DISCUSSION PAPERS

Small-Scale, Community-Managed Irrigation Systems Workshop

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Water Management Synthesis II

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INTRODUCTION

Small-scale irrigation systems are attractive for a number of reasons. Their shorter construction period allows a quicker return to investment, with a low risk of failure per unit investment. Small-scale projects also promise a broad geographical distribution of benefits. They present the opportunity to make full use of local resources. They can also be operated more efficiently than large schemes, in part because they can be managed by those who use them.

Our focus in this workshop is on strategies to support that subset of small-scale projects that are manageable by an organization representing a single community of water users, even if management functions actually or nominally rest in the hands of an outside agency. (Mini-irrigation systems, owned and operated by a single family, are not of specific interest here.)

We have chosen to divide small-scale irrigation project strategies into four components: investment, design, agency involvement, and local community organization and participation. The purpose of our discussion papers in each of these areas is not to settle but to raise critical issues which must be addressed if projects are to have a desirable impact.

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Small-scale project development, almost by definition, involves an investment strategy, a series of choices made by agencies or communities about what resources should be committed to a project, and about how, where, when, and by whom they should be allocated. Often, agency involvement has led to a decline in community participation, due, in part, to a diminution of community control over investment and management.

Local involvement extends to design. While the nature of investment is determined in large part by design possibilities, the design process itself involves some important choices, not all of them purely technical. These in turn affect the potential for community control over investment and management.

The process of investment requires interaction between the community of water users and outside agencies. A variety of agencies may play a role in project development. These include national government or parastatal agencies, international agencies, and local and international private voluntary organizations. The level of agency support may vary from the provision of loans or technical assistance to the assumption of authority for the delivery of water down to the crop root zone, as well as for repair and maintenance activities. The style of an agency has a definite impact on project outcomes.

Similarly, the nature of the community and the role it plays varies from project to project. To be successful, most small-scale projects require the mobilization of community resources, not only for construction and for design but, most importantly, for management. This mobilization cannot be assumed without full community participation in all phases of project development. This participation requires a wide base of support for the project within the community.

In the following papers, we explore these strategy components and attempt to raise what we see as the critical issues therein, illustrating them wherever possible with case materials. The papers are far from definitive and do not set forth

specific policy recommendations. Rather, they are designed to stimulate the identification and discussion of key questions. We see this as an essential step in teh preparation of a more comprehensive concepts paper. We particularly encourage workshop participants to address issues raised in all papers, regardless of disciplinary perspective.

I. INVESTMENT

by

James E. Nickum

> Moreover, the lack of capacity among the rural population to organize itself to build the necessary infrastructure will probably intensify the requirements of agricultural development for government funds, and may even exceed the limit that governments in the developing countries are able to mobilize with their present administrative capacity.
>
> The necessary condition for success in agricultural growth should be . . . the institutional innovations, both in the organization of mobilizing indigenous resources and in the form of international cooperation. . . . The critical consideration in this regard must be the promotion of participation and initiative by rural people, without which neither government program nor foreign aid can really be effective.
>
> (Yujiro Hayami et al., 1975:208,215.)

Let us begin with a premise: the community of water users should be responsible for the operation and maintenance (O&M) of a small-scale irrigation system. This may seem obvious, but all too often the actions of external agencies make it unappealing for the community to assume this responsibility.

In some cases, the end users have been responsible not only for O&M but for all the fundamental irrigation tasks of acquiring water rights, constructing, allocating water, carrying out maintenance and repair, mobilizing resources, and managing conflicts. Because outside agencies are not usually involved in these systems, we do not often hear about them. We do hear of numerous cases, however, where the community does <u>not</u> assume the duties and burdens of O&M after an outside agency has built or rehabilitated a small-scale project. Does this mean agency intervention is impossible, unless the agency wants to assume responsibility for all tasks of water management?

Clearly not. There are numerous examples of successful agency support, where the community has assumed full responsibility not only for O&M but also for a significant share of the costs of rehabilitation. For example, Hafid and Hayami (1979:124) report aggregate "inducement coefficients" (government subsidy plus locally mobilized resources divided by government subsidy) of 2.0 to 3.4 for Indonesia's subsidi desa program (1969-74), with individual cases much higher.

In existing irrigated areas, the local communities usually already contribute a large amount of resources, especially labor, to the maintenance of the system. In what is probably a typical instance, in Tamil Nadu, India (researched by Meinzen-Dick, 1983):

> While the anicut diverting water from the river and the main channel delivering water to the first three tanks are government facilities, Sananeri Tank is locally owned and operated. And the costs of operation and repair, provided by the cultivators themselves, are considerable. The major costs are payments to the local association's "staff" for maintenance and water distribution activities, provision of their own labor for repair work, and cash contributions to the tank fund for other incidental costs.
>
> Meinzen-Dick (1983:121) estimates that the value of the total (annual) contributions to the association's operational costs (in terms of the 1982-83 rice prices in the area) was approximately US $35 per hectare. . . . An interesting comparison is . . . that the Public Works Department of Tamil Nadu expends approximately US $2.50 per hectare on repairs (each year).
>
> (Coward, 1983b:14)

These high recurrent costs have often led community organizations to turn to the government not to so much to augment as to replace local contributions (Pradhan et al., 1983:17):

> Recently community irrigation organizations have been turning more to the government as a source of resources for the improvement of systems. . . . When applying for and receiving government assistance, the local irrigation organization gives up some control over what work is done and how it is carried out. In some cases it appears that the organization's efforts are beginning to be more focused on pursuing external resources at the expense of the initiative and effort required for operation and maintenance of the system with local resources. "Grantsmanship" is becoming the mode of operation instead of "self-help."

Our hypothesis is that one key to involving a community lies in ensuring its control over the processes of investment and management. An agency that wishes to support small-scale investment without assuming management responsibilities over it in perpetuity should ensure that the community is in the driver's seat.

What does it mean to be in control of the investment process? We have identified the following critical areas of decision making. There are undoubtedly others.

1. Decision to invest and site selection. The community should feel the need for a project before it is initiated. Where possible, it should do the initiating. At present, it appears that most agency-supported, small-scale irrigation commitments are made in response to direct or indirect requests by the beneficiary communities. Is this an informed choice? In most cases, it probably is. Is it in response to the prospect of receiving an economically excessive external subsidy? In most cases, it probably is.

   Complementary investments by outside agencies, such as in marketing facilities, may affect a community's assessment of the desirability of irrigation investment, as do state pricing policies. We will not deal with these directly here because we are focusing on the irrigation decision making process. The larger context should not be ignored, however.

2. Choice of components and setting of priorities for development and rehabilitation (see paper by Walters and Norman).

3. Choice of technology, especially factor mix, for construction. Although we often think of locally funded irrigation as being done exclusively with local resources, communities are increasingly aware of the properties of externally manufactured inputs, such as concrete and pumps. The problem of factor choice is more likely to be one of the different availability of resources to different decision makers. In general,

communities can mobilize labor more easily than outside agencies can. Agencies can usually mobilize funds and imported machinery more easily than communities, although the rapid spread of privately owned tubewells in many parts of the world indicate a considerable local capacity for mobilizing funds.

Local irrigation associations can be quite entrepreneurial in acquiring funds (Meinzen-Dick, 1983:117-18):

> In some areas where the Fisheries Officers at the Block Development Office stock the tanks, the Panchayat Union (or Revenue Department) may hold an auction for the fishing rights to the tanks. But Palanisami and Easter (1983:82) report that an effective ayacut association may still control and get the income from fishing by ensuring that only one bidder attends the auction and takes the bid at a low rate. Then the association auctions the fishing rights with open competition, and uses the difference for the tank fund. . . . Wade reports a similar reauctioning of the toddy license in Andhra villages to benefit the local irrigation association.

4. Choice of technology for management. Capital and labor are to some extent substitutable for each other in management. In general, one might expect locally controlled projects to have a relatively labor-intensive (and supervision-intensive) approach to management.

More importantly, there are likely to be important differences in the choice of organizational "technology" and its impact upon resource mobilization. The question of local water user organization is particularly complex. Informal organizations are often more effective than formal ones (Meinzen-Dick, 1983:127), yet it is difficult to provide outside assistance, especially loans, to an entity which is not legally constituted. Government-sponsored formal water users' associations have a mixed record. Those which have been built from within, as in the Philippines, appear to be able to mobilize adequate local resources at the same time

that they provide reliable conduits for outside assistance. In other cases, however, expecially where such associations are set up by the state, sometimes including agency officials on their governing boards, their conduit role appears to conflict with their ability to mobilize resources (Meinzen-Dick, 1983:127).

> The Irrigation Panchayat Committee for another large tank in Ramanathapuram District has both elected cultivators and statutory members from several government agencies. According to Rajagopalan (1982), this organization appears to be functioning adequately, particularly in maintenance tasks because the organization is empowered to do urgent repairs and then be reimbursed by the P.W.D. (Public Works Department). It is also useful in that it provides a regular forum for cultivators and representatives of government agencies to meet to discuss tank problems. However, the larger formal organization has difficulty collecting fees from the cultivators, whereas the informal organizations along the distributary channels can collect contributions to cover their expenses quite easily.

5. Pace of construction. External agencies have different time imperatives than do farming communities. Agencies operate under annual budgets, and prefer to complete a small project, from design to handover, within a single fiscal year. Rural communities operate according to the cropping calendar, and may be willing to adopt a longer construction period, especially if it allows relying on community labor.

6. Area to be covered by the project; irrigation norms. Local communities are likely to be more senstive to existing water and land use rights (see below). They also tend to have a better understanding of local cropping possibilities and soil conditions which affect the likely consumption of water than do the "construction" agencies which are usually in charge of external involvement in irrigation projects. "Service" agencies, such as agricultural extension, are likely to be better informed about local conditions.

7. Uses of the project. Greater consideration may be given to nonirrigation uses of a project, both its water and its facilities, where the community has the power to determine its objectives. (For further discussion, see the paper by Lynch.)

Underlying all of these decisions are questions of information and the rights to resources (Grossman, 1974:33).

> There is always a cost attached to obtaining and processing information and maintaining communication lines, and, other things equal, the more centralized the organization (or economy), the greater this cost. . . . The choice between more and less centralized economic institutions therefore hinges in some measure on the corresponding information cost.

One of the strongest arguments in favor of community control over the investment process is that it reduces the agency's burden of gathering information, especially that which is location-specific. Too often, an agency, acting more or less alone, makes vital investment and design decisions on the basis of very little information about each site (see paper by Norman et al.). One approach to improving this situation is to develop effective rapid information gathering and assessment techniques. Another is to establish decision making procedures which make use of the already existing availability of most of the relevant data within the community.

For example, site selection might be based on explicitly competitive bidding for limited state matching funds by the communities, with appropriate documentation and verification by the lending authorities. These bids could include the share of total expenses which the community is willing to assume. Where nonproduction goals such as equity are explicit state objectives, they could be included in the bids as well.

Similarly, communities already have rights to many of the resources required for a project. Yet these rights are sometimes overlooked by agencies, often on the premise that the rights of the broader community, the state, take precedence over

those of the locality. In one extreme case, in Himachal Pradesh, the government requires communities to surrender ownership rights over their existing facilities as a prerequisite to their making an application for government rehabilitation assistance.

In general, there seems to be a trend towards the state assuming ownership rights over those small-scale projects in which it becomes involved. It is not at all clear why this should be so, inasmuch as it leads to an extension of state responsibilities beyond its administrative capabilities, while locals are likely to view it as either a confiscation of hard-earned assets or as an opportunity to relieve themselves of the obligations of ownership. Partly in response, policy makers increasingly accept the need to "give the farmers a sense of ownership," so that they will not disencumber themselves. The best way to give the farmers a "sense of ownership" is presumably to make them the owners, and ensure that they remain so. The invocation of eminent domain, either implicitly or explicitly, will only botch things up.

The resources used in small-scale irrigation projects include land, water, existing facilities where present, skilled and unskilled labor, new capital, and information. There are a number of tactical issues of investment support involving each of these factors—for example, the role of contract labor versus obligated labor and grants versus loans versus matching funds. The resolution of these issues depends in large part on local conditions (e.g., tradition of labor mobilization, level of monetization of the local economy), but, even more crucially, on the loci of ownership and responsibility.

The existing patterns of the various rights embodied in ownership—rights to access, use, exclusion, transfer and disposal—are usually quite complex, especially in areas with a history of irrigation. For example, in some cases, water rights are not vested in land ownership (for Mexican examples, see Lees, 1974). In

others, water rights, although vested in land, may be distributed more equally. In the Teotihuacan Valley, Mexico, the state inadvertently dispossessed a number of small landowners by allocating water in a rehabilitation project in proportion to holding size (Millon et al., 1961). In Nepal, there are irrigation associations where water rights are tied to the land, and others which have highly sophisticated commercialized ownership of water shares (which vary as a fixed proportion of available surface supplies) which may be sold and even increased through new equity issues (against increases in the total supply). None of these associations are legally registered.

Ignoring the existing pattern of rights can lead at least to difficult bargaining between prospective gainers (and their agency backers) and losers. Again, in Nepal, a local government (panchayat) subsidized the extension of an irrigation channel into a previously unirrigated downstream settlement without taking into account the existing agreement between its own upstream settlement over sharing the water source with villages in a neighboring panchayat who had senior rights. Attempts to convince the senior villages to accept an uncompensated reduction in their share of the water source fell on deaf ears (Pradhan, 1982).

From a historical perspective, most of the issues in this paper are more deja vu than new. For example, according to Maass and Anderson, 1978:119-20:

> When near the conclusion of the sixteenth century the landowners of Alicante decided to build Tibi Dam, they appealed to the king for help. Philip the Second responded with protection and limited aid. He gave license to the city of Alicante to build the dam and to borrow money for this purpose. Although he refused to provide capital because the work would in good part benefit existing landowners, he agreed, after obtaining approval from the church, to assign the proceeds of tithes and first fruits from the lands to be benefited (that is, 10 percent of their crops) to the city to amortize the costs of building the dam. He agreed not to take any profits himself from the water; and he provided the services of Spain's most distinguished hydraulic engineer, Juanelo Turriano, to review the plans and supervise the work. Finally, he agreed that authority and responsibility for distributing water from the dam would remain with the city so that the farmers did not lose control over their destinies to any significant degree.

Not all of Philip's successors followed his hands-off policy, though. In 1739, the dam became part of the royal patrimony, and a royal agent was placed in charge of dam management and water distribution. Control returned to Alicante a century later, but fell victim to Spanish politics between 1936 to 1950, with first workers' groups and then the provincial government taking over. Maass and Anderson (1978:121) note by implication that state control was not developmental:

> As in the early eighteenth century, the farmers of Alicante appear to have paid a heavy price for their region's support of the loser in a civil war.

In sum, is it wise for the farmers to give the state a sense of ownership over their small-scale irrigation systems? Ownership is not support.

II. ISSUES OF SMALL-SCALE IRRIGATION SYSTEM DESIGN

by

W. R. Norman, M. F. Walter, and D. Merrill

1. OVERVIEW: SETTING THE PACE

In general, irrigation can increase agricultural output by extending the length of the growing season, enlarging cultivated areas, and reducing the risk of crop failure due to unfavorable crop water regimes. Technical innovations in irrigation should provide for greater production through improved availability, quantity, and timeliness of water application. Small-scale irrigation (SSI) systems have a number of attractive characteristics, including the speed with which they can be completed, their technological simplicity, and their appropriateness for local management. Highly trained professionals, both managerial and technical, are not as necessary as they are for large systems. Most important, local technical skills and resources can be more fully exploited in the construction and maintenance of these systems.

Sharing a common source of water calls for cooperation among the users. Experience has shown that such cooperative efforts are most successful if they are not too large (Stern, 1979). As these systems are to be locally managed, designers must be sensitive not only to technological appropriateness in terms of cost or sophistication, but also give close consideration to acceptability, applicability, and manageability to the local farmers and community (Underhill, 1982). It is crucial to involve local people in the design process if these goals are to be achieved.

Too often, those involved in system design do not recognize the investments in irrigation already made by the farmers. Yet the selection of the most appropriate type of system requires a greater understanding of established irrigation practices

based on indigenous technology. This knowledge must then be emphasized in the design so that the local resource base can be most effectively utilized. In some cases, the indigenous technology is more appropriate than that offered by outside agencies.

Agency designers of small-scale systems are confronted with an enormous range of physical, social, historical, and cultural conditions. These difficulties are compounded by their inadequate experience in incorporating these variables into an irrigation scheme. Often, when conventionally trained designers become involved in irrigation development in third world countries, they inappropriately transfer to the design and construction technology of large-scale developments to SSI, frequently resulting in management and operation problems. Further, if small-scale projects are to avoid many of the difficulties which have historically bedeviled large-scale systems—poor water management, insufficient land leveling, soil problems, input supply bottlenecks, introduction of locally inappropriate crops, lack of suitable internal incentives, etc.—then they will have to be viewed from a somewhat different perspective than larger systems, and appropriate technologies and guidelines for small-scale development must be developed.

These yet-to-be-identified technologies and guidelines need to cover a broad spectrum of physical and technical criteria, ranging from water source and storage needs to adequate and functional water distribution methods and ways of minimizing maintenance problems. (In addition to the strictly technical criteria, there are numerous other—social, economic, political—criteria which designers cannot ignore that interact with the technical issues and play an important role in the design process.) In order to account for the great number and uncertainty of the variables in the design process, there is a pressing need to work toward simpler designs and design requirements, allowing for maximum flexibility in the design process. Optimal designs for SSI systems will generally be local labor intensive,

draw heavily on local resources, utilize and adapt any existing irrigation technology when possible, and require a low capital investment.

The intent of this paper is to raise a number of key issues and technical shortcomings within the design process and to suggest some possible strategies that might alleviate these problems. In such a short discussion we will, unfortunately, raise more questions than we can answer; but by raising these issues and occasionally drawing on various field experiences, we hope to stimulate further thinking on this important topic. The small-scale design process deserves separate status from the conventional large-scale approach, as these community-managed systems pose unique constraints on the system and its design which often extend beyond the context of existing technology of large-scale developments.

2. IN SEARCH OF THE CRITICAL DESIGN QUESTIONS: ISSUES IN THE SSI DESIGN PROCESS

2.1 The Conventional Approach

Before examining any one design consideration individually, it will be helpful to begin this discussion with a common understanding of the design process in general. The conventional irrigation design process typically follows a general progression of steps. This conventional approach will serve as a framework for discussion. The essential components of this process are outlined in the following seven steps. While irrigation system design is by no means necessarily confined to the seven steps identified here, these do focus on the critical design stages and the principal issues of standard irrigation design.

1. Project Site Identification. The first step in the design process is to determine which project sites will be considered for project development. Certain minimum requirements are necessary (e.g., a water source) before a site is even

considered for development. Minimum requirements should not only be based on physical characteristics of the site, but should include social or political criteria.

2. Data Acquisition and Survey of Resources. The initial stage in all projects requires the assembly of a certain body of baseline data. These data will usually be both regional and site specific, and typically include information regarding: topographic details, rainfall and other hydrologic processes, crops and soils, as well as an assessment of local resources (physical and human).

3. Evaluation of Water Demands. The primary function of the irrigation system is to meet the water demands of agriculture. The assessment and quantification of these demands requires evaluation of crops and cropping patterns, rainfall (amount and distribution), evapotranspiration, soils, etc.

4. Alternative Water Source Development. Once the water source or resources have been identified, and the water demand has been evaluated, the choice of source development which will meet the demands within the constraints of the system to be developed is identified. In most areas there may be only one possible choice, whereas some sites may offer several alternative sources for development. The supply of water to be made available will sometimes depend on the extent to which the source is tapped (e.g., groundwater or large rivers).

5. Synthesis of Irrigation System. The technical aspect of irrigation development requires the capture and delivery of water to the farmers. There may be a number of schemes that will accomplish this goal. System synthesis involves identifying or selecting, and synthesizing the individual components of the irrigation system in the most appropriate and acceptable manner.

6. Design of Infrastructure. This step is usually thought of as the "core" of the design process and involves the technical "engineering design" proper. The irrigation system components (structural and operational) selected in the previous step are actually specifically defined (or designed).

7. Project Implementation. This stage involves the actual construction phase of the design process. This will generally include the organization of the group responsible for construction; collection and stockpiling of materials; mobilization of labor; and actual physical construction of the works. Management and scheduling of construction activities, quality control, and availability of financial resources are important considerations during project implementation.

2.2 Small-Scale Design Limitations

The following discussion will take each of these design steps individually and focus on the design limitations as they pertain to small-scale developments. Although the discussion may raise issues that are also concerns of large-scale irrigation projects, these design criteria will be analyzed strictly from a small-scale perspective. There will be many questions concerning irrigation development that are not discussed, but these comprise a body of issues already covered in much of the available literature.

2.2.1 Project Site Identification

Selecting an appropriate site for developing an irrigation resource becomes a vital consideration when defining the broader and overall limitations of a given irrigation development scheme. At any level of agency involvement (e.g., national, regional, or local), more sites should be considered for potential projects with SSI than with LSI. The criteria used for selecting among the possible options should include an assessment of local interest in developing and assuming responsibility for the system.

Initial selection of a site, or sites, to be considered by government agencies for SSI development can be done by first locating sets of environmental components (e.g., water source, soils, suitable microclimates) required for irrigation and then assessing local community interests and capacity to assume

responsibility for a SSI system. Alternatively, agencies can require communities to take the initiative in demonstrating that a site should be considered. Under this alternative, communities would not only have to attest to their interest and capability but would also have to prove that they have a legal right to a potential source of irrigation water. In the Peruvian Sierra, it was found that both of these approaches were being taken to initially identify potential SSI projects. In one case, a regional agency had identified about twenty potential sources of irrigation water and considered these as alternative SSI project sites. Communities were also found where the people felt they had collected all the necessary information to verify that irrigation was potentially viable, and they were trying to attract government agency interest in helping them proceed with project feasibility studies (Keller, 1983).

Such field experience suggests that because local interest and ability to assume the responsibility for SSI is so important, initial site selection is best put in the hands of the local people. However, the specifics of how local communities verify that they should become part of the set of potential sites to be considered by agencies remains hazy. What criteria need to be met to show that a site has potential? How are agency goals and policies considered in the site selection process? What is the process by which local communities can present their case in the format required by development agencies? For example, one private voluntary organization (PVO) in the Peruvian Sierra said that the local community effort to develop a SSI project was repeatedly delayed because no one understood the required government process (especially red tape) for project submission (Keller, 1983).

2.2.2 Data Acquisition and Survey of Resources

The limited availability of economic, social, hydrologic, topographic, and agronomic data severly hampers the SSI design process. Adequate data are scarce

due to the wide diversity and geographic spread of the project areas, and small-scale projects usually lack the resources (money and manpower) necessary to independently gather such information. The overriding issue for the engineer designing small irrigation systems is how to obtain the limited amount of necessary data that can be optimally utilized in synthesis and design.

One readily available source of information is the local farmers. They are usually intimately acquainted with the local cropping patterns, topography, soils, etc. They should also be consulted for information on rainfall patterns and other hydrologic details—especially extreme events—where such information is scarce or questionable. For example, recurrent dry-season irrigation problems and near project failure could have been avoided in a small Niger River rice scheme in southern Niger, had such steps been taken in the design process. The intake level of the centralized pump system was based on a ten-year low-flow record taken on a downstream bridge. As a result, most annual low-flows recede not only below the intake level, but away from the intake due to the wide, flat, and shallow nature of the river at the project site (Moris et al., 1982). Simple consultation with local farmers along the stretch of river to verify the recorded data would have prevented what is now a serious, built-in infrastructural problem.

Experience has shown that collecting these data and utilizing local feedback can be very difficult. Only after numerous visits over several months to the Cherlung farmer-operated irrigated system in Nepal, with the specific objective of understanding the management system, was it discovered that a unique system of allocating water use rights for members was in use (Yoder, 1983). The farmers were not hiding information, but rather the knowledge that was sought was so obvious to them from their lifelong experience that they did not think of explaining it. Until the system was understood, the right question could not be asked.

According to engineers with experience in the Philippines, where a participatory approach to irrigation development is being followed, the initial stage of the project is very slow. Much discussion and many meetings are required to gather the necessary, pertinent information and to launch the project. But once construction is started, it proceeds much more rapidly with full farmer support (Bagadion, 1980). In the end, the engineers' task is easier, and total elapsed time for the project is no longer than with the conventional approach. In addition, the farmers are in a very strong position to manage the operation of the system.

To some extent, designers must forge ahead and independently develop a mechanism to collect information as effectively as the local situation permits. It should be noted that time constraints on most projects reduce the incentive of the engineer to solicit local feedback as this can be a time consuming process.

In addition to the strictly data, information pertaining to other local resources is vital to SSI projects, particularly the assessment of the available human resources. The local labor force, skilled and unskilled, should be evaluated in order to determine the possible degree of local participation in both the design as well as construction phases of development. Skills lacking in the community will have to be imported from outside the local region, or the design should be modified to eliminate this need. Certainly, among the key local resources that must be assessed are the existing level of irrigation capability and the technology of the indigenous irrigation systems. In order to accommodate the inherent scarcity of data, SSI systems must be designed for maximum flexibility.

One design option is to adhere to a "minimalist" philosophy, proceeding from simple designs and technologies, limiting the scale of initial developments, then modifying and expanding the system in response to needs and limitations discovered during these initial stages and to meet growing community irrigation needs. A "catalog" of irrigation technologies with a description of the circum-

stances under which each would be appropriate might also reduce the need for detailed site information during the initial planning process. Technologies from the catalog would be used for initial cost estimates and system planning, but these technologies would require flexibility in their design so that they could be retrofit in the field according to site-specific requirements. These options are discussed below (see page __).

2.2.3 Evaluation of Water Demands

Irrigation systems must be designed to accommodate local water demands within a given command area. The usual procedure involves assessment of local climatic conditions, soil types, evapotranspiration, and some consideration of overall system efficiency and estimated losses of water on conveyance to the field, or from poor distribution patterns. Aside from these essential considerations, SSI projects are often distinguished from their large-scale counterparts by significant diversity within the irrigated perimeter. Larger irrigation works typically tend to involve single or limited numbers of crops, for example, rice. On the other hand, in observing SSI worldwide, there seems to be more extensive diversity and variety of crop types and cropping patterns within these systems. In addition, SSI may constitute only one component of the local farming systems (e.g., dryland crops outside the irrigated perimeter).

This distinction between small and large systems is exemplified in various cases throughout the world. In South America this is seen both in the Sierra and on the west coast, where the large-scale works are primarily mono-cropped for sugarcane and rice production, as opposed to smaller schemes which support more diversified farming systems. Similar differences are found in Asian countries (e.g., Sri Lanka) and West African countries where larger schemes tend to be mono-cropped in rice and smaller perimeters tend to include a greater diversity of crops (often intensive multiple-crop vegetable gardens. This, however, is not to imply

that mono-crop small systems are nonexistent. These are found in throughout the world, primarily in Asia, but by no means can be said to constitute the majority of SSI practices worldwide.

Such diversity, both internal and external to the irrigated area, necessitates much greater flexibility in terms of amount and timing of water application. In fact, by the very nature of size and the implementation of local control, small-scale systems can be more flexible. Yet, the issues raised reveal the difficulty and complexity involved in formulating how demands in smaller systems can be evaluated in the design process. In the U.S., where much of the present day irrigation technology has been developed (for single-cropped, temperate climate situations), the experience is quite different from the tropics where irrigation may be needed during two or three varied cropping seasons. This further complicates the need in these areas for the provision for annual fluctuations in rainfall, which is essentially not a part of the U.S. experience, but which can vary widely in the tropics. These factors demand increased attention to design considerations and to flexibility in order to accommodate annual variations in water demand and availability.

In addition to the demand for irrigation water, competing nonirrigation uses of water should also be assessed, particularly in the small farm sector where multiple uses from a single source (often the only source) are likely to occur. In general, irrigation should be incorporated into a multi-use framework that recognizes the needs of alternative uses (domestic, livestock, and perhaps transportation and fishing in large river developments) (see paper by Lynch in this volume). This may require some changes from conventional irrigation design.

2.2.4 Alternative Water Source Development

The most suitable water sources for small irrigation projects from a physical or technical viewpoint tend to be those which

a. are small enough to be managed by a single irrigator or a small group of cooperators,

b. can supply water to scattered or dispersed points,

c. require only moderate initial capital investments,

d. allow a relatively short period of time between the start of construction and the availability of irrigation water in the field, and

e. require relatively unspecialized technical skills for their development.

Usually, the least appropriate will be large dams and major river diversions, and the most appropriate will be small surface reservoirs, shallow wells, etc. (Finkel, 1982). Pumping directly from rivers allows large water sources to be used without the problems and cost of large headworks. This method does have limitations if water level fluctuations within the river are extreme as was observed in the Sahel.

Developing water sources from individual wells is an option where good quality groundwater is available. Such wells, usually "shallow type," have the advantage of being located close to the field, thus resulting in lower investments in conveyance structures. Small systems based on wells simplify organizational problems, but well spacing and overpumping can become serious problems in groundwater schemes (e.g., Bangladesh, Northwest Region). Conjunctive use of groundwater with surface water sources is a technology that may merit more attention. Surface water is sometimes available for irrigation during the wet season with very little development needed. Ground water can sometimes be used to supplement the surface source when the surface water is no longer available.

One of the critical concerns of design engineers involved with irrigation structures is the consequences of system failure (e.g., concerns regarding failure of headworks). Therefore, headworks may be "overdesigned," from an economic standpoint, as a safeguard against failure. Because of the many uncertainties and data limitations inherent in SSI design, the tendency to "overdesign" the headworks

is an issue that should be addressed. When, for example, should temporary headwork structures be used and what are the consequences of their failure?

2.2.5 Synthesis of Irrigation System

The synthesis of SSI system alternatives should be done with input from both professional planners and local people. A central concern in the synthesis phase is that of assuring, to the degree possible, that control be in the hands of the farmers (Underhill, 1982b). Those involved in planning and design must assess the balance of hardware and software employed within the system, along with the implications of this balance towards resultant and successful local control.. For example, are large headworks, as found in more conventional designs, needed? When? Where? When should external resources be invested in concrete, etc.?

In the synthesis of alternatives for optimal SSI designs, consideration should be given to systems that are local labor intensive, draw on local resources, and which generally require a low capital investment. Large capital investments, which localities will generally be unable to provide, frequently shift control of a project to the developing agency; so, to the extent possible, labor and local materials should be used. (Loans, rather than grants, should be considered for the same reason.) Field reconnaissance observations in Peru indicated that successful SSI design in the Sierra should aim to use abundant and underutilized human resources and convert them into capital resources (Keller, 1983).

A crucial issue that must be dealt with in the synthesis of the components of the system is the level of involvement of outside design agencies. How far down the system should technical intervention take place? Should the design go farther down the system than conventional LSI design, which often extends to the tertiary and quaternary levels of development with turnout controls at the field level; and, when is it approriate to leave the system more "open-ended," concentrating on headworks and leaving the lower end to local adaptation? This is likely to be a

very site and/or regional specific issue. In the Sahel, for example, indigenous irrigatoin systems tend to be very localized, often operated independently by single farmers, as opposed to what could be called a "regional consistency" more often found in parts of Asia (Moris et al., 1982). Managing and sharing a central water supply would likely require more external input and control farther down the system in parts of West Africa, where such "localization" has not necessitated or induced cooperative water management among farmers. Yet, there is still much to be learned about appropriate and effective inducement of cooperative water management practices in such areas where traditional practice has been single farmer/family oriented. The assumption should be avoided, however, that these areas do not possess traditional water management expertise and practices that can be utilized in the development of new schemes that require or induce participatory activities on behalf of a community of farmers.

These issues also imply the need to have a careful and thorough assessment of local resources as discussed in step number two. An appreciation and understanding of established traditional irrigatoin practices, based on indigenous capabilities and technologies, is particularly important so that the local resource base can be more efficiently utilized and synthesized into the overall design. Too frequently, those responsible for upgrading or enhancing local small systems have a faulty understanding of what they are replacing, and conventional designs either do not recognize or account for the investments already made by the local farmers. In Nepal a foreign consultant involved in the rehabilitation of small-scale systems declared that, "all of the farmers' systems are in complete disrepair and not functional." He was correct in observing that the systems were not functioning at that particular point in the cropping cycle. What the consultant did not see was the annual maintenance activities carried out by local user labor just before rice planting commenced. Shortly afterward those systems were put into

operations. An unrecognized, and more frequently underutilized, resource exists, for example, among a number of schemes along the Niger and Komadougou rivers in West Africa, both of which are areas of long-term traditional irrigation experience. A review of some of the project documents for schemes along these rivers frequently reveals little or no provision in the planning stages for the identification or assessment of traditional irrigation practices in the area (Moris et al., 1983).

Beyond this is the crucial question of how to identify local resources. Once identified, how can they best be utilized in the development of SSI works. Once this is assessed, what already exists locally can thus be built upon, and crucial technical gaps which need filling will have been identified in the process. Consideration must also be given to the fact that in some cases indigenous technology is perhaps more appropriate than that offered by outside agencies. More frequently, however, the most important issues that will likely need to be addressed are those that surround the quesiton of what the appropriate mixture and intervention is of technologies and management practices that will both exploit existent local resources and provide the support needed for the farmers to exercise and maintain control over developed systems.

The appropriate degree of hydrologic control and dam/diversion projects should be decided upon at this stage in the design. In some areas, opportunities to optimize both the hydrologic control (hardware) and the management control (software) may be considered. A careful assessment of existing hardware and indigenous systems is critical in this stage.

Planning and design of the headworks and main canals of small irrigation systems is basically an engineering task based on the physical environment, as well as the social. In some cases, further down the system consideration might be given to the utility of directly involving farmers in locating canals, turnouts, and other

local structures, and consulting them about trade-offs when choosing the components of the system.

Much of the potential for SSI development lies outside of single source systems (e.g., diversions, tanks) and will be found in the utilization of multiple point surface and groundwater sources. However, technological improvements are lagging in the area of water lifting devices adequate for such development and research is presently rather limited. Most of the literature on small mechanical pumps is oriented towards domestic use and does not address either volume of flow or aggregate demands—both of which are crucial in irrigation (Jenkins, 1980; Club of Friends of the Sahel, 1977). In addition, what has been developed has generally not been tapped. How does one determine the type of lifting device to be used? Key considerations include: (a) energy source—e.g., manual, animal, diesel, gasoline, and solar (the energy issue is a very crucial one in areas where gravity-fed irrigation is not possible or is nonexistent); (b) user experience—determines amount of training required; (c) logistic backup—in-country spare parts, mechanics, fuel delivery, etc. In a very general sense, water lifting technologies need to be suited to the local physical, human, and economic conditions of the region.

Input supply bottlenecks frequently become a problem in many smaller irrigation works, particularly in the more remote rural sections. Methods of alleviating these difficulties need to be given careful, premeditated consideration in the synthesis of the system components of any scheme on the drawing board. This is particularly applicable to small pump schemes where in-country fuel, parts, and maintenance support is crucial to the life of the project.

Finally, are there design choices and actions that can be made at this stage that will prevent or reduce the creation of post-implementation dependencies? The identification of local resources <u>before</u> final construction

/implementation is crucial. Gaps can be identified and filled with training of locals (e.g., to build and repair). Necessary inputs and supplies need to be assured, with local infrastructure, local manufacture and parts availability, etc. In general, increased local resource use (both human and physical) will often be the most cost-effective method of avoiding this problem.

2.2.6 Design of Infrastructure

One glance at the data requirements of conventional system design reveals that an overwhelming quantity is necessary. Both the scarcity and uncertainty of data in third world countries virtually precludes elaborate designs that require extensive, high quality, technical and physical data. When can one utilize generalized data; are these data so site-specific that generalized data have no utility? For example, one might be able to utilize more generalized data in areas with less extreme topography, such as in the Sahel, but in not mountainous and more disaster prone areas, generally not.

In order to minimize the effects of these uncertainties and to avoid conventional design requirements that call for extensive data, adoption of "pre-selected" design criteria is a possible option. In such an approach, the engineer would not design a unique site-specific system for every SSI development, but rather would incorporate designs of standard structures (e.g., from a "catalog" of irrigation technologies). These would be "pieced" together to produce a hybrid system suited to local conditions, requiring a minimum of site-specific information. In order to implement such a strategy, a set of guidelines and criteria must be assembled which would enable the engineer to determine to what extent a given project areas falls within well-known bounds and would not require extensive site-specific data. As yet, such guidelines do not exist.

Another approach, which is not altogether exclusive of the one above, may be to adopt what can be termed a "minimalist" approach. Under this scheme,

the project proceeds from baseline design technologies (i.e., the minimal necessary to make it functional) and is then modified and adapted in response to successes, failures, and changing demands on the system. The aim of such a minimal investment and technology approach is to minimize the possibility of gross project failure due to inaccurate assessment of the development site variables. The design is approached with the understanding that the initial development will very likely not be the final product. This methodology would clearly demand a significant amount of design flexibility and resiliency, yet would likely take maximum advantage of local resources. As opposed to the more conventional planning-design-implementation hierarchy, this type of approach could likely be tailored to SSI development to allow for feedback and modification at all stages in development. For example, a minimalist approach might be more suited to disaster prone, mountainous areas, while a standardized design approach might be more appropriate in Sahelian West Africa where the topography and climatological events are less extreme. In many situations, a modified combination or mix of both approaches would best fit local conditions.

Irrigation development has historically been hampered due to a critical lack of engineers and personnel with technical expertise. When will the use of a standardized design alleviate this problem? When should para-professionals be trained in these projects? The lack of technical backstopping often seems to be an inherent problems with PVO's and NGO's. This was found to be a critical situation in the Sahel (Moris et al., 1983). Both are quite involved worldwide in SSI development works, yet the issue of how they can obtain the technical expertise they require has yet to be solved. As a result, many mistakes have been made that parallel those of large projects albeit on a micro-scale.

The lack of "ground truthing" at this stage in the design process seems to be an inherent problem in irrigation development throughout the world, yet it is

particularly crucial to smaller schemes where field knowledge is vital. It seems that engineering design has often been based on extremely limited sight acquaintance and does not take into account local logistical and administrative capabilities. Design technology is often chosen from a distance by individuals with little awareness of local performance and constraints. Much greater emphasis needs to be placed on designing the irrigation system in the field. Across West Africa a number of sites can be found where minimal field familiarity on behalf of the designers resulted in serious system problems: e.g., a river dike being built in part over a sand bar; irrigated rice perimeters laid out in extremely sandy patches of soil pump intakes placed above annual minimum river flows; drainage ditches placed at levels where they actually draw water into the system rather than drain it out; reservoirs with insufficient catchment areas to reach design storage capacities (Moris et al., 1983).

2.2.7 Project Implementation

Project construction requires labor, materials, equipment, and supervison. One of the primary resources in many developing areas is labor. This is particularly beneficial in projects where must of the construction work can be accomplished using manual labor. Not only does the use of local laborers generate a greater sense of responsibility within the community, but capital needs will be considerably lower since outside labor need not be hired. The use of indigenous materials to replace those that have to be purchased or imported from outside the community will usually be quite beneficial. However, when outside materials must be utilized, fairly rigid quality control standards should be established.

In general, equipment used to construct small projects should be consistent with the available labor force and type of construction. Most of the equipment used by local laborers in the construction of small systems will be hand tools (e.g., picks, shovels, hoes, hand levels, etc.). Heavy equipment will

sometimes be necessary where rough earthwork is required; small power equipment may also be useful in some cases.

In order to put the essential elements for construction——labor, materials, and equipment——together in an effective way, close supervision by qualified personnel is necessary. The acceleration of construction of small-scale irrigation schemes will stretch the capacity of countries to provide good field supervisors. Thus, there is a critical need for trained personnel able to manage the construction of small schemes.

Training local farmers on the management and maintenance aspects of the system is an area where small-scale developments should invest significant time and energy. This training could coincide with implementation in a work-learn framework. A 250 small (4 hp) pump scheme on the Niger River in central Mali failed to include farmer training/education in the use and maintenance of the pumps when the project was implemented. Rather, several nonlocals were trained and brought in as pump mechanics. The result was a continuing problem of unnecessary levels of pump failure due to the farmers' lack of knowledge of appropriate operation and upkeep, as well as effective communication problems between the mechanics and the farmers, and a general failure to communicate and emphasize preventive maintenance measures (Moris et al., 1983). It must be stressed that staff training is <u>not</u> equivalent or fully substitutable for farmer training.

The role of the engineer in the implementation process is very important; yet, in working on the field and village level, engineers and designers have often been the source of critical errors. Too frequently, engineers emphasize the complexity of the technical design and maintain a social distance from the community. This tends to generate a continuing dependence on the engineer's expertise and services. To alleviate this problem, planners and designers should be

encouraged to work in or near the field. This would provide the feedback from the initial implementation stage necessary for sound, progressive, and self-corrective design work.

Perhaps one of the more crucial revisions in the conventional design and implementation process would be to redefine or restructure the design-implementation steps (or phase). The division of responsibilities between designers and implementors needs to be modified somewhat to promote dialogue and exchange of experiences between these two disciplines. This kind of feedback should not be limited to the design staff, but should also include local input and feedback as well. Finally, the technical design of small-scale irrigation systems should be planned to minimize delays in implementation. Delays in the construction phase, especially in projects where the community is heavily involved, can result in disillusionment and serious erosion of incentives.

3. CONCLUDING REMARKS

SSI design criteria need to be identified and established which will supply the rural sector with the sufficient technical resources needed to exercise and maintain the control and use of local natural resources necessary for irrigated agriculture. Although a number of issues have been raised and discussed throughout the preceding pages, many of which are left unanswered, we have sought to emphasize the need for local control in the design process. We see this as a key element in the future of successful SSI development.

III. COMMUNITY PARTICIPATION AND LOCAL ORGANIZATION FOR SMALL-SCALE IRRIGATION

by

Barbara Lynch

A. Introduction

Small-scale irrigation projects present a set of opportunities for community involvement in overall investment, system layout, operation, and management. Because of their relatively small size, these projects can be managed at the community level. Their simpler technology may permit operation, maintenance, and some design change to be carried out by workers with general skills (e.g., masons and carpenters) and with local or readily available materials and tools. Finally, the existence of irrigation structures, roles, and institutions within a community is usually an indication that human resources are available for system rehabilitation, extension, or upgrading.

Small-scale projects not only present opportunities for community involvement, but their success is likely to depend upon it. Because projects tend to include a large number of widely scattered sites, it is costly to invest in extensive feasibility studies at each site. Thus, a development agency must to a large extent rely upon information already available in the community. This information includes data on soils, climate, crop water needs, and the availability of building materials. In addition, it includes knowledge of property rights—to the water source, field boundaries, rights to irrigation water, and usufruct and ownership rights over land affected by the project. Finally, information about labor availability on a seasonal or permanent basis is likely to be available only at the community level.

The community is not only a fount of information, but it can be an important source of human resources. Agency costs are often reduced by the use of community labor in construction, maintenance, and repair activities. Furthermore, the expense to an agency of administering many small systems at the local level after construction has been completed may be reduced if responsibility for water allocation, operation and maintenance, and supervising water delivery is allowed to rest with the community. Finally, it may be expected that, in addition to their own information, labor, and administrative talent, many communities will mobilize contributions in the form of cash, tools, and local building materials.

The ability of the community to take responsibility for these aspects of a project will depend on the one hand on a high level of community participation in different phases of project development and on the other, the existence of (or potential for) local organizations capable of carrying out irrigation tasks which can best be performed at the local level. This assertion, however, raises a number of questions about the necessary prerequisites for effective community participation, the identification or creation of appropriate local organizations and institutions for irrigation project development, the tasks and functions of local irrigation organizations, and about the way in which development agencies can best promote local participation and organization. The discussion which follows will highlight some of these issues.

B. <u>What resources are available at the community level for participation in small-scale projects and do constraints exist which may limit this participation?</u>

1. How does the presence or absence of a traditional irrigation affect the potential for community participation and local organization?

a. <u>Communities with an irrigation tradition.</u>

Many small-scale irrigation projects are undertaken in communities where an irrigation system already exists. In these communities, one may expect

to find that, in general, cultivators understand how irrigation systems work, what the water needs of crops are, and how these relate to local climatic conditions. In addition, it is likely that a set of procedures for water allocation exists and that these procedures were designed to reduce conflict and to serve minimal water needs for the irrigation community at the time the system was designed. Such communities will usually have a local organization whose function it is to allocate water, to carry out O&M activities, to supervise the system, to levy fines and water charges, and to resolve intrasystem conflicts. In some cases, the presence of a traditional irrigation system will also imply a tradition of communal labor for construction and maintenance of this system. Where a traditional system is functioning, then, the following resources for further irrigation development are also likely to be present:

(1) Information on climate, hydrology, and crop water needs, and in the irrigation works.

(2) A system of property rights in land, water, and a set of procedures for allocation taking into account both these rights and crop and human needs in order to maintain levels of intracommunity conflict at acceptable levels.

(3) Patterns of resource mobilization for maintenance and repair, including communal labor.

(4) The existence of a local organization, either a general-purpose organization, or one specifically oriented toward irrigation activities, which has had experience at performing irrigation tasks.

b. <u>When a traditional system no longer works</u>.

While the existence of an irrigation tradition often implies the presence of some or all of the above resources, this is not always the case. The institutional framework for a community may be insufficient or inappropriate to meet present water demands. In other cases, the changing economic and social position of a community within a national system may result in a breakdown of traditional authority structures. This in turn may make it difficult to allocate water or to supervise delivery without external assistance.

For example, the president of a community irrigation association in the Peruvian altiplano described an anarchic water allocation process in which the strongest members of the community got the lion's share of the water. He felt that the introduction of a schedule from the Direccion de Aguas made possible orderly and more equitable distribution.

In Quinua (Ayacucho), Peru, Mitchell (1976) found that the dissolution of a traditional prestige hierarchy charged with allocation decision-making resulted in the devolution of responsibility for water distribution or irrigators assembled at distribution points. He suggests that this acephalous method of distribution has resulted in a considerable increase in fighting. Here too, externally mandated schedules may offer a solution to conflict and allow organizational development.

A traditional organization may have the capacity to carry out irrigation tasks at the local level, but it may lack the ability to mobilize the local or agency resources needed for extension, rehabilitation or upgrading. In this case an outside catalyst may be needed to offer guidance to the community in setting its priorities, in working within the constraints of available resources, and in processing demands to agencies in the most effective way.

Finally, the potential for system control by traditional irrigation organizations may be weakened if there is a disjuncture between the capacity of the organization and the technology proposed or in place. For example, current water demand may exceed the capacity of existing allocation procedures or physical structures to meet them. A project may call for the extension of water rights to a new set of beneficiaries; traditional irrigation institutions may be designed to exclude this group from meaningful participation. System maintenance may call for the development of a local labor force no longer available, or changing crop water requirements may require changes in organizational procedures. In the face of these constraints, can traditional organizations undergo changes that will better

enable them to meet changing needs or would it be better if they were replaced by new organizational forms?

c. Where no irrigation tradition exists.

To what extent does the absence of established irrigation roles and institutions pose a serious obstacle to community participation or to the creation of effective local irrigation organizations? Communities without irrigation may be divided into two groups: (1) those existing communities where agricultural and/or pastoral activities have been taking place, but where irrigated agriculture is new to the farming population; (2) resettlement communities, where colonists have had no experience with agriculture in a similar environmental context. In both cases we may expect to find a more limited local pool of information about important physical variables. In the first type of community, however, there is likely to be some information available about soils, hydrology, and climate; there are also likely to be organizations and institutions for community participation in public works projects, for conflict management, for resource mobilization, and for consensus building. It may be possible to transform these into irrigation organizations.

However, even in the second more extreme case, colonizers may bring with them information about the performance of irrigation systems in other contexts which will allow them to contribute information needed for the development process. The often heterogeneous, and sometimes transient, nature of the resettlement community may impede the creation of local organizations and irrigation roles, but this may be offset by an ideological or religious commitment to making the land productive. The absence of entrenched factions may also facilitate participation and institution building.

2. How do patterns of resource distribution within a community affect its potential for participation in project development and the capacity of local organizations to take responsibility for system operation and maintenance?

The pattern of resource distribution is the most critical aspect of community structure for the purposes of irrigation development, one which at times appears to defy agency attempts at its modification. Major resource distribution issues include the allocation of land and water rights within the community, sectoral conflicts over water use, and class or ethnic cleavages which may prevent the equitable distribution of project costs and benefits.

a. Rights in land and water.

These include the right of a community to a particular source, the right to land required for tanks, dams or main canals, rights to lands within the community to be appropriated for irrigation facilities, rights to irrigated lands, and finally rights to irrigation water. These rights may be codified (as in the case of the Chilean water law which specifies that domestic water use takes precedence over use for irrigation), or they may be customary. Failure to ascertain a community's title to a water source or to the lands over which water must be carried from this source has resulted in the delay and, at worst, the abandonment of small-scale projects.

Customary rights to land and water are often harder for an outsider to discern than legal rights, but they may be equally important. Pradhan (1982) attributes the failure of an attempt to provide water from a Nepalese diversion system to a new group of users to the fact that project developers (in this case, the district panchayat) did not take into account the unwillingness of upstream users to relinquish historical water rights gained as a result of a half-century's investment of money, time, and labor into the system.

Rationalization of water delivery, even without the redistribution of water rights to new groups of cultivators, may result in a reallocation of water

rights with a consequent effect on use rights to irrigable lands. Millon (1961) notes that the redistribution of water rights on a strict hours per hectare basis removed from the water user's association the discretion to deliver enough water to small landholders to keep them afloat during dry periods. This effective curtailment of use rights as a result of inadequate water delivery resulted in a sharp increase in conflict within the system. In summary, failure to take existing property rights into account in project development may discourage participation, weaken local organizations, and/or directly contribute to project abandonment.

Irrigation development is sometimes accompanied by the creation of new rights—in water, in the system itself, and in some cases land. For example, the Sukhomajri Tank Project in Haryana (India), a Ford Foundation project, created water rights with the decision to use the tank for irrigation as well as for soil conservation purposes (Seckler, 1980). These rights were distributed equally among all families irrespective of land holdings, but dependent upon a payment to the Water Users Association. These rights could be transferred freely. The effect of this broad distribution of rights to irrigation water should be greater participation in irrigation activities and greater commitment to the success of the system among all classes, but the impact of this innovation has not yet been studied.

In Bangladesh, agency-funded pump irrigation projects have created rights both in water and in a water delivery system. Early data for the Thana Irrigation Program (Blair, 1974) suggest that the concentration of these new rights in the hands of local elites not only undermined equity concerns, but had a negative impact on efficiency. These early pump projects depended upon continuing heavy subsidies, and the goal of local responsibility for management was never achieved.

In contrast, the PROHISKA low-lift pump projects were designed to enable groups of landless people to acquire low-lift pump and shallow tubewell

programs have not been universally successful, they have allowed a far broader participation in water management and have permitted the creation of flexible organizational structures capable of responding to changing management needs. The deliberate attempt to broaden the distribution of wealth in a region through the allocation of new rights in water and in irrigation facilities is a relatively recent phenomenon. To what extent does the broadening of participation through this distribution of new rights enhance the capacity of local organizations to perform irrigation tasks?

b. Social structure and the distribution of project costs and benefits.

An irrigation project may make no substantial changes in the distribution of property rights in land and water within a community, but may distribute costs and benefits in seemingly unpredictable and sometimes problematic ways. According to Cloud (1982:5),

> In African systems, where women still have independent access to land through traditional use rights, there is evidence that they lose access when irrigation is introduced unless specific measures are undertaken to preserve it. This is important for efficiency as well as equity reasons because women in many African systems are independently responsible for provision of parts of the family food supply.

In People of the Sierra, Pitt-Rivers (1961) notes the aggravation of conflict between a mill-owner who depended upon irrigation water for his mill and village cultivators depending upon the same water supply for irrigation. Changes in the availability of water for domestic use as a result of irrigation system improvements may either burden women with added chores or release their time for agricultural activities.

Irrigation system changes may encourage broader community participation through the provision of ancillary benefits such as power generation or water for fish rearing. If this is the case, it is likely that support for a project will be widespread even if the number of irrigators is limited. On the other hand, if a

small-scale irrigation project cannot distribute benefits to all affected by it, is it reasonable to expect that a local organization will be able to mobilize local resources and manage conflict effectively?

c. Changing patterns of resource distribution.

It is possible that the distribution of rights, costs and benefits associated with the project may require that external resources and mechanisms be used to idemnify losers and to gain their support for (or at least acquiescence) to new irrigation projects. At times, it may even be necessary for the state to exercise its right of eminent domain in order to condemn land for reservoirs or canals. Community participation in all phases of project development may, however, minimize the need for indemnification and condemnation. An NIA-Ford Foundation Project in Central Luzon, for example, encouraged local participation in planning and preconstruction activities. Farmers were able to suggest canal layouts that would minimize land losses to any one farmer (Korten, 1982:14).

In order to provide equitable access to irrigable land, the introduction of an irrigation system may be accompanied by a thorough reallocation of community lands. Norman (1983) describes the procedures used by ONAHA (National Office of Hydro-Agricultural Management) in Niger:

> . . . a survey team is sent into the area to determine who owns what, how much, etc. Land within the perimeters is then divided up between farmers on the basis of such factors as previous ownership (of land within the perimeter), amount of total land owned and presently farmed, family size and needs, etc.

To what extent is it possible for local organizations to carry out this type of land redistribution? What can the community through widespread participation be expected to contribute to this process?

In summary, resource allocation factors—such as the distribution of rights in land and water, social structure, sectoral competition over water, and the need for land condemnation or redistribution—may present constraints which

limit the potential for local organization and community participation in some instances. In such cases, it is important that as much control of the decision making process as possible be left in the hands of the community, and that in order to maximize local support, benefits and rights be built into projects that compensate in some way for those lost.

C. What characteristics should local organizations have if they are to become effective collaborators in small-scale irrigation projects?

1. Accountability.

It appears that there is a basic need for a local irrigation organization to be accountable to its members, yet agencies often attempt to create local organizations accountable to the agency rather than to the user group. That is, local organizations become mere appendages of the bureaucracy rather than entities well rooted in the community. If a local organization is to be accountable, must it include members of all interest groups within the community of irrigators in order to accurately represent their needs? A community of irrigators may include a number of groups with opposing interests. These may include men and women; different ethnic groups with distinct farming systems; and tenants, sharecroppers, and squatters as well as landowners. Other interest groups include upstream and downstream water users and cultivators on hillside and valley lands. An irrigators association should be able to balance these competing interests well enough to maintain support for the system and cooperation in maintenance tasks and to keep conflict within acceptable bounds.

While an organization may adequately represent the interests of the community of irrigators (West, 1983:49),

> . . . the property rights implications of collective adoption frequently alter access to land resources that threaten vested interests which leads to resistence to planned social change. These may be class interests, but they may also represent conflict among land uses.

Some of these possible conflicts of interest have been suggested in the preceding section. Should a local organization take into account the needs of those dependent upon other uses of water within the community—including domestic use, livestock, forestry, industrial use (including local milling, brewing, textile processing), fish raising, power generation, river transport, and tourism and recreation? If these sectoral interests are represented among irrigators, accountability is likely to be a less serious problem than in communities with a high degree of occupational specialization.

Beyond the community of irrigators and other water users, a local organization probably ought to be accountable to the entire population affected indirectly by the project. This population may be the same as the water user community, but, where this is not the case, project success may depend upon the widespread perception that the project will directly or indirectly benefit the community as a whole rather than increase the power and wealth of a small minority at the expense of other community members. Can irrigator associations be responsive to other interest, given their limited purpose and representation? A more generalized local organization such as a local government or a civic-religious prestige hierarchy may be in a better position than an irrigator association to represent a broad spectrum of interests.

Lees (1974:86) suggests that with the transfer of control over irrigation decisionmaking from communities to a state authorized junta de aguas or water users' association,

> The government . . . appropriated not private property but what was considered to be communal village property for the use of a special interest group. If this group is smaller than the whole community, the introduction of a distinction based on inequality will undermine the ideal through which the community is integrated—its public and communal activities, resources and officials.

While a generalized local organization may be best able to forge consensus, minimize conflict, mobilize local resources, and build support for a project, it may lack the expertise needed for irrigation decision making.

It may be possible to solve this problem through the employment of technical experts and skilled labor by the generalized organization or through the creation of a special ad hoc irrigation committee directly responsible to a more generalized community body. This was the case in the Peruvian community of Collini (Puno), where the irrigation committee was supervised by the two branches of local government.

More attention should also be paid to the ways in which informal groups and networks may ensure that a formal irrigation organization will be accountable to a broad public. The importance of such informal networks in managing conflict within the system is illustrated by the following Indonesian example (AID Report on Indonesia, cited but not referenced in Cloud, 1982):

> In Village S, problems often arise between farmers on the upper and lower slopes, whose irrigation water comes from the same source. The farmers of the lower slope (who live near the main road) tend to be better educated, wealthier and generally more powerful in the community. When the farmers of the upper slopes have to approach them, women are usually delegated as the intermediaries, since heated quarrels tend to arise when two men face each other to discuss water conflicts (and the more backward (sic) upper-slope farmers would probably lose those arguments). Only if agreement cannot be reached through these informal visits, do they ask community irrigation officials (centeng) for help.

Up to this point, this discussion has focused on the accountability of water user associations to the community, whether broadly or narrowly defined. To what degree must a local organization also be accountable to the development agency? At one extreme, accountability to a development agency or state water authority may undermine the accountability of a local organization to the community as a whole. Lees (1974) has shown examples of this process for the valley of Oaxaca in Mexico. In other cases, an organization which is already accountable to the

community at large may undergo a transformation that renders it accountable to the state or agency and for that reason enables it to receive state or agency aid. The Philippines case provides a good example of this (Coward and Levine, 1978):

> . . . material assistance is being given to indigenous systems on a loan basis. The Government is concerned with ensuring the repayment of this investment. Thus, each indigenous system receiving government assistance is required to formally organize in accordance with standardized rules laid down by the Securities and Exchange Commission.

While Coward and Levine argue that this approach is unnecessary where local organizations (zanjeras) have been operating successfully for long periods, the ability of an organization to adapt to external requirements without losing its authority may be an important survival trait.

Local organizations are faced with the task of striking a viable balance between their accountability to the project agency and their responsibility to their local constituency. If the organization is an appendage of the bureaucracy, its range of functions may be constricted. This will be especially true if outside-oriented people who lack community support end up in leadership roles. Local constituents should find the tasks assigned to a local organization by an agency both appropriate to the organization and useful to the community.

2. Ability to perform general functions and specific irrigation tasks.

According to Coward (1983a) an irrigtion organization must be able to perform five distinct tasks if the operation of the system under its custodianship is to be sustainable. Three are specific tasks—water acquisition, water allocation, and system maintenance. To these he adds the more general tasks of resource mobilization and conflict management. Working from this framework, I have enlarged the set of irrigation-specific tasks to include information collection, labor mobilization for construction and repair as well as maintenance activities, system supervision (making sure that irrigation rules are observed and identification of water delivery or allocation problems), and the levying and collection of water

charges and fines (both for theft and misuse of water and for failure to fulfill labor obligations). To Coward's general tasks and functions must be added the mobilization of community support first for system construction and later for its smooth operation, maintenance, and eventual repair or rehabilitation.

Is it possible to identify local organizations with the capacity to carry out all these functions? Is a general-purpose organization (e.g., a local government, civic-religious organization) as likely as an irrigation organization to be able to carry out these specific tasks and general functions? How does one build into an organization the flexibility to carry out such a diverse set of actions? Are all these tasks and functions equally important? Can they be carried out by a development agency at a reasonable cost?

3. Ability to interact with development agencies.

It would seem that in order to become an effective collaborator in irrigation development, a local organization would not only have to be accountable to its constituents and capable of performing the tasks and functions listed above, it would need flexibility to respond to the demands of the irrigation project. In other words, the organization must have the capacity to deal effectively with development agencies. This may necessitate incorporation or registration as an entity responsible for loan repayments as in the case of the zanjeras in the Philippines (Coward and Levine, 1978). The organization may have to develop a capacity to manage finances, write grant proposals, and to work together with a number of government bureaus. In addition, if the local organization is general-purpose, the inclusion of irrigation-specific expertise within the organization may be required. A useful development agency role may be to supply resource persons to help local organizations to respond effectively to this type of project demand.

D. How does agency and state behavior encourage community participation and effective local organization?

Levels of community participation in development projects and the nature of local organization are both in great measure responses to the behavior of the agency involved in a specific irrigation project and to the general policy environment within which both agency and community are operating. This community response is rooted in history. Where the past record of development agencies in a region has been characterized by the failure to carry through on projects, communities are unlikely to commit a large share of local resources to a long-term effort and instead will seek aid for smaller projects to be carried out quickly with low levels of community participation and responsibility. Because this local response is to past experiences, changes in agency behavior may not immediately elicit desired community organizational responses. This has been a source of frustration for development personnel in the past. Nonetheless, some bureaucratic changes ought in the long run to foster community participation and the empowerment of local organizations.

What then are appropriate agency strategies for encouraging participation? Should the agency play an active role in creating local organizations as it does in much of Latin America? Or should it simply recognize existing institutions? Issues related to agency function and style will be discussed in the following paper. In this section I will focus on three aspects of agency and state behavior as they relate to community participation and local organization--laws pertaining to irrigation associations, the role of the community organizer or catalyst, and socioeconomic baseline data collection procedures.

1. How can laws pertaining to irrigation organizations or to the rights of communities and local water user associations affect participation and local organization?

First, a water law may require a shift in accountability of a water users group away from the community to the agency or state, or it may allow authority

for water management to rest with the community itself. Where a local organization derives its authority from the state, it may find itself in the uncomfortable position of carrying out policies which it has not helped to shape. Is this likely to reduce the organization's support within the community or make it more difficult to attract qualified community members to leadership roles? Or does state authority enhance the power of a local organization?

Second, a law may narrowly specify the form of irrigation association required for receiving state or agency aid, or it may permit the development of a variety of organizational forms by leaving formal matters unspecified. Some Latin American water laws (notably Mexico and Chile) link state assistance in small-scale irrigation to the creation of formal water users associations which derive their authority from a government ministry or agency and becomes accountable to it. (The problem of accountability has been discussed in greater detail above.) In the case of the Mexican law this organizational form is narrowly specified. Goldring (1983) notes that small-scale projects are more likely to succeed where both agency and community perceive these state mandated organizational forms as useful and beneficial. On the other hand, among reasons for project failure she lists "farmers did not like the organization imposed by SAHR (Secretariat of Agriculture and Hydraulic Resources) agents for handling the system" (p.21).

2. How does the role of the community organizer affect participation and local organization?

Many small-scale irrigation projects involve the use of promoters, catalysts, or community organizers to guide and foster participation. These agents may perform widely differing roles. In some cases they may be little more than salesmen for a specific program or design. Goldring (1983b) interviewed a Oaxaca project promoter whose role was to enter a community, to inform residents about an impending project, and to conduct "labores de convencimiento" (efforts to convince people) until at least half of the potential water users show their

willingness to sign an agreement both to the system and to a community labor and cash contribution. She found that the job of the promoter is not to reach a negotiated settlement about design, timing, and contributions, but rather to obtain ratification for a predesigned project. The promoter as salesman attempts to generate support for and create an organization compatible with a particular project type.

At the opposite extreme is the community advocate. The advocate is often an outsider with some influence in national or international development circles, who brings the needs of the community as he or she perceives them to the attention of agencies. Several Puno communities owed their irrigation systems or improvements to advocates. At Ccotos, a North American sociologist in residence helped to gain agency support for an irrigation project and a North American Sister of Charity succeeded in enlisting Canadian financing for the construction of headworks and a matrix canal. She had also been working with AID/Lima to get support for further improvements at Cahualla.[1] It was also reported that projects were frequently advocated by local school teachers, whose visions all too frequently were not linked to widespread community support for a project.

A third role for the community organizer is that of resource person--an outsider enlisted by the community to help it to establish its irrigation priorities, to build organizations in order to carry out new functions related to project development, and to help translate the felt needs of the community as a whole into viable proposals for outside support.

Who should these organizers be? Can community residents be trained to fill these roles or are they best performed by agency staff? Is it best to rely upon

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[1] In this case, unfortunately, the advocate's political expertise was offset by her lack of engineering experience. This resulted in the installation of a poorly engineered main canal. See the preceding design paper (Norman et al.) for some possible solutions to this problem.

seasoned professionals or does the transient nature of the job require a dedicated and enthusiastic cadre of young people? The problems encountered with turnover among the IO's (institutional organizers) at Gal Oya may suggest that the role of community organizer is better suited to some stages of professional development than others.

3. **Is it possible for an agency to collect the data necessary to ensure that participation will be fostered by a particular development strategy and that appropriate local organizations will be identified or created to bear responsibility for irrigation decisionmaking?**

It would be tempting to recommend that any small-scale irrigation project should be accompanied by a thorough sociological/anthropological baseline study. However, such an approach would not only be prohibitively expensive, but might not yield much more relevant information than a better directed short-term study. How much does an agency need to know about a particular community before engaging in a small-scale irrigation project? If full community participation is built into a project, an agency may need to know very little. If this is the case, what information is essential?

A first task of a baseline study might be to determine whether or not an indigenous irrigation system actually exists. If so, how does its design affect irrigation organization and the distribution of its benefits? What is the history of the system, and how has this history affected the allocation of water and land rights? What components of the community population are served by the system? To these queries we may add the items used by de los Reyes (1980) in her assessments of communal gravity systems in the Philippines:

1) the person or group entrusted with overseeing system operation;

2) the organizational setup of the irrigation association if one exists;

3) rules and practices associated with the allocation and distribution of water in the system;

4) roles related to system maintenance and activities involved in system maintenance; and

5) conflicts related to the use of water and procedures observed in the resolution of irrigation disputes.

Finally, it would be worthwhile to know how much of the existing physical and organizational apparatus of the system can be utilized in a project.

Whether or not irrigation exists, the following questions should also be asked. What is the level of community support for a project? Bagadion et al (1980) point out that

> . . . there are often conflicting views among (irrigation association) members as to the desirability of NIA assistance, since it may bring them differential benefits; farmers with easy access to water may be relatively satisfied with the present situation and (resent paying for new construction costs) while others downstream may be very keen on improvements to obtain a more reliable water supply.

Are there organizations and leaders within the community capable of performing irrigation roles? What is the basis of their support?

To summarize, development projects for small-scale, community-managed irrigation systems often depend upon substantial community contributions of labor, information, local materials, tools, and often cash. Project beneficiaries are usually expected to assume responsibility for system operation, maintenance, and repair, and for water allocation after the project is completed. If contributions from the community are to be forthcoming and if transfer of responsibility of the system is to be successful, attention must be paid to these issues of local organization and community participation in all phases of project development.

IV. AGENCY CAPACITY AND ORIENTATION

by

Susan Turnquist

One of the most difficult questions confronting policymakers committed to assisting the development of small-scale systems is how to resolve the discrepancy between an implementing agency's purpose and procedures. David Korten (1980: 483-484), assessing the history of poverty-focused programming, identifies one of the unmet needs as "building the capacity of donor organizations—whether public or private, foreign or national, planner or implementor—to provide assistance in ways which respond to local needs while building local social and technical capacity." He attributes this lack of donor capacity to excessive pressure for immediate results, which produces a bias towards projects rather than programs. Korten's table illustrates the contradictions this poses for donor agencies with a stated commitment to poverty-focused rural development (see Table I).

Table 1: Contradictions in Foreign Assistance Programming

Poverty-focused rural development involves projects which are:	Donors remain impelled to prefer projects which are:
Small	Large
Administrative and personnel-intensive	Capital- and import-intensive
Slow to implement	Easy to monitor and inspect
Not suitable for complex techniques of project appraisal	Suitable for social cost-benefit analysis

Source: Korten, 1980:484.

Irrigation development has typically been undertaken in a "project-oriented" manner, emphasizing the time- and budget-bound design and construction of a system. Typically an agency's responsibilities have ended with completion of construction. The success of small systems, however, depends on the extent to which they meet the needs and elicit the commitment of a community of users. By using the resources of a community and including the community in all phases of a "project" stage, an agency may achieve a more programmatic effect. That is, it ultimately supports the community's assumption of responsibility for operation and maintenance and helps them make their investment pay off. The distinction between the project and program approach is the agency's commitment to post-construction processes (which need not mean the agency's post-construction involvement).

Although the agency's actions set the stage for these processes, agency personnel are too few to be directly involved in the operation and maintenance routines; community water users are needed in small schemes for this. To ensure that local water users are both equipped and content to assume these responsibilities, the agency must find patterns of administration which encourage and benefit the participation of local water users. Mobilizing community resources in order to carry out a program of small-scale irrigation development entails a reconsideration of the capacities and orientation of an agency which has likely been concerned in the past mainly with large-scale systems and a "top down" approach. A conclusion reached by participants at a conference of irrigation agency officials, social scientists, and donor agency officials in Manila in 1982 was that agencies cannot be assumed to have the capacity to own and directly operate small-scale irrigation systems widely dispersed across a range of environmental and socioeconomic conditions (Coward and Koppel, 1982:8).

Moreover, the complexity of the task of small scheme development is accompanied, and to some extent caused, by increasingly complex criteria for project success. Criteria have broadened to include cost recovery for construction, equity, and assumption by local users of the responsibility for system maintenance and operation. The "project-oriented" goals of system construction have been joined by the more "program-oriented" goals involving system operation.

The questions which follow relate to the implications for agency structure and processes of adopting a strategy of small-scale irrigation development. The questions focus on three levels: (1) procedures: What style of agency organization facilitates the participation of intended beneficiaries in all phases of project decision making? (2) capacities: What is the range of functions an agency or agencies may find necessary to perform to implement a program of small-scale irrigation development? (3) What are the pros and cons of a multi-agency versus a single-agency approach; and what factors enter into a planner's selection (or creation) of implementing agencies?

The following discussion is founded on the assumption that an agency committed to a small-scale approach to irrigation development recognizes the benefits of including local farmers in decision making which will directly affect their livelihoods. Given this premise, the issue of how this might be realized is addressed.

> A complex system that works is invariably found to have evolved from a simple system that works.
>
> -- Murphy's Laws on Technology

A. What procedures (and structure implied by these) permit an agency to achieve its purpose of delivering useable irrigation systems to communities of users?

A few features of this type of service delivery may be noted. A primary feature is the dispersion of small-scale project sites. This poses problems for information flow, decision making, and deployment of personnel.

Constraints on Information Flow

Communication is a common dilemma in agency/community relations (Coward and Koppel, 1982:6). Agencies frequently have few, if any, mechanisms by which to transmit information to local groups and even fewer by which to receive information. For small-scale schemes this impedes a necessary collaboration between those who hold the best information about the particular micro-environment, especially regarding the range of seasonal variation and those who hold the information about technical feasibility.

Constraints on Decision Making

Decision making improves with the quality of information. More than that, the participation of local people in decision making ensures that information about their needs is incorporated into project design. At the stage of project construction, the dispersion of project sites requires that some decision making be authorized at the field level. Bhargava (1980:Ch.5) cites the absence of field level authority to make decisions as a contributing factor to long delays in project completion in Karnataka, India. After a system is operable and managed by local users, crises requiring agency support may be resolved faster if agency decision making is decentralized.

Constraints on Deployment of Personnel

Both information flows and decision making are contingent upon links between local people and agency representatives. The deployment of agency personnel to scattered sites can be difficult, as Bhargava (1980) notes in his Karnataka study. Staffing may be insufficient to provide each site with a full-time agency supervisor, transportation may be inadequate for one supervisor to cover more than one site, and remote sites may be viewed as unattractive assignments by agency staff.

Organizational Style

Given these dispersion-related constraints, it would be logical to encourage local authority for decision making at the project site. The need for decentralization in a participatory approach is well-known, if difficult to achieve. Leonard (1982:4), citing Thompson (1967:72-73, 86-87), notes that "an organization operating in an environment characterized by change and incomplete information must have decentralized management in order to cope." Yet decentralization by no means precludes centralization of particular functions and of authority for particular types of decisions. "Development" is a process of induced change in which both central and local levels of involvement are necessary. The dilemma is to find a balance between enough local autonomy to encourage initiative and participation necessary to rural-based development and enough control by the center to support broad-based local participation by preventing or at least minimizing corruption and control by local elites.

"Decentralization" can take many forms. Leonard (1982a:32-33) suggests that different forms of decentralization are more appropriate for different task requirements, available resources, and political constraints. It follows from this that not all types of decentralized organization will be effective in all circumstances, and in fact may even be counterproductive. The capacities of each level (local, intermediate, center) for specific functions must be assessed before responsibilities are placed at any level. The assumption that local participation is good does not imply that people have time to waste attending pointless meetings.

Notwithstanding the efforts by Leonard (1982) and Uphoff, Cohen, and Goldsmith (1979) to address these issues, the fact remains that, as Johnston and Clark (1982:169) point out, "analysts, planners, and politicians simply do not know what kind of local organization is in the poor's interests." (emphasis in text) There are no clear-cut answers as to the type of organization that an agency might

promote for locally owned small-scale irrigation systems which serve farmers of all types. What seems important, then, is that an agency have flexibility to experiment and learn from its experiences in working with existing or newly created local organizations.

A "learning process approach" as advocated by David Korten (1980) and Johnston and Clark (1982) characterizes the strategy used by the National Irrigation Association (NIA) of the Philippines. Key elements of this strategy include (Korten, 1980:493-494):

1. a series of time-phased learning laboratories (pilot projects);
2. a National Communal Irrigation Committee, which plans and monitors research and training;
3. process-oriented research, in social science, management, and water management;
4. "seeding pilots" in which a satisfactory pilot project is used as a model for one pilot project in each region.

An important activity of the NIA is the assessment of a community's existing patterns of social characteristics and irrigation practices. In the initial Laur Project, one of the two pilot systems was dropped due to unresolvable community conflict. In the other, the sound experience of farmers who traditionally irrigated from local streams had provided not only a wealth of knowledge to be tapped in making system improvements, but also a tradition of community irrigation practices.

Originally an outside agency had been contracted to carry out the task of building a community organization with which the NIA could work to develop the local system. This division of functions met with difficulties in field-level coordination, and the tasks were then assumed by the NIA. Frances Korten (1982:57) lists a set of agency capacities and procedures, based on the NIA experience, which enables an agency to systematically share decision making with local users:

a. Does the agency have a "rapid assessment" technology by which it can learn about the current irrigation arrangements and other operationally relevant social characteristics of the people to be affected by the irrigation system? Does it have a way of using that knowledge in developing the irrigation system? Does it have a way of reasonably accurately estimating the area to be irrigated in a proposed project?

b. Does the agency have specialized personnel who can develop the water users' association, working closely with the technical people? Is there a training program that develops such field workers' capabilities for the specific task of developing water users' associations?

c. Is there a clear framework for relating the organizational and the technical work at each stage of a project so that the field level technical and organizational staff and the farmers understand their respective roles?

d. Have the procedures that the agency requires of its field staff been closely examined to make sure they fit the operational requirements of the strategy for developing strong water users' associations?

e. Are there training programs to help develop among technical staff the attitudes, skills and knowledge suited to the strategy?

This leads us away from agency style and into its range of operations. The two are not unrelated. An agency which defines itself as a Public Works-type design-and-conquer agency will define its range of operations accordingly. In contrast, a "service" type agency which defines itself as a facilitator will see its responsibilities in a different way. The issue, then, is the question:

B. What is the range of functions an agency (or agencies) may find necessary to perform to implement a strategy of small-scale irrigation development?

A full range of functions might include project selection services, farmer-oriented services, design and construction services, and regulatory services.

Project Selection

Among project selection functions could be included:

a. providing mechanisms for communities to make requests;

b. assessing the technical feasibility of requests;

c. in conjunction with a community, assessing the extent and types of services a community requires from an agency;

d. selecting promising project sites from among requests (assuming these exceed its resources) in terms of its own resources and policies, and perhaps directing communities whose requests were rejected to other agencies of community development.

Farmer-Oriented Services

Farmer-oriented services encompass organizational assistance such as providing community organizers either to establish or to strengthen a users' organization which can then mobilize community resources; technical assistance in the design of a system to meet community needs; access to financial and material resources needed to carry out the design; provision for any training necessary to operate and maintain the system: and arbitration over land and water disputes that impede either the construction or operation of an equitable system.

Design and Construction

Design and construction services, while included above as "assistance," may in some cases be necessary to provide directly if the situation calls for skills or equipment not possessed within the community. For example, in community systems in southern Nepal, professional tunnel diggers are hired to construct canals to bring mountain streams to cultivated fields several kilometers distant. (This is a private contract rather than an agency-provided service, but is an example of construction activities for which users' labor is not sufficient to carry out the task.) Another example may be the installation of deep tubewells, for which heavy equipment is needed.

Regulation and Arbitration

Regulatory services may be a necessary function of an agency, even in the absence of agency support for system development. Where water is scarce or expensive to capture, enforced regulations may be necessary to prevent the depletion of a public good by a single community or group of individuals. An agency may serve as ombudsman or judge in inter-community conflicts over a common water source. Communities may even prefer the arbitration of an agency in intracommunity conflicts. Chambers (1980:39) cites Ongkingco's (1973:242) observation that:

> It is striking to note the satisfaction of farmers when somebody in authority, like a policeman or a major, attends to water distribution problems. Under these circumstances, farmers even seem to be satisfied with reduced water supplies.

When a single or lead implementing agency does not carry out a full range of functions, gaps in functional integration are a likely outcome. These have occurred in large schemes in which the agency's post-construction responsibilities consisted of releasing water from primary cachements, with no other organization taking up the organizational slack between water delivery to a system, and water arrival at the field level.

Bhargava (1980) notes the constraints in completing construction of a tank when disputed land rights delay the process and no authority rests in the implementing agency to arbitrate these conflicts. In Bangladesh, minor irrigation is a project area of many agencies. A parastatal agency, the Bangladesh Agricultural Development Corporation, plays a major role in the distribution and servicing of pumps and engines for tubewells. Organization of tubewell groups is not among its responsibilities, with the result that many tubewells are used by fewer farmers (irrigating fewer acres) than are officially listed as users.

The full range of activities involved in irrigation development is complex; whether they are performed by one or several agencies is less important than the fact that all of these functions are significant, perhaps even necessary, to the success of irrigation development as it has been defined. Attention to the performance or coordination of all of them is desirable.

C. **Given that a program of small-scale irrigation development has been clearly defined, what factors are useful for a planner to consider in selecting or creating the administrative apparatus to implement it? What are the benefits of a single agency versus a multiple agency approach?**

The small-scale irrigation group has expressed a clear preference for an agency approach which permits a high degree of local autonomy (and, I would add, one which exerts enough centralized control in areas exhibiting high degrees of inequality so that local elites are constrained from capturing all benefits). However, an agency's suitability for implementing a program is affected by additional factors such as political context, agency orientation, adaptability to new demands, administrative simplicity and linkages, needs for functional redundancies, and capacity for mobilization of nonlocal resources. Discussion of these is linked to questions regarding pros and cons of a single agency versus multiple agency administration.

Political Context

Selection from among existing agencies takes place in a political context, one which may overshadow the priority of other criteria. In terms of the stability of an existing agency's program and mandate, is commitment to irrigation development high or low, waxing or waning? Is another agency's involvement in irrigation competing with that of the first? Is a shift occurring between agencies? The decision to support an agency whose involvement in irrigation is supplanting that of another should not be automatic; the agency in descent may have a more

appropriate structure for the tasks of small-scale irrigation, while the ascending agency has a construction-type of orientation.

Associated political issues include agency association with political bodies. Is the agency associated with a particular party or faction which limits (or increases) its potential to capture resources (funding) and serve all potential water users? Is the agency associated with a program that may have a short political life, and if so, will the agency survive the demise of the program or of a change of government?

Agency Orientation

The remaining issues derive from the political commitment to a small-scale strategy, and relate back to issues of decentralization. Leonard (1982a:28) distinguishes two types of decentralization as follows:

> The classical distinction between "devolution" and "deconcentration" is a recognition of the futility of analyzing decentralization along a single dimension. The former refers to the process of empowering autonomous units of local government; the latter, to the granting of authority to field units of a central government hierarchy. These two forms of decentralization are conflicting. Devolution involves a weakening of the local authority of central government; deconcentration generally involves strengthening it through an increase in the discretion of its agents.

A full discussion of the types of decentralization appears in Leonard (1982a). While the distinction made above between deconcentration and devolution has great relevance to irrigation development assistance, it is raised here to provoke thought for the workshop rather than to serve as an analytic tool in the remaining paragraphs. "Decentralization," as used here, describes an administrative structure which supports efforts of local organization by providing agency linkages and locating decision making authority at or near the field level.

Decentralization does not guarantee that an agency will be community-oriented. Who does the agency identify as its constituency? To whom is it

accountable? What is the professional socialization of agency staff: does professional status accrue only to paper pushers? Does the agency reward efforts to improve linkages with other agencies and local organizations?

Agency Adaptability

Agency adaptability is another consideration. To what extent is an agency ready to respond to new demands on its services? Can its present capacity, if insufficient, be built up to expand its range of services? Can a public works agency be retooled to provide farmer-oriented services, or a service type organization assisted in adding technical capacities?

Administrative Simplicity and Linkages

Functional differentiation between multiple agencies comes at a price of additional efforts to coordinate different services. When coordinating mechanisms are absent or ineffective, gaps in services are likely to result. Efforts to graft new functions onto an agency by its contracting out particular services to specialized organizations, such as those specializing in community organizing, may be the most efficient way to respond to increased demands. However, as Frances Korten (1982:57) notes, when the NIA hired an outside agency to carry out community organization tasks for the Laur Pilot project, they found that

> . . . (this) has the inherent weakness that it divorces the organizational and technical work, making it difficult to involve the farmers in the key questions regarding the planning, design, construction and operation of the system —and hence severely weakens the possibilities of developing strong water users' associations.

A more complex but perhaps more effective response is to incorporate new capacities into the agency structure, staff, and procedures. If this is done, administrative complexity is likely to increase, but should not be permitted to exceed the capacity of the organization to implement the program. Johnston and

Clark (1982:Ch.5) point out that the challenge of organization design is to balance the benefits which can be obtained through larger, more complicated organizations against the costs of calculation and control which such complexity tends to impose.

The benefits of complex organization (mobilization and deployment of resources, increased likelihood that gaps in services will be recognized) must be weighted against the benefits of simple organization (smaller transaction costs, more direct relation between distribution of costs and of benefits, more easily controlled by members). Dimensions administrative complexity include size and multiplicity of functions.

Functional Redundancies

Functional redundancies are a benefit of a multiple agency approach to irrigation development. Leonard (1982b:209-213) notes that multiple approaches to a single problem enhance the likelihood that something will work—especially important if the solution to a problem is unclear. Redundancy also permits less effective organizations to be bypassed and failing organizations to die.

This implies that the active involvement of mixed agencies (government and nongovernment) promotes a strong program, without any need for heavy investment in coordination efforts. Is there a role, then, for private enterprise? Leonard (1982b:215) states that "a major unanswered question remains about privatization as a device of rural development," and asks, "Can an otherwise uncommitted or incompetent state do anything to promote the services offered to the poor by the private sector?" The private sector has been encouraged in Bangladesh to offer pumps for sale and repair services, and these services have met with a responsive market. It remains to be seen if this will contribute to broadening access to irrigation for all farmers or for only a minority.

Mobilization of Nonlocal Resources

A possible disadvantage of multiple agency involvement is the resulting competition for nonlocal resources. A single agency with representation at a high administrative level may have more success in mobilizing resources (and defending its slice of the budget) than will a conglomeration of agencies. Ministries such as Public Works may have large budgets, while others survive on less; the location of the irrigation agency in one or another ministries may guarantee that it will be underfunded. Funding limitations need not be a disadvantage; budget constraints may serve to encourage noncapital-intensive programming. However, it is important that an agency have access to a budget sufficient for its program.

In conclusion, the organization of appropriate administrative structures has a critical effect on the opportunities offered to local organizations of water users to obtain assistance in creating or improving community-controlled irrigation systems. Issues have begun to take shape, but a clear view of viable options is not yet available.

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