 589-6858	Agricultural Economist with experience in Somalia and Ethiopia. Member of Somali Irrigation Impact Evaluation Team. Experienced in process of design, implementation, management and evaluation of small irrigation schemes for small-holders in semi-arid topics.
A. Ray Love Deputy Assistant Administrator/AFR AID Rm. 6936 Department of State Washington, DC 20523 (202) 632-9244	Civil engineer with degree also in business administration. Irrigation experience in Africa and Asia.
Max K. Lowdermilk Irrigation Specialist USAID/New Delhi Agency for International Development Washington, DC 20523	Irrigation specialist; experience in Pakistan, India. Agricultural extensionist in soils, economics. Senior Water Management Specialist for Asia Bureau. Designer of many projects. Trainer and project manager. Experience in Egypt, Sri Lanka, Bangladesh, Thailand.
John Malone Chief, Agricultural Division, OED World Bank 1818 H Street, N.W., Room 6041 Washington, DC 20433 (202) 473-2893	Economist; expertise in impact evaluation of irrigation projects; work experience in Sudan, Indonesia, Egypt, Morocco, Korea, Mexico, Madagascar, Turkey.
Sandra Malone Program Operations Specialist PPC/E AID Room 3722 Department of State Washington, DC 20523 (202) 632-2308	Program manager; member of team for Pakistan Impact Evaluation. Handled logistics and impact on women.

Charles K. Mann Associate Director Agricultural and Social Sciences Rockefeller Foundation 1133 Avenue of the Americas New York, NY 10036 (212) 869-8500	Development and agricultural economist; expertise in economic analysis of irrigation policy; experience with Topraksu On-Farm Development Project in Turkey.
Emilio Martinez Agriculture Program Specialist Rural Development Office USAID/Santa Domingo APO Miami 34041 (809) 682-2171 x 435	Soil scientist; agriculture program specialist, specifically in water management; experience in the Dominican Republic.
Dayton Maxwell Officer-in-Charge AFR/SWA/SRD AID Room 3491 Department of State Washington, DC 20523	Engineer; programs USAID policy activities for river basin development in Africa-Sahel region; experience with Gambia, and Niger River Planning, and Senegal River and Lake Chad Basin projects; other work in Somalia, Laos.
Jonathan McCabe Chief, Sahel and West Africa Projects AFR/SWA AID Room 2733 Department of State Washington, DC 20523 (202) 632-7886	Chief, Sahel and West Africa Projects Bureau for Africa Agency for International Development
John McCarthy Chief, Planning Division ASIA/DP/PL AID Room 3208 Department of State Washington, DC 20523 (202) 632-7477	Economist; expertise in design, implementation, evaluation of irrigation schemes; experience in Indonesia, Burma, Thailand, India.

Cressida McKean Economist PPC/WID AID Room 3243 Department of State Washington, DC 20523 (202) 632-2808	Development economist specializing in off-farm employment. Responsible for economic analysis for Peru Irrigation Impact Evaluation.
M. Peter McPherson Administrator AID Room 5942 Department of State Washington, DC 20523 (202) 632-9620	Administrator, Agency for International Development.
Douglas Merrey Senior Social Analyst S&T/Office of Multi-Sectoral Development AID Room 608 SA-18 Department of State Washington, DC 20523 (703) 235-8857	Anthropologist. Deputy Manager of Water Management Synthesis II Project. Experience with farmer organizations for irrigation development in South Asia.
Frank E. Mertens Agriculturalist AFR/TR/ARD AID Room 2941 Department of State Washington, DC 20523 (202) 632-0196	Agronomist with training in international agricultural development. Designed and implemented deepwell irrigation projects and settlements for small farmers in Libya; established pilot projects in Oman and Quatar; feasibility study in Nigeria, Hadejea Valley.
Patricio Millan Chief, Operations Evaluations Office Inter-American Development Bank 808 17th Street, N.W. Washington, D.C. (202) 634-8140	Economist and civil engineer; experience in planning and evaluation of water development projects in Latin America.

F. W. Montanari
Water Resources Engineer
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Civil and sanitation engineer; experience in water resources management.

Robert Morrow
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Agricultural economist. Major interests in farm management, agricultural credit and the supploy of production inputs. Long-term experience in Iran, Phillipines, Vietnam, Korea and Egypt.

Josette Murphy
Coordinator for Agriculture
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Economic anthropologist; experience as coordinator of impact evaluations in agriculture.

Richard Saise Mwanza
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Land Use Planning Officer
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Agricultural engineer. Designed and implemented rice irrigation scheme (40 ha) in Zambia; planning for design of Lottee irrigation scheme; responsible for planning and implementation of government settlement schemes, irrigated or rainfed.

Ronald Ng
Monitoring and Evaluation Officer
World Bank, Room N-1030
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Agricultural economist; specializes in monitoring and evaluation; field experience in East Africa.

Ni Van Nguyen Project Engineer c/o USAID/Dakar Agency for International Development Washington, DC 20523 962-517	Irrigation engineer, with training in irrigation and drainage. Experience in Vietnam, Senegal, and the United States.
Edward Norum Director Center for Irrigation Technology California State University, Fresno Fresno, CA 93740 (209) 294-2066	Agriculture engineer; experience with design, implementation and evaluation of irrigation projects in Near East, Nigeria and South Africa, Latin America.
Maureen Norton Acting Chief, Evaluation ADIA/DP/E AID Room 3208 Department of State Washington, DC 20523 (202) 632-5860	Agricultural economist; expertise in on-farm water management, impact evaluation of land reclamation and small-scale irrigation projects; experience in Philippines, South Korea and Egypt.
Barbara Nunberg Senior Social Science Analyst PPC/E/S AID Room 3534 NS Department of State Washington, DC 20523 (202) 632-9105	Social science analyst, Sector Coordinator. Member of impact evaluation team for AID irrigation project in the Peruvian highlands. Experience in Latin America.
Jose Olivares Senior Agricultural Economist The Word Bank Agricultural and Economics Policy Division 1818 H Street, N.W. Room N-1116 Washington, DC 20854 (202) 676-1735	Agricultural economist and engineer with field experience in Peru, Morocco, Mali, Sudan, Thailand; participant in numerous World Bank-sponsored irrigation development schemes worldwide.

Zakaria Ousman Assistant Director Agriculture and Training Services Government of Chad c/o 1957 Summit Street, Apt. A-6 Columbus, OH 43201 (614) 422-9519	Agricultural economist; former Deputy Director of DEFRA, Ministry of Agriculture, Chad.
James Painter Division Chief Planning Resource Systems Bureau for Program and Policy Coordination AID Room 3750 Department of State Washington, DC 20523 (202) 632-3918	Budget and public administration specialist with field experience in Pakistan.
Glen Patterson Deputy Assistant Administrator Bureau for Africa AID Room 6944 NS Department of State Washington, DC 20523 (202) 632-7300	Deputy Assistant Administrator, Bureau for Africa, Agency for International Development.
Dean Peterson Professor Emeritus Department of Agriculture & Irrigation Engineering Utah State University UMC 41 Logan, UT 84322 (801) 750-1149, 2785	Civil and irrigation engineer; experience with design, implementation, and evaluation of irrigation systems for USAID projects in the U.S., Middle East and Southeast Asia; former chairman of U.S. Federal Committee on Water Resources Research.
Mario Quiroga Engineer and Implementing Officer USAID/Lima APO Miami 34031 286000	Civil Engineer with experience in Peru. Project manager for AID 059 loan; interest in design and implementation of irrigation projects.

George Radosevich
Water Law Attorney and Consultant
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Attorney with specialty in water law. Has examined irrigation systems operations, evaluations, formation of water user associations, drafting laws on water resources development, management and control for surface and groundwater, structuring government organizations for implementing irrigation and water use programs.

Sanath K. Reddy
Agronomist of Rural Sociology
USAID/Bamako
Agency for International Development
Washington, DC 20523
Cable only

Agronomist, USAID, Mali; expertise in international agricultural development, specifically on-farm water management, other small-scale irrigation schemes.

Donald Reilly
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AFR/TR/TO
AID Room 2497
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Engineer with experience in Africa, Afghanistan, Korea. Involved in design and monitoring of implementation for the Helmand Valley project. Interest in realistic planning, costing, scheduling, implementation and evaluation of irrigation projects.

Sande Reinhardt
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Water management specialist; experience in implementation of irrigation projects; National Institute for Hydraulic Resources, Dominican Republic.

Frank S. Ruddy Assistant Administrator/AFR AID Room 6936 Department of State Washington, DC 20523 (202) 632-9232	Assistant Administrator, Bureau for Africa, Agency for International Development.
Joseph Ryan Program Economist PPC/PDPR/RD AID Room 2675 Department of State Washington, DC 20523 (202) 632-1772	Economist; experience with AID programs in India.
Larry Saiers Deputy Director AFR/DP/PPEA AID Room 3913 Department of State Washington, DC 20523	Deputy Director, Office of Development Planning, Division of Policy, Planning, Evaluation and Economic Analysis, Bureau for Africa, Agency for International Development.
Norman Schoonover Overseas Development Coordinator AID Africa Bureau c/o American Embassy, Paris France APO New York 09777 Tlx: 842-650-221	Development economist. Involvement with Bahel Small Perimeter Project, Senegal; OMUS Management for AID program regional agricultural research, environment, etc., for Senegal River Valley; member Cooperation for Development in Africa (CDA) Irrigation Technical Committee.
Thayer (Ted) Scudder Professor of Anthropology California Institute of Technology 228-77 Cal Tech Pasadena, CA 91125 (213) 354-4207	Social scientist, ecologist, research, evaluation of large-scale river basin development projects, and their impact on irrigated and nonirrigated systems at household, community and regional levels. Experience in Near East, Africa, Asia, and the United States.

Kenneth Sherper Director, NE/TECH AID Room 6660-A Department of State Washington, DC 20523 (202) 632-8306	Expert in development economics and public administration; experience with irrigation project management specifically in North Africa, Middle East, Ethiopia, Lesotho and Korea.
John R. Shields Staff Analyst/Agricultural Economist AID/BIFAD Room 5318 NS Department of State Washington, DC 20523 (202) 632-8409	Agricultural economist; AID/BIFAD staff analyst.
Arthur Silver Assistant Director, Special Development Isues, ASIA/DP AID Room 3208 Department of State Washington, DC 20523	Political scientist with expertise in development issues; field experience in Somalia, Pakistan, Guatemala.
Emmy Simmons Agricultural Economist, SDPT USAID/Bamako Agency for International Development Washington, DC 20523 Cable only	Agricultural economist with experience in the Philippines and West Africa. Involved in impact evaluation of Bicol, multi-donor meetings on the Office du Niger, and assessment of irrigation opportunities in the Sahel.
David Songer Agriculture Development Officer NE/TECH AID Room 6484 Department of State Washington, DC 20523 (202) 632-9262	Agricultural engineer; experience in many aspects of irrigation project design and management, overseas experience in Ecuador, Egypt, Asia and the Pacific.
Eugene Staples Deputy Assistant Administrator Bureau for Asia AID Room 6212 NS Department of State Washington, DC 20523 (202) 632-8572	Deputy Assistant Administrator, Bureau for Asia, Agency for International Development.

David Steinberg Irrigation Sector Coordinator Office of Evaluation/PPC/E AID Room 3726 Department of State Washington, DC 20523 (202) 632-8342	Irrigation sector coordinator for AID Bureau for Program and Policy Coordination. Author of a number of works on Asian history and economics.
Ben Stoner IDP Project Office USAID/Dakar Agency for International Development Washington, DC 20523 962-517	Economist and public policy specialist; experience with all aspects of integrated rural development projects especially coordinator for AID Bureau of Program and Policy Coordination. Author of a number of works on Asian history and economics.
Richard Suttor Agricultural Economist S&T/AG AID Room 403 SA-18 Department of State Washington, DC 20523 (703) 235-8946	Agricultural economist; experience in designing strategies for irrigation development in Egypt and Southeast Asia, evaluating merits of investments in irrigation versus other schemes in agricultural sector, and impact of agricultural price and subsidy policies on irrigated agriculture.
Mark Svendson Water Management Specialist ASIA/TR/ARD AID Room 3327-A Department of State Washington, DC 20523 (202) 632-9102	Water management engineer; expertise in irrigation system management with focus on farmer involvement; interest in development of "medium-tech" solutions for water control and allocation problems, and socio-organizational data; experience in South and Southeast Asia.
Akira Takahashi Faculty of Economics The University of Tokoyo BUNKYO - KU Tokyo, 113 Japan Cable: TOKUNIVECON (03) 812-2111	Economist; consultant to countries throughout Asia on irrigation, employing an interdisciplinary approach. Author of book on agricultural development in the Philippines.

Nukool Thongtawee Director, O & M Division Royal Irrigation Department Samsen, Bangkok 10300 Thailand Phone: (02) 2413348 Cable: RID Bangkok	Irrigation engineer; specific expertise in Southeast Asia in designing, implementing and evaluating irrigation projects.
Norman Uphoff Professor, Chairman, Rural Development Committee 170 Uris Hall Cornell University Ithaca, NY 14850 (607) 256-6370	Political scientist. Experience with Gal Oya Water Management Project, Sri Lanka. Member of Water Management Synthesis II Project, Cornell University. Organizer of SSRC South Asia Conference on Irrigation, Bangkok, January 1984.
G. Reginald Van Raalte Director, Office of Project Development Bureau for Asia AID Room 3318 Department of State Washington, DC 20523 (202) 632-8164	Lawyer with extensive experience in project development in Africa, Latin America and Asia. Particular interest in evaluation and learning from the experience of experts on and managers of irrigation projects.
Pieter Van Stekelenburg Engineer, Rural Sociology & Agricultural Engineering International Institute for Land Reclamation and Improvement P.O. Box 45 6700 AA Wageningen The Netherlands 08370-19100	Rural sociologist and development economist, with expertise in cooperatives. Interest in feasibility studies, evaluation, and backstopping. Country experience in Mexico, Ecuador, Colombia, Jamaica, India, and the Sahel.
Fredesbindo Vasquez Head, Instituto Nacional de Ampliacion de la Frontera Agricola Ministry of Agriculture (INAF/MIN AG) Lima Peru	Irrigation specialist; work based in Peru.

Anamaria Viveros-Long Social Science Analyst PPC/E/S AID Room 3726 Department of State Washington, DC 20523 (202) 632-0825, 1892	Social scientist; experience with evaluation of agricultural services projects directed at small farmer production.
Theresa Ware Behavioral Science Officer USAID/Bamako/SDPT Agency for International Development Washington, DC 20520 Cable only	Cultural anthropologist, rural development specialist. Interest in organization, management issues of project design to permit increased effective participation by farmers in irrigation. Experience in the Sahel.
Caroline Weil PPC/E AID Room 3941 Department of State Washington, DC 20523 (202) 632-3420	Degree in International Affairs; member of Team to conduct Peru Impact Evaluation.
Dennis Wendell Project Development Officer ASIA/PD/SA AID Room 3318 Department of State Washington, DC 20523 (202) 632-9000	International development specialist. Experience in rural development projects in pump irrigation, water management research, small gravity systems, agricultural cooperatives, and water management associations. Countries of irrigation experience: Pakistan, South Vietnam, Peru.
Herathkumara Wickramaratna Chief Irrigation Engineer Settlement Division MEA/MASL 248 Galle Road Colombo 4, Sri Lanka 589536 Ext. 211	Irrigation engineer and water management specialist. Experience in Sri Lanka and Niger. Involved in planning, design, construction and operation and maintenance of irrigation and other water projects.

John Wilkinson Program Analyst/PPC AID Room 3750 Department of State Washington, DC 20523 (202) 632-3918	Economist; team leader for Peru Irrigation Impact Evaluation.
James Wilson Human Resources Development Officer M/PM/TD/DSP AID Room 435, SA-14 Department of State Washington, DC 20523 (202) 235-1342	Political scientist and economist. Participated in Impact Evaluation for Turkey On-farm Water Management. Experience in Haiti as Project Officer.
Jerome Wolgin Acting Chief, Economic Development Division PCC/PDRR AID Room 3889 Department of State Washington, DC 20523 (202) 632-3572	Economist; expertise in financial and overall economic viability of irrigation projects, experience in Senegal.
Leonard Yaeger Deputy Assistant Administrator Science and Technology Bureau AID Room 4942 Department of State Washington, DC 20523 (202) 632-4871	Deputy Assistant Administrator, Bureau for Science and Technology, Agency for International Development.
Michael Zak Program Officer PPC/E AID Room 3534 NS Department of State Washington, DC 20523 (202) 632-9104	Political scientist in economic development. Experience with design and implementation of projects in Latin America and Africa.

Devres Conference Facilitators

Jayne Millar-Wood
President and Conference Coordinator

Allen Turner
Associate

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APPENDIX VIII

SUMMARY CABLE ON IRRIGATION CONFERENCE
SENT TO AID FIELD OFFICES

UNCLASSIFIED

AID/PPC/E/S:DSTEINBERG:SFK
5/26/83 EXT. 28342
AID/PPC/E:RBLUE/DAA/PPC:FSCHIECK/AA/PPC:JBOLTON

ROUTINE

AIDAC

E.O. 12356: N/A

TAGS:

SUBJECT: AID IRRIGATION CONFERENCE

REF: STATE 013164

1. AID, UNDER THE AUSPICIES OF THE OFFICE OF EVALUATION, ON MAY 3-6 HELD THE FIRST WORLDWIDE CONFERENCE ON IRRIGATION SPONSORED BY THE AGENCY. USAID MISSIONS WERE REPRESENTED AND HOST COUNTRY PARTICIPATION FROM: 17 COUNTRIES. THIS CABLE SUMMARIZES THE RECOMMENDATIONS EMINATING FROM THE CONFERENCE.

2. COPIES OF THE CONFERENCE REPORT WILL BE FORWARDED WHEN AVAILABLE, AS WILL A REVISED VERSION OF THE BACKGROUND PAPER.

3. THE IRRIGATION CONFERENCE BACKGROUND PAPER FOCUSED ON ISSUES OF WATER MANAGEMENT BASED ON THE LOCUS OF RESPONSIBILITY FOR SUCH MANAGEMENT. IT NOTED THREE DISTINCT CONCEPTUAL MODELS: THE INDIVIDUAL FARM IRRIGATION SYSTEM (BANGLADESH AND SOMALIA MODELS), COMMUNITY BASED SYSTEMS, AND AGENCY-BASED (GOVERNMENTAL/PARASTATAL) SYSTEMS. THIS CONTINUUM REFLECTED THE MOVEMENT FROM SUBSISTANCE TO SURPLUS PRODUCTION, AND FROM RELATIVE AUTONOMY TO DEPENDENCY IN TERMS OF TECHNOLOGY, FINANCING, TRAINING, ETC.

UNCLASSIFIED

THE PAPER ALSO NOTED THAT POOR WATER MANAGEMENT WAS WIDELY REGARDED AS THE PRIME REASON FOR IRRIGATION PROJECTS FAILING TO FULFILL THEIR POTENTIAL, AND THAT THE CLOSER SUCH MANAGEMENT WAS TO THE USERS OF IRRIGATION, THE MORE LIKELY IT WOULD REFLECT LOCAL NEEDS.

4. THE FOLLOWING ILLUSTRATIVE RECOMMENDATIONS WERE MADE BY THE EIGHT ISSUE GROUPS.

A. THE PRINICIPLE OF EQUITABLE COST RECOVERY FROM THE BENEFICIARY BASED ON BENEFITS RECEIVED AND CAPACITY TO PAY. FULL OPERATIONS AND MAINTENANCE CHARGES SHOULD BE RECOVERED FROM USERS IN CASH OR KIND AS SOON AS FEASIBLE, WITH USER ASSOCIATIONS HAVING A ROLE IN THE PROCESS. COLLECTION OF RATES IS DEPENDANT ON THE SUSTAINED AND EFFECTIVE OPERATION OF THE SYSTEM. SYSTEM MANAGEMENT SHOULD BE TRANSFERRED AS SOON AS POSSIBLE TO LOCAL USER COMMUNITY.

B. ECONOMIC ANALYSIS OF IRRIGATION PROJECTS IS IN A SORRY STATE AND NEEDS TO BE AN ORGANIC PART OF PROJECT DESIGN AND ELEMENTS OF THE POLITICAL ECONOMY MUST BE TAKEN INTO ACCOUNT. PROJECTS MUST BE FINANCIALLY VIABLE.

C. TECHNOLOGY SELECTED FOR IRRIGATION PROJECTS SHOULD PERMIT MAXIMUM FLEXIBILITY IN DESIGN, INSTALLATION, AND OPERATION. TECHNOLOGY OPTIONS SHOULD BE SYSTEMATICALLY REVIEWED BY AN INTERDISCIPLINARY TEAM PRIOR TO SELECTION BASED ON: PROVEN RECORD OF SATISFACTORY PERFORMANCE UNDER SIMILAR CONDITIONS, HIGH RELIABILITY, AGRONOMIC FEASIBILITY, ACCURATE ECONOMIC ANALYSIS (ESPECIALLY BETWEEN CAPITAL AND RECURRENT COSTS) COMPATIBILITY WITH THE ENTIRE FARMING SYSTEM, THE TARGET GROUP'S SOCIO-ECONOMIC AND EDUCATIONAL PATTERNS, AND THE HOST COUNTRY PLANNING, MANAGEMENT, TECHNICAL AND ANALYTICAL CAPACITY.

D. ANALYZE POSSIBLE GENERIC PROBLEMS CONNECTED WITH THE NEED FOR FREQUENT IRRIGATION REHABILITATION, BEGINNING WITH CAUSES, NOT SYMPTOMS. INCREASE EMPHASIS ON TRAINING BOTH FRO DIAGNOSIS OF REHABILITATION NEEDS AND FOR OPERATIONS AND MAINTENANCE. INCREASE EMPHASIS ON COMMUNITY MOBILIZATION FOR REHABILITATION AND OPERATIONS AND MAINTENANCE. REHABILITATION PROJECTS SHOULD REASSESS THE ORIGINAL OBJECTIVES OF PROJECTS TO ENSURE FEASIBILITY OF EFFORT, AS WELL AS ANY POTENTIAL FOR PRIVATE SECTOR ACTIVITY.

E. IRRIGATION PROJECTS TOO OFTEN FOCUSES ON IRRIGATION ALONE.

EMPHASIS SHOULD BE ON FARMING HOUSEHOLDS AND ON TOTAL INCOME GENERATION FOR FAMILIES INCLUDING NON-IRRIGATION AND NON-FARM INCOME POSSIBILITIES. AID SHOULD ONLY SUPPORT IRRIGATION AFTER ANALYSIS OF POSSIBLE IMPROVEMENT IN PRESENT FARMING SYSTEMS IN PREFERENCE TO INTRODUCING MASSIVE CHANGE. IRRIGATION PROJECTS SHOULD MAXIMIZE THE SPREAD EFFECTS OF IRRIGATION NON-IRRIGATORS, SUCH AS ADJACENT LIVESTOCK ENTERPRISES, RAINFED CULTIVATORS, SECONDARY MARKET TOWNS AND RELATED INDUSTRY AND LABOR. AID SHOULD ASSIST HOST GOVERNMENTS IN EFFORTS TO FORMULATE NATIONAL POLICIES RELATED TO AN APPROPRIATE MIX OF IRRIGATION, RAINFED, AND RANGE INVESTMENTS.

F. PRIOR TO INVESTMENT PLANNERS MUST INITIATE MEETINGS WITH FARMERS TO DETERMINE APPROPRIATE FARMER GROUPS AND LAND TENURE ISSUES, DISPUTE SETTLEMENT MECHANISMS, NECESSARY FARMER SERVICES, AND THE SOCIO-ECONOMIC COSTS OF IRRIGATION

G. DESIGN OF IRRIGATION PROJECTS AND PROJECT AGREEMENTS SHOULD INCLUDE HOST-COUNTRY COMMITMENT TO ACHIEVE CRITICAL ORGANIZATIONAL AND PROCEDURAL CHANGES FACILITATING PROJECT IMPLEMENTATION IN PROJECT AGREEMENT. A "ROLLING DESIGN" SHOULD BE APPLIED TO MANAGEMENT AND ORGANIZATION TO PROVIDE FLEXIBILITY, AND SUCH DESIGNS SHOULD INTEGRATE CENTRALIZED AND DECENTRALIZED FUNCTIONS AT COMMAND AREA LEVEL.

H. BUILD ON EXISTING WATER USER ASSOCIATIONS WHERE APPROPRIATE RATHER THEN CREATE NEW FORMS. AT THE INTERMEDIATE LEVEL BETWEEN FARMER ORGANIZATIONS AND STATE BUREAUCRACIES, PROJECT DESIGN SHOULD EXPLICITY INCLUDE A STRATEGY FOR 1) LINKING INSTITUTIONS AND 2) PROBLEM IDENTIFICATION AND SOLVING AT THE NATIONAL LEVEL. AID SHOULD COLLABORATE WITH GOVERNMENT INSTITUTIONS TO DEVELOP STRATEGIES FOR IRRIGATION, COLLECTION OF DATA, AND ANALYSIS AT ALL LEVELS. PROJECT DESIGN SHOULD INCLUDE METHOD TO RECOGNIZE AND AND REACT TO CHANGE IN INTERDISCIPLINARY, INCREMENTAL AND INTEGRATED MANNER. TRAINING MAY BE REQUIRED. DONOR AGENCIES SHOULD RE-EVALUATE PERSONNEL POLICIES, TRAINING AND OPERATIONAL PROCEDURES TO STIMULATE CONTINUITY, INSTITUIONAL MEMORY, FEEDBACK AND SELF-ANALYSIS.

5. ALTHOUGH THE CONFERENCE CITED NO SPECIAL CONDITIONS UNDER WHICH IRRIGATION SHOULD NOT BE PURSUED, IT NOTED THE NEED FOR CAREFUL AND REALISTIC ANALYSIS OF ALTERNATIVE PRODUCTIVE POSSIBILITIES AND OTHER CONDITIONS SUCH AS MACRO AND MICRO POLICIES THAT ACT AS CONSTRAINTS OR

INCENTIVES.

6. SPECIAL ATTENTION WAS FOCUSED ON PROBLEMS OF AFRICAN IRRIGATION, AND ALTHOUGH NO UNIVERSALISTIC LESSONS COULD BE APPLIED FROM OTHER REGIONS TO AFRICA, ATTENTION WAS FOCUSED ON PROBLEMS CONNECTED WITH THE BROAD DIVERSITY OF AFRICA AND ESPECIALLY THE POTENTIAL FOR RECESSIONAL FLOOD AGRICULTURE, A SUBJECT NOT YET FULLY SURVEYED.

7. THESE AND OTHER RECOMMENDATIONS ARE NOT APPROVED AGENCY POLICY, BUT THEY PROVIDE A FRAMEWORK FOR MORE CAREFUL ANALYSIS OF IRRIGATION PROJECTS AT THE PLANNING STAGE. AID/W IS CONSIDERING THE POSSIBILITY OF PREPARING A POLICY ON IRRIGATION.

COMMENTS ARE WELCOME AND SHOULD BE DIRECTED TO DAVID STEINBERG, PPC/E. 44

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