



**IMPROVING POLICIES AND
PROGRAMS FOR THE
DEVELOPMENT OF SMALL-SCALE
IRRIGATION SYSTEMS**



WATER MANAGEMENT SYNTHESIS PROJECT

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DEVELOPMENT OF SMALL-SCALE IRRIGATION SYSTEMS**

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PREFACE

This paper was prepared with support from the Water Management Synthesis II Project (WMS-II). As part of this project, a group of faculty and students at Cornell University reviewed past agency experiences with promoting the development of small-scale irrigation throughout the world. In addition to drawing on our own experience, we surveyed the literature and made several field visits to countries with significant small-scale irrigation experience. A workshop was also held at Cornell in November 1983 and was attended by US and international participants representing irrigation agencies, donor agencies, and the research community. The ideas in this policy report draw on all of these sources of information, experience, and opinion.

An expanded discussion of small-scale irrigation systems is available in four papers—investment, design, local organization, and agencies in the Cornell Studies in Irrigation monograph series. To order, write Cornell Studies in Irrigation, 372 Caldwell Hall, Cornell University, Ithaca, New York 14853 USA.

EXECUTIVE SUMMARY

For more than a decade, the Agency for International Development has supported projects concerned with the development of small-scale irrigation in Asia, Africa, Latin America, and the Near East. Other major donors, including the World Bank, the Asian Development Bank, the Inter American Development Bank, and Food and Agricultural Organization, also actively support small-scale irrigation projects. As worldwide experience accumulates, there is a growing need to undertake a critical evaluation. This policy report reviews past project problems and develops a set of initial guidelines for program planners instituting small-scale projects throughout the world. The report is directed toward both aid agency planners and national agencies responsible for irrigation development. Within this broad framework, widely applicable planning advice is outlined, although ample attention is also devoted to the individual problems that occur under localized conditions.

A comprehensive two-part definition for small-scale irrigation is developed. Traditionally, small-scale irrigation is defined by command area alone. However, although size is an important criterion, equally necessary is the inclusion of systems that are managed by local entities. This two-part definition allows planners to form a more complete picture of the sector and to make use of complementary and contrary experience from both types of systems.

Small-scale irrigation has a number of attractions for host countries and donors alike. These include the possibility of rapid completion, exploitation of new water sources, the dispersion of state funds among scattered sites, and the potential to significantly aid small and marginal farmers. However, programming difficulties can make small-scale projects hard to implement. A primary problem has often been in motivating local user groups to undertake management responsibilities for new or rehabilitated systems. Design problems can also negatively affect these systems. Perhaps the most critical and ambiguous question raised in this paper is the optimal mix of state and local responsibilities for creating and sustaining small-scale irrigation facilities. It is not always possible to know what the optimal mix is as a program is planned, although evidence suggests that less central agency involvement is generally better than more. Four primary program elements are critically affected by this choice: the investment process, engineering and design, local organization and farmer participation, and actions of the technical agencies.

During the past two decades, direct government investment in irrigation works predominated. Small-scale systems have generally become part of the public sector, and the agency their ultimate owner and operator. An indirect investment strategy may not allow the agency to completely control development, but it is more likely to induce matching investments from the locality. Also, responsibilities for maintenance and operation are more likely to be undertaken by the local users, and the difficult task of persuading farmers to assume responsibility for works that they had no part in designing is bypassed. In developing a format for an indirect investment strategy, three steps should be taken:

1. Investigation of investment strategies in the small-scale and agency sectors;
2. Investigation of the capacity of local groups to operate irrigation works on a sustained basis; and
3. Study of the implementing irrigation agency.

The technical design of irrigation systems normally receives a great deal of attention from both national and donor agencies. While appropriate design is critical to project success, planners must ensure that training programs designed to improve engineering skills orient the engineer to the independent design of small-scale systems. Attention to locally provided information and experience is also important. In sum, as part of the institutional analysis, the irrigation agency's technical design process should be carefully documented. If an existing local sector will be assisted by the project, information should be gathered regarding the design processes used in this sector.

A participatory design process should include specific plans for developing agency capacity for action in a participatory manner.

Almost without exception, small-scale irrigation programs anticipate that some irrigation responsibilities will be assumed by local groups.

The assumption of these responsibilities requires the existence of effective irrigators' associations. This in turn will depend upon agency policy regarding farmer participation in early project phases, the role of local organizations vis-a-vis development agencies, an agency's understanding of the local social structure, and attention devoted by the agency to organization building. If local organizations are to be effective,

- (1) there needs to be agreement on the policy that local irrigation groups will be created as autonomous local entities rather than as appendages of an irrigation agency;
- (2) program planning should be based on a detailed understanding of the local social structure;
- (3) programs must involve local farmers in preconstruction organization efforts in early project decisions;

- (4) provision should be made for action research and monitoring activities related to local organizational processes.

A consideration of agency roles and processes in small-scale irrigation programs should include examination of the following issues: agencies and the investment process, the choice of implementing agency, the service role for the agency, creating an organizational set for the agency, and the special role of private voluntary agencies in small-scale irrigation development. Small-scale project planning should include

1. An identification of the various agencies involved in small-scale irrigation activities, both public and private;
2. A decision on the style of program implementation;
3. The development of a working group to act in concert with the implementing agency.

Small-scale irrigation systems have been and promise to continue to be essential elements in the irrigation sector of many third world countries. Policies and programs for small-scale irrigation that facilitate a new mix of agency and local rights and responsibilities in irrigation development hold considerable promise for the future.

For more than a decade, the Agency for International Development has supported projects concerned with the development of small-scale irrigation facilities. Projects have been implemented throughout the world in Asia, Africa, Latin America, and the Near East.¹ Other major donors such as the World Bank, the Asian Development Bank, and FAO are also actively supporting small-scale irrigation projects. As interest in small-scale systems deepens, there is a growing need to evaluate our past experiences. This paper, however, does not simply evaluate the present situation, although it does draw extensively on earlier research reports. Instead, the purpose is to provide a more comprehensive picture, to develop guidelines to be used by agencies involved in formulating policies and programs supportive of small-scale irrigation.

Before discussing policy and programs, we need to develop a definition for the widely-used term small-scale irrigation. First, we eliminate irrigation systems that serve individuals or single enterprises rather than a group of users. The most common method used to delineate small-scale systems is to assess size of command area. For example, in India, "minor" irrigation systems are defined as those with less than 2,000 irrigated hectares. Alternately, small-scale systems can be defined according to a maximum project cost.

Although these parameters take in many "small" state-run systems, there is often another category that is outside the responsibility of the irrigation agency (these systems may receive some aid from other agencies such as the agriculture department or the rural development department). These systems are sometimes referred to as traditional, indigenous, or local. While command areas are typically small,² the systems are relatively independent of the state and are managed by a local entity that can take several forms.³

Thus, in considering small-scale irrigation programs (especially in settings where irrigation already exists), our definition includes two distinct categories: (1) smaller systems in which the state irrigation agency is directly involved (the precise definition will vary from state to state), and (2) local irrigation works that are managed by a local entity (which may be relatively "invisible" to the formal irrigation sector).

Our two-part definition incorporates the standard agency approach of assessing command area and systems that are locally managed. Using one definition alone will

obviously lead to a less than complete picture and may omit systems in one section or the other. We know that both categories of small systems can occur simultaneously in a given region, thus we prefer basing program explorations and initial feasibility studies on an investigation of both categories. There are several programming advantages to this approach.

- Program assistance will not inadvertently be limited to the government small-scale irrigation sector (though that may be the ultimate choice in a particular project formulation).
- Accessible local sector irrigation experiences may help to convert more government small-scale systems into local sector systems.
- Contrasting and analyzing the performance of small-scale systems of each type may help to identify appropriate forms of government assistance to each category (we stress that assistance is likely to be different).

Having "highlighted" the local sector, assistance programs must be planned such that policies and procedures that merely transform local systems into small-scale government systems are avoided. The exception would be those cases where it can be shown that local sector systems are no longer viable as autonomous entities.⁴

THE IMPORTANCE OF SMALL-SCALE IRRIGATION

Past attention to large-scale irrigation works with their complex engineering facilities, enormous budgets, and visible irrigation bureaucracies has distorted our picture of the prevalence of small-scale irrigation. In most instances, small-scale irrigation has been viewed as unimportant, or at best transitory, but the facts suggest otherwise. There is evidence that small systems are significant in terms of total area commanded and in persistence over time in a wide range of national settings.

- In Utah and Colorado, between 85 and 90 percent of the irrigated area of each state is managed by mutual associations (both incorporated and unincorporated), with an average command area of about 700 hectares.⁵
- In Korea, 64 percent of the total irrigated area is served by systems of less than 50

hectares that are managed by autonomous farmer organizations (Wade, 1982).

- In West Africa, significant portions of the irrigated area are served by traditional systems (Underhill, 1983); in Nigeria, there are about 800,000 hectares of "traditional" irrigation and just over 100,000 hectares of "modern" irrigation.
- In the South Indian state of Tamil Nadu, nearly one million hectares of land are irrigated by tanks. More than 50 percent of those tanks have commands of less than 40 hectares (Saktivadivel et al., 1982).
- In the Peruvian sierra, nearly 500,000 hectares, about 20 percent of the total cultivated area, is irrigated by small- and medium-scale systems (Bazo, 1982).
- In the Philippines, approximately 50 percent of the irrigated area is served by local, communal systems (Korten, 1982).

Recently, policy makers have viewed assistance to small irrigation systems as important for other reasons. One notion is that investment in small systems reduces the period between project initiation and system operation, garnering quick results. A second attraction is that small-scale irrigation facilities can sometimes be used to exploit new water sources as, for example, in the case of pumps for extracting groundwater. A third advantage is that small-scale irrigation programs can allow state resources to be dispersed among numerous project locations. Finally, small systems are more likely to reach small and marginal farmers. While each of these outcomes are theoretically possible, program design and/or implementation can preclude attaining these results.

Nonetheless, the desirability of these irrigation goals, the widespread dissatisfaction with the performance of large-scale irrigation schemes, and the prevalence of small systems in many countries suggest that a significant portion of donor funding for irrigation development should, and will, be directed toward the small-scale irrigation sector including the government and the local sector component.

DIFFICULTIES IN PROGRAMMING SMALL-SCALE IRRIGATION PROJECTS

While the development of small-scale irrigation works has proven to be an effective means to expand or improve irrigated area, increase

food production, and raise producer incomes, certain difficulties also repeatedly occur. There are frequent problems with the physical design of small-scale agency systems, and once designed and built, O&M performance has been poor, partly because of the difficulties agencies experience in attempting to motivate local user groups. Finally, a growing problem is that of the recurring government costs in operating small (as well as large) systems.

Design problems in the local sector sometimes occur because of limited knowledge, materials, or both. Uncontrollable environmental changes such as a shifting river course or changes in runoff patterns due to watershed deterioration can also negatively affect these systems. In the local sector, there often are problems in mobilizing resources when the availability of resources changes sharply or when unusual catastrophes destroy developed facilities, requiring emergency labor. One of the most difficult problems faced by systems in the local sector is effective interaction with government agencies that does not compromise their capacity to be self-sustaining.

At present, there is considerable interest in developing appropriate formats for small-scale irrigation development. At one extreme, some governments suggest that technical agencies assume more responsibility in both local and state small sectors. A minority of others are proceeding in the opposite direction. We believe that the most critical and ambiguous issue is that of the optimal mix of state and local responsibilities in creating and sustaining small-scale irrigation facilities.^b

It is not always possible to know what that optimal mix is at the time a program is being planned, although there is evidence to suggest that less central agency involvement is generally better than more.⁷ Nonetheless, a tentative decision has to be made and a set of monitoring and evaluating procedures put in place that will allow reassessment of and modification in the mix, if required. A failure to be clear about the desired balance of responsibilities between the locality and the agency and inconsistency between this and other features of the small-scale irrigation program seems to be central to many implementation difficulties. As detailed below, ambiguity about this mix has especially undesirable impacts on four critical program elements—the investment process, the engineering design process, activities of the local users' group, and the action of the technical agencies.

KEY PROGRAMMATIC CONCEPTS

In designing a program for small-scale irrigation system development, consideration must be given to four key program components:⁸

- THE INVESTMENT PROCESS in which choices are made regarding what resources will be provided by whom and through what processes.
- THE DESIGN PROCESS involving choices about who will implement what design procedures to identify and specify the technical components of the irrigation schemes and their technical procedures.
- THE LOCAL ORGANIZATIONAL PROCESSES in which choices are made about what local entity(s) will perform what irrigation functions.
- THE AGENCY PROCESSES in which choices are made about what agency(s) will implement what activities with what staff and with what objectives.

It is important to note that these four components are highly interrelated and choices made regarding one component may either require or preclude choices in another. Choices regarding each of these components may be different for small-scale systems in the agency sector as compared to choices for the local sector. Finally, we recognize that it may be impossible to make final choices at the time of project design because of inadequate information, limited experience, etc. In that case, the preferred alternative is to build procedures into program implementation that will allow review of the initial choices and subsequent modification if needed.

THE INVESTMENT PROCESS

During the last two decades, the dominant mode of government investment in irrigation works has been direct.⁹ That is, the government, acting through one or more of its technical agencies, acts directly, using its own budget and staff to design, construct, and operate irrigation facilities that are government-owned. Of course, there have often continued to be parallel investments in the local sector through the mobilization of local resources. Though fewer in number, there have also been some interesting government programs that are based on an indirect investment strategy in which government makes resources available to the local sector (in the form of grants, subsidized

loans, technical assistance) to begin irrigation development on works owned and controlled by the locality.¹⁰

The direct investment process creates small-scale systems that are in the agency sector with the agency as the ultimate owner as well as the operator, although it may attempt to assign responsibility for some of the more onerous tasks to water users. On the other hand, the indirect investment process is a way of channeling resources to the small-scale systems in the local sector, either to create new works or to improve existing facilities.

Each of these investment strategies has potential advantages and disadvantages. Advantages of the direct investment strategy include the ability of the technical agency to plan and, to some extent, control the pace of development and improve the technical quality of the works that are constructed. The disadvantages are the usually higher initial expenditures that are required (in part to fund the costs of the supporting bureaucracy), the increased burden to recurring costs because of the agency's continuing responsibility to maintain and operate the facilities, and the usual difficulties encountered in transferring any of these responsibilities to a local group. Irrigation systems built in the direct investment mode also frequently encounter the problem of goal incompatibility—for example, the agency's goal with regard to crop production may be at odds with the objectives of the local producers. Since the direct investment approach often proceeds with little prior discussion between the agency and the farming community, these differences may not become apparent until well into project implementation.

A related issue is that of site selection. In the direct investment approach, primary responsibility for the selection of project sites rests with the agency—though in some cases it may, in part, be responding to requests that have come from local groups. One result is that agencies are sometimes required to select sites when only partial information is available. While some of these difficulties might be overcome by better planning and implementation, some are fundamental to the investment process itself. Direct investment places the locus of control squarely with the implementing agency, usually creating few opportunities or incentives for local involvement until very late in the process. Typically, local involvement at that time takes the form of bounded responsibility for something that government has created and controls.

In contrast, indirect investment has the disadvantage that the agency may be less able (though not completely unable) to control the pace of development and to achieve technical modernization of the works. With indirect investment, control over these key decisions shifts from the technical agency to a local entity. There are, however, several advantages to this strategy. First, government investment can have the effect of inducing matching investment from the local group, thus reducing the cost of irrigation development to the government.¹¹ Recurring costs to government are also reduced because the responsibility for maintenance and operation of local sector systems is largely with the local group (though government aid may be required in unusual circumstances). An additional advantage is that the transfer issue is avoided, the difficult process of persuading local people to be partially responsible for something that government has created and that all parties perceive as belonging to the state. Similarly, indirect investment can ameliorate problems of goal incompatibility since the local group will come forward requesting assistance to achieve goals that it has identified as important (though the matter of goal incongruity within the group should not be discounted). The indirect approach also incorporates site selection issues. Communities able to agree to request assistance will show some of the social capacity required for successful irrigation development. Of course, not all communities requesting assistance will have the physical conditions that would make investment feasible. With indirect investment, the process starts with the clear arrangement that government is providing assistance to some local group to create or improve works that belong to that group and that will be operated to achieve that group's goals.

In sum, the indirect approach uses instruments such as subsidies, low interest loans, grants, tax abatements, technical assistance, regulation of water rights, food-for-work aid, and other means and their combinations to support the basic investment actions of a local irrigation-owning group. The end result of indirect outside investment is markedly different from direct state control over new or modified irrigation works.

Thus, the choice of an investment strategy is a fundamental step in planning a small-scale irrigation program. While there is no single prescription for selecting between direct and indirect investment strategies, there are a series of preproject planning steps that can help

ensure that consideration of this critical choice has been adequate. These steps include the following:

1. As part of the institutional analysis component in the planning process, investigation of the investment strategies being used in both the small-scale agency and local sectors should be conducted. This analysis should contrast the approaches (if both exist in the national setting being considered) and, if possible, provide data on the outcomes in each sector. If any experience with indirect investment exists, an understanding of the inducement effect that such a strategy may have had is especially useful.
2. During the institutional analysis, planners should carefully investigate and assess the current and recent past capacity of local entities in both the agency sector and the local sector to sustainably operate irrigation works. If viable groups already exist in the local sector, a strong case can be made for employing the indirect investment approach. If functioning local groups already exist in the agency sector, the indirect approach may be initiated and result in the shift of systems from agency to the local sector. If no viable groups are found, it will be impossible to use an indirect approach unless planners are prepared to actively and formally promote group formation as part of the project.
3. The third step is a study of the irrigation agency (and/or other agencies dealing with small-scale irrigation in a particular locale). A careful analysis of the past experiences of the agency in providing assistance to small irrigation works in both the agency and local sectors is a critical part of the assessment. This analysis will help identify the extent of agency development and reorientation that would be required to successfully implement either of the strategies.

Many evaluation studies of AID small-scale irrigation projects have come to conclusions similar to that of the 1979 report, "Pattern Analysis of Small- and Medium-Scale Irrigation Projects" (p.4):

Locally-managed irrigation systems are generally better maintained and more efficient in water control than systems dependent upon state operation.

As outlined above, the indirect method of irrigation investment offers greater potential

for creating or assisting sustainable, locally-managed irrigation works. In contrast, direct investment compromises this outcome. Projects with the explicit goal of developing small-scale irrigation works that are effectively operated and sustained over time by local entities should give close consideration to the design of investment processes that are indirect rather than direct. As is discussed below, the fundamental decision to pursue an indirect investment strategy has implications for the three other key program processes.

THE DESIGN PROCESS

In the formulation of small-scale irrigation projects, AID gives a great deal of attention to the technical design of the subprojects. This arises, in part, from AID's interest in having the transfer of modern technology and technological knowledge be part of its irrigation projects, and in part reflects concern that AID funds are used to construct civil works that are sound from an engineering perspective and not subject to allegations of malfeasance. In spite of the effort spent on the design process, problems still continue to plague small-scale programs (GAO, 1983).

An end result of these concerns is that the technical irrigation agency is assigned primary responsibility for establishing design criteria and applying these to subproject design and construction. The agency can then be held accountable for problems in the design and construction, though, in actuality, there is often little accountability within the agency for poor project design. The large role assigned the agency often means that a local presence in decision making is effectively displaced. As a result, design decisions are typically formulated and implemented with little utilization of local information and experiences that farmers may have but that designers may find impossible to acquire using normal engineering design procedures. The omission of local knowledge and experience from the design process is especially critical given that most currently used design procedures are highly information-intensive and that the information required usually is not available in the formal sector for the specific locations for which works are being prepared—stream flow data has not been recorded, micro soil maps are not available, and detailed topographic maps have not been prepared.

Many small-scale irrigation programs include funds for training the design staff to improve their engineering skills. While the

need for additional training is often called for, training that orients the designer to more sophisticated, information-intensive procedures may be dysfunctional. Most traditional training programs are not likely to prepare engineers to better design small structures in the absence of formal data.

Training programs that encourage the independent design of small systems based on a modest collection of formal data and a high input of locally-provided information and experience (coming from either or both farmers and/or local agency staff) need to be developed. Programs should also emphasize an incremental and flexible design approach that proceeds from few and simple structures and techniques (building on local apparatus where they exist) that can be modified over time as needs arise and additional information and experience is acquired. In computer terminology, we can say that there is a need to design small-scale irrigation works that are "user-friendly"—that build on familiar operating principles and that utilize local construction materials available to, and manageable by water users.¹²

This design approach is especially relevant in the case of local sector small-scale irrigation. When working in this sector, it is important that the structures and techniques designed for improving the system build on what already exists and avoid creating facilities or procedures that increase the dependency of the systems on the agency.

This approach can also be applied to systems in the agency sector. Incremental design procedures utilizing a high degree of local input will result in more manageable systems by water users either as part of an agency system or make more feasible the transfer of subprojects from the agency to the local sector.

In formulating a small-scale irrigation program, specific attention must be devoted to

- which design procedures are necessary,
- who will implement design plans,
- what technical structures will be specified,
- which procedures will be planned.

Typically, as the irrigation agency develops a plan, it will follow an established design format, specify the various water diversion or pumping, conveyance, and distribution structures, and list the procedures to be used in allocating and distributing water from these structures. This approach has two shortcomings: (1) poor initial information may cause faulty designs; and (2) because water users do

not participate in the design process, they will have little commitment to the final structure and may even feel alienated due to design-created conflicts.

A design process that blends professional expertise and local knowledge, experience, and preferences is requisite for success. There are at least two ways in which such a process may be developed. Where an indirect mode of irrigation investment is being pursued, control of the design process will be in the hands of a local group and necessary technical services made available from the irrigation agency. Since the agency is performing a support role, there is a greater likelihood that local knowledge and preferences will be incorporated into the design. Or, if this does not occur, the local group may be in a position to reject the design altogether. If such a service role is new to the agency, effort will have to be devoted to training staff and developing agency procedures that support this mode of operation.

When the direct mode of investment is being followed, significant modifications in the agency's processes and procedures for designing the civil works and the embedded operational procedures may be required. Training that focuses on the new skills that will be required, as well as the modified agency procedures that will be necessary, must be given top priority (Alfonso, 1981). Furthermore, since these skills and procedures will likely be novel in the particular project settings, it will be necessary to provide staff training. The content of this training should be based on the results of case studies, action research, and other learning modes.

In summary, in formulating a small-scale irrigation development program, a key programmatic issue to be considered is that of the nature of the technical design process to be used. There is growing evidence to support the proposition that the design process is enhanced when local knowledge, experience, and preferences are incorporated along with modern engineering skills. Incorporation of local input can occur when local groups are in control of the design process, as with the indirect investment approach. In the case of a direct investment approach, provision is needed for the development of modified agency procedures and the training of staff in skills needed to gather and utilize locally-provided information.

Steps to be taken in developing a sound technical design component include the following:

1. As part of the institutional analysis, the technical design process now being used by the irrigation agency (under both the direct and indirect investment approaches, if they each operate) should be carefully documented. This documentation should focus on the steps followed in the design process, the nature of the preproject data that are collected, and the design results.
2. If there is an existing local sector that will be assisted under the project, information should be gathered regarding the design processes that are in use. This analysis should give attention to the concepts that are employed, the data that are utilized, the persons who are involved, and the design results. If there has been previous government assistance to the local sector, an analysis of the impact of that aid on the design process should be included.
3. If a participatory design process is to be used, and if it is determined that the existing design process omits local involvement, project formulation must include specific plans for developing the agency capacity to act in a participatory manner. Usually this will require planning for three sets of activities: (1) experimental efforts and action research to identify and test suitable procedures and approaches for including farmers in the technical design process, (2) the development of staff training programs based on action research experiences, and (3) the modification of agency procedures to support staff working in a participatory manner.

LOCAL ORGANIZATIONAL PROCESSES

Almost without exception, planning for small-scale irrigation program development anticipates some irrigation responsibilities being assumed by local groups—even though these groups may not be involved in that planning. Some plans are even quite specific as to the type of local entity that will assume these responsibilities, usually a water users' association (WUA). Irrigation projects continue to make this assumption, even though there have been very few positive experiences.

In reviewing agency experiences with water users' groups, several issues repeatedly arise.

1. **The issue of organization after construction** (Korten, 1982).

Since, in most instances, the role of the local irrigation group is primarily conceptualized as that of being responsible for the civil works—cleaning the canals, repairing small damage, etc.—especially in the agency sector; understandably, little or no attention is given to the local group until something has been constructed and needs to be maintained. This approach has numerous shortcomings.

First, late local involvement in the development process usually means that there is little beneficiary input in preconstruction decisions and activities, such as those regarding the investments to be made and the design of the physical structures and layout. Without a local organization, it will be difficult, if not impossible, for the agency to obtain preconstruction inputs. Unfortunately, there are even situations in the local sector where groups exist but have been bypassed in the first project stages.

Second, and related to the first point, if the water users are not involved in the design process, there is an increased possibility that the end result will be inappropriate facilities for local conditions—turnouts incorrectly located, volumes of water insufficient, or procedures will be required that the local group cannot implement. The result is that the irrigation group, new or old, will be asked to be responsible for a set of civil works that simply do not do the job. This is clearly a disadvantageous assignment for any group.

Third, beginning the organizational effort after construction may be complicated by the fact that the planning and construction processes created or exacerbated conflicts between the group members (for example, disputes over the location of canals), which make the achievement of a reasonable level of group solidarity difficult.

Fourth, phasing the organizational effort to follow construction means that a very important opportunity to use preconstruction activities as a locus for group formation and strengthening has been lost. Since there are so many critical decisions to be made in the preconstruction period, this is an ideal time to offer the irrigation group opportunities to participate and to relate this participation to organizational efforts. Delaying organization until after construction may leave the farmers with the impression (perhaps a correct one) that they are simply being asked to be the system's caretakers.

A fifth problem is that pressures are created for rapid group formation because the completed facilities need to be operated and maintained immediately. Starting group organization processes in the preconstruction period allows a more suitable pace of group development to be followed. In the Philippines' communal program working with systems in the local sector, planners have found that organizational activities should begin several months before design efforts are initiated (Korten, 1982).

Finally, we should note that if the intended beneficiaries stand on the sidelines until the system has been designed and constructed, they are likely to feel alienated toward both the development process and the irrigation facilities. Attempting group formation or improvement in a context of alienation is an unpromising beginning.

There are, then, several important reasons for reversing the usual pattern of construction before local organization. This is a general strategy that should be adopted in all small-scale irrigation development programs, both those operating in the agency as well as the local sector.¹³ If this path is followed, there are a number of programmatic consequences that follow.

2. Local groups as appendages of the agency.

Nowadays, most irrigation agencies are in favor of, or at least accept, the notion that local irrigation groups should be formed or strengthened. What is sometimes less clear is the desired relationship between these local groups and the agency. Particularly, but not only when operating in the agency sector, irrigation agencies act as though the local groups are appendages of their bureaucracy rather than autonomous groups with their own irrigation agendas. In fact, there is some question as to whether or not irrigation agencies can actually create autonomous irrigation groups—though they may be able to help strengthen existing autonomous groups. There may be an important role for private voluntary organizations (PVOs) in these organizing efforts—though it is important to recognize that the PVO will need to have, or develop, specific experience with organizing groups for irrigation purposes, if it is to be successful.

Evidence for the appendage approach is seen in such agency actions as appointing the local leaders, standardizing the group's constitution, and establishing the group's functions. While

the agency may have a point of view on all such matters, if it controls these critical decisions, local people will see the group as an appendage of the agency rather than as an independent organization. Therefore, the apathetic response to many efforts to establish water users' associations should be interpreted as a reluctance to be part of an agency's bureaucracy rather than as a reluctance to act collectively for irrigation purposes. Program planning needs to establish a set of concepts and procedures to implement a strategy for creating, or strengthening, autonomous local entities. Strategies that are designed to create local groups controlled by the irrigation agency have little promise of success.

Autonomous local groups in either the agency sector or the local sector have two potentially important features that contribute to their success. First, they are accountable to people in the local setting rather than to an external agency. This downward and internal accountability enhances the probability that the organization and its leaders will perform suitably in the eyes of the group's members and be able to mobilize the resources required for sustained group action. Autonomous groups can also flexibly deal with changing local circumstances and adjust to varied microsettings (both physical and social) in a way that is difficult for groups that are part of a large agency structure. The flexibility implemented by a locally-accountable association staff has a high probability of evincing local support.

3. Understanding the local social structure.

A third reason that agencies frequently encounter difficulty in working with users' groups is that they lack understanding of basic aspects of the local social structure. In this case, necessary information varies somewhat in the situation where irrigation already exists as compared to the situation in which irrigation is being introduced.

In the case of an area that is already irrigated—a common situation in AID irrigation projects—planners must first determine what organization for irrigation tasks, formal or informal, exists in the project area (Coward, 1984). Especially in the local sector, one may find the existence of traditional irrigation groups in various states of viability. Where such groups exist, efforts should be made to understand the tasks they perform and the relationships that exist between these tasks and the physical infrastructure that the group is operating. If such groups have ceased to exist or are in a state of disarray, there will be a

need to investigate the causes of their demise as a basis for planning appropriate program actions. Where irrigation is being developed as a novel approach to agriculture,¹⁴ attention should be given to studies of the local social structure to determine what factors and experiences in the local setting can be used to support group action, which irrigation system operation and maintenance will require.¹⁵

A second very important aspect of the local social structure is ownership and distribution of land and water rights in the locality of the project. The fundamental point is that irrigation activities inevitably alter existing rights—expanding them, redistributing them, or changing their nature—and the reactions of people to proposed or completed irrigation development activities will depend, in part, upon what will or has happened to their rights. Not infrequently, agencies implement irrigation development activities either ignorant of the local pattern of rights or with the assumption that the benefits of the project will be so overwhelming that people will accept any reorganization of rights that occur.¹⁶ In some instances, arrogant agencies assume that local people have no rights superior to those of the state agency. In brief, proceeding without a background knowledge of local rights is likely to create a situation in which the arbitrary gains and losses resulting from the project are a major impediment to the creation or continuation of a viable users' group.

4. Group formation as an agency sideline.

The last point to be made regarding programming for local organizational processes is that work with water users' groups often is merely a sideline responsibility of the irrigation agency. Core staff are not trained to plan and implement these activities and the irrigation agency usually provides few rewards to people who concern themselves with social processes. Clearly, a young engineer will receive more reward for designing an impressive weir than in forming a water users' group.

As a result, the agency is usually staffed with unskilled and unqualified personnel for WUA activities. In many places, organizational activities will be assigned to the agriculture department and its extension staff on the presumption that they know how to work with farmers. In many cases, this also is unsatisfactory because most extension staff are trained to transmit information rather than to assist in organizational activities. As will be discussed, a major programming issue is who (that is,

whose staff with what professional skills) will be responsible for local institutional development activities. Also to be considered is the question of whether a different staff is needed to work with groups in the local sector as compared to groups in the agency sector?

Thus, several matters related to local organizational processes must be considered as part of the program development process. These include the following:

1. There needs to be agreement on the policy that local irrigation groups will be created as autonomous local entities rather than as appendages of the irrigation agency. If it is not possible to achieve agreement as a precondition to the project, then provision should be made in the context of the project to experiment with the creation of such groups—establishing them in selected areas and carefully monitoring their performance. It should also be agreed that the results of these tests will be the basis for a reconsideration of existing policy.
2. Program planning for small-scale irrigation should be based on a detailed understanding of the local social structure—especially an understanding of any existing organizational arrangements for operating irrigation facilities and information regarding the pattern of rights to land and water in the project areas. Where such information does not exist at the time of project planning, steps must be taken to carry out data collection as part of the design process or, if that is not feasible, incorporated into the program as an early project activity. Where possible, the use of local social science research groups to obtain this information is highly desirable (more on this in the following discussion of agency processes). Elaborate village studies are not needed, but the usual questionnaire-based research approach is also not appropriate. There has now been enough experience with investigating local irrigation organization that techniques using combinations of local informants, written records, and field observations can yield suitable results.
3. To provide a solid base for forming new irrigation groups or strengthening existing ones, the irrigation program must give explicit attention to preconstruction organization efforts and arrangements for involving the local group in the early project decisions. Where this is a new procedure, the project will need

to provide a plan to identify and test tentative procedures for broader use in later stages of project implementation.

4. Finally, an important part of the program design should be the provision for action research and monitoring activities related to these critical local organizational processes. It is very likely that in the planning stage much will be unknown about these processes and impacts that government intervention may have on them. Rather than setting out a five- or seven-year program that assumes certain conditions to be true and then details the actions to be taken by various parties, there is a need to make starting assumptions and provide procedures that will allow those assumptions to be tested and alternative strategies to be examined. An excellent example of this approach is the recently initiated program for development of minor irrigation in the state of Madhya Pradesh, India (AID, 1983). In this project, the planners recognized the importance of local groups in the operation of the minor irrigation systems, but also were cognizant of the fact that there was little prior experience on which to build. The solution was to include in the design a series of action research projects intended to develop the experience and knowledge needed for later implementation.

AGENCY PROCESSES

1. Agencies and the investment process

As a result of the widespread use of the direct investment approach in implementing programs of small-scale irrigation development, the activities of irrigation agencies have become a critical part of the process. Thus, one finds components to strengthen the capacity of the agencies dealing with small-scale irrigation through staff training and the provision of transport and other facilities, etc., in many project proposals. On close inspection, it is clear that most of these strengthening activities are designed to make the agency more effective in implementing direct irrigation investments. In situations where the indirect mode is being used, other institutional development approaches will be required. Thus, program choices regarding agency assistance turn, in part, on the fundamental decision regarding the investment approach that will underpin the development program.

2. The choice of implementing agency

In many operational situations, the second basic choice is which agency or agencies will be supported for implementation of the small-scale irrigation program. This issue arises because, in many places, responsibility for small irrigation works may be delegated to various agencies: the irrigation department, but also the agriculture department, and sometimes the department of local government or home affairs. Or, as in Indonesia, for example, different agencies had responsibility for separate portions of the systems—the main system works were built by the irrigation department and the tertiary facilities by the agriculture department. In making this choice, it is also important to understand what processes of change may be underway. In numerous settings, one observes that during the past decade all irrigation activities become more concentrated in the irrigation agency while they became more peripheral in others. The wrong choice can result in a frustrating inability to implement the program design and preclude the ability of program expansion and continuation following the assistance of the external donor.

The choice is sometimes complicated by the fact that the irrigation agency is likely to have a direct construction orientation, whereas other agencies dealing with small-scale irrigation may have a more indirect orientation and provide building funds to local government bodies.¹⁷ On the other hand, the irrigation agency will likely possess superior engineering skills and competence. Thus, if indirect investment strategy is being pursued, there will be an important choice between assisting the technical agency develop the skills and capacities to implement a new strategy and assisting the nontechnical agency to improve its technical capacities.

There may be a number of situations in which the program designers choose to cooperate with more than one implementing agency. For example, if the program of small-scale irrigation development is to be implemented in both the agency and the local sectors, different agencies may be appropriate actors. The key points include an identification of the sector(s) in which the program will operate (agency and/or local); an identification of the agencies, if any, that are working in each of those sectors (both government and nongovernment organizations); and a decision regarding which of those organizations will be implementors of the planned program. By electing to work with the irrigation agency alone, the program may limit

itself to the agency sector only or to a particular approach to development of the small-scale sector.

3. A service role for the agency

The previous discussion regarding the role of local groups in small-scale irrigation may leave one with the impression that there is little for agencies to do. However, this is not our conclusion. Rather, what is needed is a mix of state and local responsibilities. In too many cases, the present mix gives undue weight to the agency, insufficient attention to the locality, and the present pattern may also assign the wrong tasks to the agency.

Our basic point is that, given the size of the command areas and the dispersed nature of these commands, the agency role in small-scale irrigation development should be a service role rather than the role of operating and managing these small works. Services would be provided to the various local entities—farmer irrigation groups, cooperative organizations, local governments, etc.—responsible for the operation of the irrigation facilities. Among the service functions are the following:

- provision of financial assistance in the form of grants or subsidized loans;
- technical assistance in designing and constructing facilities;
- technical assistance with regard to improved system management;
- assistance in the formation or strengthening of a local water users' group;
- the regional coordination and regulation of water allocation between systems, as in a watershed, along a particular stream, or for a designated groundwater area.

With the exception of developing water users' groups, this range of tasks is one that many irrigation agencies will be able to perform—or could perform with some additional assistance. What is implied in this definition of tasks, and is more difficult to achieve, is a style of implementation that emphasizes support for local groups.

Some important research analyzing the extent of bureaucratic reorientation that is needed to implement a more participatory style of irrigation development has been done (Alfonso, 1981). This work demonstrates that the required reorientation will necessitate changes in basic agency operations and procedures. For example, in the case of the Philippines, the usual measure of staff success,

the area of irrigable command, had to be changed to the number of functionally irrigated hectares.

As mentioned above, tasks that irrigation agencies are least prepared to implement are assisting in the formation of new users groups or in the strengthening of existing irrigation groups. Typically, agencies lack staff trained in group organizing skills. Sometimes this gap is filled by assigning the task to the extension wing of the agriculture department, but this is usually unsatisfactory because extension agents are formally trained to disseminate information rather than to organize farmer groups. Another alternative is to utilize a PVO that may have experience in community organizing—though not necessarily in the specific context of irrigation. However, the irrigation agencies that have experimented with new approaches to farmer organization are concluding that the staff to perform these tasks need to be part of the irrigation agency if close interaction between the technical and organizational staff is to be achieved. This is especially clear when the process of group organization is conducted concurrently with planning and design activities rather than delayed until after construction.

4. Creating an organizational set for the agency.

In addition to the main irrigation agency, a cooperating set of involved organizations, including some that are not typically associated with irrigation programs needs to be developed. Emerging experience shows that where breakthroughs occurred in irrigation development, the work of the mainline irrigation agencies was complemented by other organizations, including research units, management institutes, private voluntary agencies, and other government departments. As our concept of what irrigation development involves has expanded so has our notion of the groups that can contribute to this process. In various programs in India, Indonesia, the Philippines, and Sri Lanka, for example, innovative irrigation programs are being implemented by the irrigation agency in close collaboration with social scientists, management specialists, and local voluntary agencies.¹⁸

David Korten has stated the need for this set of organizations to be formed into a working group that "learns" about irrigation development through regular processes such as action research, monitoring and evaluation, workshops and seminars, etc. (D. Korten, 1981). The working group provides a conduit for interac-

tion between the irrigation agency and its various "partners" that cannot be achieved by contracts alone.

The contributions of the research and management specialists of the working group are especially noteworthy. The conscious decision for sustained involvement of management specialists is particularly important if a significant reorientation in agency procedures is being planned—for example, reorientation to more of a service role or a participatory style of irrigation development. In this situation, the assumption is that part of the cause of past poor irrigation development performance was the structure and procedures of the irrigation agency itself. Management specialists can help identify these problems and propose solutions.

The inclusion of a research component within the working group is based on the assumption that not all the factors constraining irrigation development, nor the corrective actions required, are fully understood. There is, therefore, need for monitoring and evaluation of past performance and outcomes, as well as designing and testing innovative strategies for irrigation development through field-based studies and action research. Typically, implementing agencies have neither the mandate nor the capacity to systematically inquire and innovate. Thus, the creation of a working group adds the capacity for flexibility and adaptability to the overall program.

5. The special role of private voluntary agencies.

In many national settings, private voluntary agencies are active participants in small-scale irrigation programs—usually busy at work in the local sector. (We have found evidence of programs in Africa, Asia, and Latin America). Typically, outsiders assume that their work is technically weak, although it may be strong with regard to matters of local group involvement and participation. We think this stereotype deserves further inquiry. Most observers agree that PVOs have the significant advantage of being able to tailor their activities to local conditions and to be flexible as special situations arise—features difficult for agencies to duplicate because of the scale at which they are working.

Related to this is the capacity that many PVOs have to work on innovative and experimental approaches to irrigation. There are several important examples of this. In Bangladesh, PVOs are working with the innova-

tive idea of forming landless people into irrigation pump groups, which then contract with farmers to provide irrigation services.¹⁹ In both India and Nepal, voluntary agencies are experimenting with novel arrangements for assigning water rights after the construction of irrigation works—an allocation of rights that is not dependent upon one's ownership of land in the command area.²⁰ The Sri Lanka National Freedom from Hunger Campaign Board is actively promoting a program to rehabilitate and restore village tanks based on active village involvement and responsibility rather than the agency-based approach that the government is pursuing.²¹

A major question is how to enlist the special capacities of PVOs to contribute to small-scale irrigation development programs. Most PVOs do not have the capacity to undertake responsibility for the massive efforts that governments currently manage, and AID programs should not channel funds to PVOs with the idea that the scale of their work can be easily enlarged. However, a modest portion of funds from a larger irrigation development program can be channeled to PVOs' innovative work within the context of the particular program. For example, in the recent planning of a program for small-scale irrigation development in the north Indian state of Himachal Pradesh, the suggestion was made that an Indian PVO with experience in developing small irrigation reservoirs in upland areas be provided modest funds to work with the Soil Conservation Department in the state. In these selected experimental locations, the PVO would test approaches for reservoir development that give more attention to local involvement in planning and design, as well as more consideration to procedures for protecting the watershed on which the reservoir will depend. It would be inappropriate to ask the PVO to implement programs throughout the state, but it does seem reasonable to assign it the task of helping the department develop better models for implementing such activities.

In summary, a fourth key programmatic issue to be considered in formulating a program for small-scale irrigation is involvement. There are several issues to be resolved:

- which agencies are to be involved,
- what functions are they to perform, and
- what assistance (staff development, new facilities, management advice), if any, will they require to perform these functions.

Planning for and implementing this component of the program will involve the following steps:

1. An identification of the various agencies involved in the implementation of small-scale irrigation activities, both public and private, including investigation of the strategies that they use, the sectors in which they operate, agency and/or local, the financial and staff capacities they have, and some indication of their changing mandates, if any, for work on this topic.
2. Having selected the agency(s) that will have major responsibility for implementation of the program, discussions regarding style of program implementation need to be initiated and concluded (if possible). Of primary concern is agreement on the extent to which the agency is going to act as a support group for local actions versus act as a direct implementor of irrigation development. If agreement is achieved in the planning stage, one can then assess the gap that exists between present agency capacities and the planned agency role. That gap can then be the basis for planning institutional development, including needed training programs.

In some instances, the agency may not be prepared to commit itself to a more service-oriented role. In that case, provisions should be made for pilot projects and/or action research that will permit field explorations. Trials can be done by the agency itself or through the work of an appropriate PVO.
3. A third major step is establishing a working group to act in concert with the implementing agency. The minimum group that will be required includes: (1) a research unit(s) to deal with both technical and institutional/-organizational issues, (2) a group with expertise in management to advise on agency and program procedures, and (3) if not already represented in the irrigation agency, a group experienced with matters of local group formation and organization. The program design should provide an institutional structure for the working group, a modest budget, and a preliminary set of tasks to be performed. The working group may also be an appropriate forum to host external technical assistance.

SUMMARY AND CONCLUSIONS

The strategy proposed is not problem-free, but the associated problems may be less intractable and require fewer external resources for resolution. A recent report of the General Accounting Office reviewed several AID irriga-

tion projects and concluded that the present strategy of irrigation development is questionable on two grounds—the budgetary incapacity of most LDCs and their associated weak institutional expertise.

The overall strategy for developing small-scale irrigation works discussed in this paper is not entirely new since elements are already incorporated in various programs around the world. Nonetheless, when joined together, these components represent a significant departure from the present situation—something of the paradigm shift called for by Underhill et al. (1983).

The strategy outlined above holds promise for resolving several of the difficulties plaguing small-scale irrigation work. These include

- 1) The large problem of escalating recurrent costs as government assumes increased responsibility for small and scattered irrigation commands. An indirect investment strategy is a means by which government can induce local groups to invest in these facilities, thus leveraging the initial government input and reducing the need for substantial repeated investments.
- 2) The continuing difficulty of preparing appropriate designs for a large number of scattered sites for which little formal data exist. The utilization of an incremental and participatory design process that allows for changes and improvements to be made over time, and that incorporates whatever local information and experience is available, is a solution to this problem. It is a superior solution to the one that calls for an increasingly information-intensive and engineer-centered approach.
- 3) The ubiquitous problem of nonfunctioning irrigation groups. A strategy that conceives of such groups as autonomous entities rather than appendages of the bureaucracy, begins the implementation of group formation early in the project process rather than delaying it until after construction, and that implements this process with staff skilled in institutional matters increases the chances of success enormously. Likewise, inducements for local investments and better designed facilities will help local groups to function effectively.
- 4) And, finally, the widely recognized problem of inadequate agency capacity. In part, the problem is that agencies have been asked to do too much in the field of small-scale works. They have been asked to carry out planning, design, and construction activities for numerous subprojects in essentially the

same manner that they manage large-scale, single-location projects. The strategy of having the irrigation agency assume more of a support role and of conducting its program as part of an organizational set in which other, nonengineering specialities are available to assist will do much to close the large gap between what irrigation agencies are able to do and what they should be doing to implement the development of the small-scale irrigation sector.

Small-scale irrigation systems have been and promise to continue to be essential elements in the irrigation sector of many third world countries. Policies and programs for small-scale irrigation that facilitate a new mix of agency and local rights and responsibilities in irrigation development hold much promise for the future.

NOTES

¹For information, see U.S. Agency for International Development (1979), Steinberg (1983:55), and selected reports in USAID's Series on Project Impact Evaluations, No. 4, Philippine Small-Scale Irrigation (1980); No. 12, Korean Irrigation (1980); and No. 29 on Indonesia (1982).

²Some large traditional systems have been documented. See Pradhan (1982) and Tan-kim-yong (1983).

³See Esman and Uphoff (1984) for a discussion of various types of local organizations.

⁴For further information, see East-West Center (1983).

⁵These figures were pointed out by Susan Thompson and are reported in US Department of Commerce (1980).

⁶This opinion is also implied in a recent report by Steinberg (1983).

⁷This point is made in USAID (1979:4); see also additional materials in various chapters of Coward (1980).

⁸Note that this is not meant to ignore traditionally important aspects of program planning such as monitoring and evaluation, examining economic feasibility, etc. See Nickum (1984) for discussion.

⁹This discussion of direct and indirect investment strategies draws on ideas first presented in a paper by Coward (1983b).

- 10 Interesting examples are the subsidi desa program in Indonesia, the communals program in the Philippines, and the self-help irrigation program in Guatemala. See Hafid and Hayami (1979), F. Korten (1982), and Water Management Synthesis Project (1983), respectively.
- 11 For an important analysis of this effect in Indonesia and the Philippines, see Hafid and Hayami (1979) and Dozina, Kikuchi, and Hayami (1979).
- 12 For a good discussion of implementing a participatory design process, see Mayson (1984).
- 13 The recent GAO report makes a similar recommendation, although it does not explicitly note that the early phases of project planning and design can be a vehicle for organizing farmers. See US General Accounting Office (1983).
- 14 See Underhill et al. (1983) for a discussion of the "novelty" factor.
- 15 See Diemer and van der Laan (1983) for such an analysis in Senegal.
- 16 A good illustration of this assumption gone wrong is provided by Pradhan (1982).
- 17 This issue is encountered in many countries. For a discussion of this in Himachal Pradesh, India, see Coward (1983a).
- 18 For India, see Indian Institute of Management (1982); for Indonesia, see Morfit (1983); for the Philippines, see David Korten (1980); for Sri Lanka, see Uphoff (1984b).
- 19 The work of these indigenous PVOs has unfortunately not been documented in an easily accessible fashion. For the work by PROSHIKA, see Wood (1982); for BRAC, see Bangladesh Rural Advancement Committee (1983, 1981).
- 20 See Seckler and Joshi (1981) for a description of the Sukhomajri project in India.
- 21 In Sri Lanka, the Freedom From Hunger Campaign emphasizes tank rehabilitation as a means of improving agricultural conditions in villages. Various materials (available from FFHC, 17 Langdon Place, Colombo 7, Sri Lanka) have been prepared for village consumption, explaining the program, and providing guidelines for villages to plan and carry out a rehabilitation project. For another project targeted at similar villages, see Medagama's (1982) report of a World Bank-assisted program.

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