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# IMPLEMENTATION AND INSTITUTIONAL ASPECTS OF INTEGRATED WATERSHED MANAGEMENT

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There is a growing concern about the high levels of erosion in Asia and the ineffectiveness of programs designed to improve the situation. In upland watersheds forestry and agricultural productivity is declining as soil is carried down the slopes while in the lower parts of the watershed sediment accumulates in reservoirs, ditches and stream beds. The sediment accumulation imposes costs on these downstream areas by reduced reservoir capacity and increased ditch and road maintenance.

A number of efforts have been made to slow this downward rush of soil but with limited success. Much of the failure of these efforts seems to be in the project implementation stage.

> "Good ideas do not fully materialize unless proper care is taken at the implementation stage. The saddest thing ... is that, whilst so much time and attention was paid to the technological component in the earlier stages of pre-planning, planning and the feasibility study preparation, there was not much attention paid to problems of actual implementation of the watershed management project. It was assumed that the presence of the existing extension machinery in the district would take care of the situation. This expectation was proved wrong." (Jayaraman 1982, p. 97).

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## Sources of Problems

Implementation problems are indicated by damaged or poorly constructured terraces, check dams in disrepair, excessive rates of erosion and sedimentation, and cropping systems which do not provide a basic subsistence for farm families. To determine what the real problems are, one must look behind these physical and economic manifestations of failure. Examples of the real reasons for failure include: little or no local participation, inadequate information, exclusion of downstream interests, inadequate development and testing of technology, conflicting points of view among various interests, lack of adequate extension education and technical assistance, delays in delivery of key inputs, including financial resources, and a fragmented government management structure.

This is not an exhaustive list of problems plaguing attempts to implement projects to improve watershed management. However, it is likely that for any given watershed project many of these problems will have occurred to some degree. In most cases it is not that we are unaware of the problems but that these are difficult problems to surmount.

For example, the problem of exclusion of downstream interests is a very likely occurrence in upland watersheds. Even the agencies concerned with irrigation, power, and agriculture will normally be excluded since the upland watersheds are mostly administered by forestry departments. The normal administrative boundaries will exclude downstream interests. Thus new administrative arrangements

will have to be designed to overcome this typical organizational weakness.

To help us understand why many projects never achieve their full potential, this paper focuses on the implementation and institutional dimensions of the watershed management problem. These aspects of watershed management are the ones which never seem to receive attention until a project has run into difficulties. In fact, it is our thesis that the failures in watershed management can be traced back to inadequate implementation which has been hampered by inappropriate institutions both non-organizational and organizational (see Figure 1). These inadequate institutions make it difficult or even impossible to introduce effective management measures and implementation tools which are included in the watershed management plan. The inadequacy may also be in the nature of the management measures and the implementation tools designated in the plan.

Thus the paper uses two important aspects of Hufschmidt's (1984) conceptual model. One focus is on the last three stages of the watershed management process ($T_{3j}$, $T_{4j}$, $T_{5j}$ in Table 1). We are concerned with how plans are implemented during the project's installation, operation and maintenance phases. What management measures, implementation tools, and institutional arrangements are required in a project and how are the implementation tasks performed? As pointed out by Ziemer at a recent seminar at the East-West Center, this "how" is often forgotten:

> The "how" is often thought to be completed with planning. Although sound planning is a major and necessary step in minimizing erosion, its implementation is all too often underplayed. The on-the-ground operator is the key to success or failure of a plan. Commonly, little effort is

Figure 1. Problems of Implementation in Watershed Management nd the Role of Implementation Research

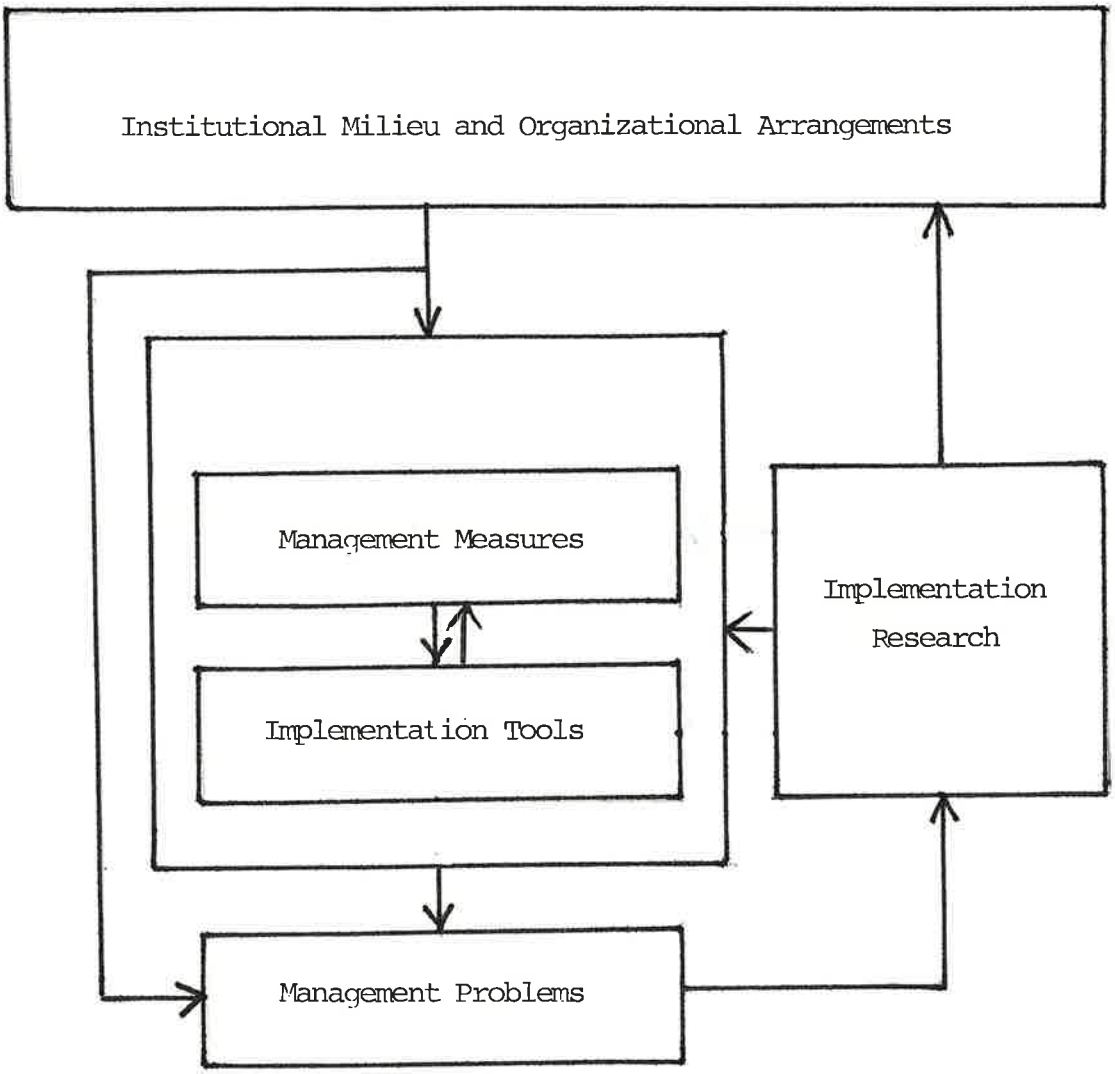

Table 1. The Watershed Management Process Related to the Watershed Management Elements

**Management System Elements**

| Management Process \ Elements | Management measures | Implementation tools | Institutional and Organizational Arrangements |
|---|---|---|---|
| Planning | $T_{11}$ | $T_{12}$ | $T_{13}$ |
| Design | $T_{21}$ | $T_{22}$ | $T_{23}$ |
| Installation | $T_{31}$ | $T_{32}$ | $T_{33}$ |
| Operation | $T_{41}$ | $T_{42}$ | $T_{43}$ |
| Maintenance | $T_{51}$ | $T_{52}$ | $T_{53}$ |

T = Tasks

(Hufschmidt, 1984)

> expended to include operators in the planning process. In general, their skills have been developed through personal experience of what seems to work. Unfortunately, what works best for dragging a log or constructing a stream crossing may not be best for reducing erosion. An important part of reducing steepland erosion is successful interactions between planners and operators. Success is often based as much on personalities as on their technical abilities (Ziemer 1984, p. 4).

The other key concerned is with the institutional arrangements both organizational and non-organizational. In Hufschmidt's conceptual model institutional arrangements are part of a dimension which cuts across all stages in the management process from planning to maintenance. It also includes all management activities but concentrates on the institutional element of the management system ($T_{13}$, $T_{23}$, $T_{33}$ and $T_{43}$ in Table 2). The success of most watershed management projects depends on how well these institutional and organizational arrangements are understood and developed during project implementation.

To shorten our terminology we shall refer to institutions and organizations, where institutions are the non-organizational arrangements. Institutions are, therefore, collective conventions and rules that establish acceptable standards for individual and group behavior, reducing individual uncertainty with respect to the actions of others (Bromley 1982(a); 1982(b)). Institutions create ordered sets of relationships among people, defining their rights and obligations, privileges and responsibilities (Schmid, 1972). Economists call the individual components of these relationships property rights.

Property rights create opportunities and incentives and define who can take advantage of them. If property rights are to guide the allocation of natural resources they must be well-defined, enforced,

Table 2. Analytical Framework for the Implementation of Watershed Management Projects or Programs

**Management System Elements**

| **Management Activities** / Elements | Management measures | Implementation tools | Institutional and Organizational Arrangements |
|---|---|---|---|
| Land Use Assignments | $T_{11}$ | $T_{12}$ | $T_{13}$ |
| Resource Utilization Actions | $T_{21}$ | $T_{22}$ | $T_{23}$ |
| On-site Management Practices | $T_{31}$ | $T_{32}$ | $T_{33}$ |
| Off-site Management Practices | $T_{41}$ | $T_{42}$ | $T_{43}$ |

T = Tasks

(Hufschmidt, 1984)

and transferable (Bromley, 1982(a)). Only when property rights are well-defined do individuals fully understand the implications of their actions. Enforcement determines the probability of a resource owner enjoying the benefits of his actions. If the probability of enforcement is low, it is less likely that the owner will devote resources to that use. Transferability of property rights helps make the owner aware of the costs of his actions. If resource transfer to higher valued uses is prohibited such opportunities will be ignored and inefficiency will result (Anderson, 1982).

When the patterns of behavior are formal, purposive and lasting we create organizations, such as the family, the firm, or the government agency. Institutions help to define organizations by providing the principles and relationships that guide their formation and conduct.

## Conceptual Framework

Implementation research will be used as a means to more clearly identify watershed management problems. As shown in Figure 1. implementation research is used to evaluate all three elements of the management system. To do this the management activities and specific tasks required to effectively complete each element in the system are evaluated (see Table 2). A key part of the evaluation is to know the specific activities and tasks which are needed to obtain the planned outputs. "If eleven discrete activities were required to produce a given result, it would not be good enough to succeed at only ten. Failure at any step . . . will cause the entire effort to fail"

(Kelman, p. 78). While Kelman's statement may be a little strong it points out the importance of each activity and task. Implementation must be as carefully planned as the technical and physical aspects of the project and then put into practice. As Jayaraman so clearly stated we cannot assume that the farmers or some government agency will do the proposed task.

For example, soil conserving practices which will reduce short-term returns to tenant farmers will be difficult to implement even when long-term benefits in terms of land productivity are substantial. Also, construction of some types of engineering structures such as check dams may be questionable if adequate administrative procedures and/or incentives do not exist for maintaining the structures. Incentive systems can be established for implementing soil conserving practices on rented land, and agencies can be set up with adequate funds and trained staff to maintain structures. But, these "implementation incentives," and "institutional arrangements" must be planned for, along with planning for the physical control measures. Are there procedures for offering incentives? Is there an existing sympathetic organization or agency which has standard operating procedures, and the necessary equipment or does the agency have people trained and motivated who can create the necessary capabilities? (Kelman, p. 84).

The problem may start with one element in the management system such as the institutional arrangements. Lipton (1968) describes an Indian village where the farms runs down a long slope. Soil quality varies from top to bottom along the sloped, but varies little along a contour of the slope. If farm fields were divided horizontally along

the contours of the hill, plowing would be cheaper, erosion would be reduced and average output would be higher. However, each father avoids the problem of giving the best quality land to one son by dividing the land into vertical strips: "This saddles each generation of sons with longer, thinner sloping strips, increasingly costly and inconvenient to plough properly, i.e., repeatedly and across the slope." (Lipton, 1968 p. 339). Thus one of the first steps in reducing erosion would be to help the families develop a scheme for comparing plots of different quality. In addition, an insurance program may be necessary to eliminate the need to have plots at different rainfall locations on the hill (Popkin 1981).

For each activity one must consider the three step sequence of alternative management measures, implementation tools and institutional arrangements necessary for completing the activity. Implementation is concerned with the how of completing a series of tasks which will result in a set of management measures being applied and used in an effective manner.

For each management measure to be used, several candidate implementation tools are identified and evaluated in terms of feasibility, cost, and effectiveness. Thus, for example, for a forest area on public lands to be harvested for commercial timber by a private contractor, the specified management measure may relate to harvesting techniques, including methods of timber removal and road design and maintenance. The implementation tools may be a government license with specific requirements for harvesting techniques, accompanied by an inspection system and sanctions for failure to adhere to the requirements.

In a governmental license-inspection approach to control private logging on public land: alternative combinations and levels of inspection and size of fines for noncompliance should be postulated, and their costs and effectiveness estimated. An alternative or addition to the fine would be to shut down the operation immediately after an infraction was discovered. The analysis could proceed by seeking answers to such questions as: How many unannounced inspections per year and what level of fines for noncompliance are necessary to induce a probability or compliance of at least 90 percent? What would be the cost and administrative feasibility of such an inspection-fine system? Or alternatively, should a government inspector be at the site 100 percent of the time, as is the case for dam construction?

If the major cost of soil erosion is in downstream areas then off-site activities may be easier to implement than on-site activities. For example, shelter belts could be established along all streams or timber removal could be prohibited within 100 yards of a stream. These management activities might be easier for a forestry department to implement than on-site activities. Thus, the tools available to the forestry department for implementing these activities would have to be evaluated to determine if in fact this would be the lowest cost procedure for controlling soil erosion. Part of the question would involve whether or not the forestry department would be sympathetic to the approach and if it had the necessary resources.

By so analyzing the relevant implementation system for each management measure, implementation tool and institutional arrangements in the plan, detailed information on the estimated costs,

effectiveness, and feasibility of implementation becomes available. This information may lead to proposals to change the organizations and institutions or to modify specific management measures which will increase project effectiveness and reduce costs of implementation. Such analysis could lead to formulation of alternative packages of management measures-implementation tools-institutional arrangements, and their ranking in terms of costs, benefits, and feasibility.

One key part of this analysis is to determine whether or not the organizational capabilities are available or could be developed. If these capabilities are not available or cannot be developed then the project should not be implemented.

> "An organization's capabilities are defined by its physical plant and equipment, its staff and the procedures it has developed to accomplish certain tasks routinely. The sad tales of implementation failures are frequently tales of insufficient foreknowledge of those assets and their limits" (Kelman, p. 78).

## Implementation Research

Looking at the problem of watershed management plans in this way has obvious implications for the planning process in that much more attention should be given to formulating detailed implementation plans and strategies than is now the case. But where are the data on costs, effectiveness and feasibility of specific management measures and implementation tools to come from? Such data must come from existing experience in Asian countries. Asian case studies are needed based on their experience with implementation of various resource management activities. The analytical framework of the case studies and the specific questions to be asked would be in terms of the explicit

linkage of the management measures-implementation tools-institutional arrangements framework. From case studies, generalizations can be developed concerning how watershed management projects should be implemented.

The literature on policy implementation, based largely on the U.S. experience with national policies and programs, suggests that there are a number of common elements involved in effective implementation on which implementation research should focus. In a chapter reviewing implementation studies Sabatier and Maymanian summarize the common elements which they found in these studies. Based on their findings we suggest that for analysis of project or program implementation, one should consider the following questions:

(1) Are objectives clear and consistent?

(2) Is implementation assigned to a sympathetic agency with adequate resources?

(3) Are there adequate financial and technical resources?

(4) Are there a minimum number of clearance points and actors involved in project implementation?

(5) Is there cooperation among the various actors involved in the project or program?

(6) Is project or program flexibility adequate to adjust to possible changes in socioeconomic conditions?

(7) Is there a minimum number of behavioral changes required to implement the project or program?

(8) Is there a valid causal theory underlying the project plan?

(9) Does the program or project have political support and do implementing officials have good managerial and political skills?

The first question, clarity and consistency in objectives, is well understood but many times difficult to obtain. Because many

watershed projects involve a number of potential beneficiaries with different objectives, compromises usually must be made. For example, how much weight should be given to the objective of reducing soil erosion and how much to raising the level of income of the people in the region. Many times these two objectives will be in conflict, at least, in the short run.

Second it is important to assign implementation to a sympathetic agency with adequate resources. Most public bureaucracies develop a general policy orientation which can only be changed slowly and at considerable cost and delay. For example, a notable change in the regulation of pesticide safety occurred when enforcement was transferred from the U.S. Department of Agriculture to the Environment Protection Agency (Sabatier and Mazmanian, p. 153). In addition, the sympathetic agency must have the necessary resources or be given new resources if the project is not to be delayed or neglected. For watershed management in developing countries this issue arises in terms of assigning responsibility to forestry, agricultural, irrigation, land development or electric power agencies.

The third question should not really need mentioning but it occurs again and again. We do not provide adequate financial and/or technical resources to install and operate a project on a sustained bases (see Jayaraman 1982). Inadequate maintenance of irrigation systems is a classic example in developing countries. Neither adequate funds nor technical resources are provided to perform the well known maintenance tasks. This same problem is likely to arise in watershed practices now being installed.

The fourth question is the number of clearance points and semiautonomous actors involved in implementation. The more clearance points and actors involved the more difficult it will be to obtain agreement on basic objectives and to implement plans. Delays will occur as the lead agency attempts to negotiate a consensus.

> "In the absence of such goals consensus; there is every likelihood that opponents or lukewarm supporters of program objectives will be able to control sufficient clearance points to demand important concessions and potentially to scuttle the program. . . This is particularly likely in intergovernmental programs . . . The number of clearance points would not be so critical if central officials had sufficient sanctions and inducements at their disposal" (Sabatier and Maxmanian, p. 156).

The fifth and closely related question is the need to obtain cooperation between the lead central agency and the other participating organizations, particularly local government and village officials. A clear set of program goals and appropriate incentives and sanctions are important assets in obtaining this cooperation. Yet, the central agency must be able to adjust to local conditions and needs if the program is to obtain local support and cooperation from village leaders.

The integrated multi-disciplinary approach necessary for effective watershed management does pose some special implementation problems related to questions 4 and 5. This approach almost guarantees that there will be a large number of clearance points and actors involved (see Jayaraman 1982 for a good discussion of this problem in India). Thus special efforts will be needed to assure cooperation among the various organizations. The problem is magnified

by the fact that watersheds often cut across administrative and political boundaries.

In addition, there will be five or six important land use activities in these upland watersheds: forestry, grazing, agriculture, agroforestry, mining, and recreation. One should also include transportation and housing as important associated land uses which are a consequence of the above primary uses. Each of these land uses may be the responsibility of one or more different agencies, again, making watershed management difficult.

Sixth, changes in socioeconomic conditions may have a major impact on the implementation of a watershed project. For example, a change in prices for livestock or wood may make it more difficult to introduce soil conserving practices. Unanticipated population increases may require adjustments in the plans to include more food crops. These and other potential changes will require adjustments in the original plan. The project must have built-in flexibility to adjust fairly quickly to unexpected macro changes.

With respect to the seventh question, many watershed management projects may require major behavioral changes, and will, therefore, be difficult to implement. Such changes could be minimized by developing technologies which use locally available materials, are easily understood by users and do not deviate much from local practices. For example, in the Philippines, strip planting of Leucaena leucocephala fits these criteria much better than bench terraces as a means to control soil erosion and is preferred by upland farmers (Serrano 1984, p. 9). The use of pilot projects, the staging of projects to allow for learning, and the effective use of extension

education programs can help overcome some of these difficulties. However, if project success depends on major behavioral changes which are judged unlikely to occur. the project should probably be rejected at the planning stage.

The eighth question involves the basic problem of whether or not it is technically or socially feasible to achieve the objectives given the type of program or project being implemented. For watershed management the question is whether or not the program can provide erosion control while meeting other objectives. This will depend partly on whether the project formulators understand the factors and casual linkages related to attaining the stated objectives and associated outputs. Even if the planners understand these relationships, is it possible to provide enough implementation tools and make adequate institutional arrangements to get the job done? One should go a step further and ask whether or not the project can provide the outputs in an efficient manner i.e. does it offer the highest return and do benefits exceed costs? Thus the validity of the casual theory should include considerations of economic efficiency.

Finally, the last question deals with political support and management, and is particularly important when it comes to adjusting to changes in socio-economic conditions, inconsistencies among objectives, weaknesses in design or faulty causal theory. Most projects or programs will go through a period when the plan has to be adjusted to the specific conditions found in the local area. This certainly is true for watershed management projects. It is during these adjustment times that effective management and political support is critical. As Jayaraman (1982) points out a key part of management

in watersheds is to establish downward linkages (internal support), horizontal linkages (external support) and upward linkage to higher executives. Without management and political skills, to do this,

> "the program is likely to be beset by scandal, internal dissension, continuous conflicts with peer and subordinate agencies, and/or an inability to develop creative solutions to inadequacies in the underlying causal theory. Without political support from interest groups and key sovereigns, the program is likely to be severely damaged by attacks from opponents...and to be unable to reformulate and improve the underlying causal theory and implementing mechanisms consistent with the original objectives" (Sabatier and Mazmanian, p. 159).

## Lessons From Experience

In addition to having an explicit plan for implementation, adjustments in project plans and designs can improve implementation. Experience has shown that it is very difficult to plan for all contingencies in advance. However, user input can help in planning for some of these contingencies. "Changeability is of considerable importance for project preparation and implementation which needs to be flexible. Such flexibility is inherent to farmer-centered methods during project implementations" (Hoare, 1984 p.31 and 34). Farmer will make additional information available to planners concerning physical conditions and what might be acceptable. The users are an important source of information and political support which has been ignored all too often. User participation should eliminate situations where one arrives at the implementation stage only to find that the recommended practices are either physically inadequate or socially unacceptable. In other words, users help one to develop a valid underlying causal theory and approach.

An illustration of the failure to do this was the Highland Agricultural and Social Development Project in Northern Thailand funded by World Bank which planned coffee production for large areas. However, during the implementation stage it was found that two-thirds of the project area was below the optimum altitude for Arabica coffee and that many soils where unsuitable for coffee (Hoare, 1984, p. 27). It took over a year to get the plan changed and fruit trees introduced into the project plan.

Government agencies responsible for watershed and irrigation management complain that the farmers will not participate in project maintenance. However, it is hardly likely that farmers will want to participate in maintenance after having been systematically excluded from the planning, design, construction, and operations phases. Farmers wonder why they should maintain a "government project." The lesson here is to get users involved in planning and implementation as soon as possible. This will mean funds and staff for the specific purpose of organizing users so that they can provide useful inputs to the whole management process.

However, to do this may require a basic change in a government agency's organization and incentive structure.

> "The improved layout resulting from farmer input in the design and construction stages causes better system performance...and fewer operation and maintenance problems...This would appear to be a potential incentive for the irrigation agency to incorporate farmers in the design process. But given the usual organization of irrigation agencies into separate divisions for design and construction on the one hand; and operation and maintenance on the other, the incentives to incorporate farmers may exist only at the very highest levels within the irrigation agency" (Small, 1982, p. 7).

Building more flexibility into the original plan can help overcome implementation difficulties such as have occurred with coffee in northern Thailand and reforestation in the Philippines. As Galvez states:

> Project implementation must be provided with a variety of alternative species and the flexibility of changing the combinations must be left open...A fixed plan on the hectorage of a given species will only magnify the difficult task of implementing a reforestation project...Area estimates for a given plantation purpose should be established at the planning stage of the project to provide reasonably accurate estimates of costs and benefits. This should not, however, tie the hands of the implementers when some of the species later on are found to be unsuitable or display unsatisfactory performances in the field (p. 27-28).

Maintaining flexibility means that a watershed management project should not be based on only one practice such as terracing or one tree species for reforestation. One wants a project which can adjust to changing socioeconomic conditions. In the case of watershed management a range of practices and crops should be offered so that packages can be designed for different resource and economic conditions which are found in the watershed. In an area with surplus labor a program should be designed which uses heavy inputs of labor to install practices. The project managers should anticipate and even expect that the plan and design will be modified to adjust to unforseen conditions during implementation.

Another strategy which can be used is to develop the project in stages so that users and managers have a chance to learn as they expand the project (Howe, 1971). This slows down the rate of behavioral change which are required for project implementation. It would also allow implementers to adjust the plan to correct for any

mistakes in the basic causal theory or for any changes in socioeconomic conditions.

One example of irrigation staging would be to start out with a temporary barrage and unlined canals to irrigate an area near the river. The temporary barrage can be replaced by a permanent barrage once farmers have learned how to use the irrigation water effectively. The final stages could be a storage dam, which would reduce fluctuations in supply, and the lining of canals. These later stages would occur once water shortages became serious and farmers were at a level of knowledge to use additional water effectively. Once the dam was built, water may also be available to irrigate a larger area. The expansion of irrigation would benefit from the knowledge and experience gained from the older irrigated area. Planners would have a much better idea of crops, cropping practices, drainage needs, markets and possible environmental impacts.

A related strategy would be to use a pilot project approach in which practices are first tested under actual field conditions before the full project is implemented (Nangju, 1983). In watershed management, it would mean selecting an area in the watershed and applying the planned practices and crops. Different implementation tools would be used to get the farmers to adopt the desired measures. For example what percentage cost-sharing would be required to get farmers to establish and maintain terraces? In addition what combination of crops would meet the food and income demands of the farmers? Such approaches help build solid causal theories and good local political support.

The pilot stage may have to be preceded by a research program which would help design and test alternative cropping or agro-forestry systems. Once some of these systems are developed the pilot project could begin. Yet until these systems have been tested under actual farming and forestry conditions implementation of the full scale watershed management project should not start.

In some situations, the problem will be more of a need to show farmers that the new practices are actually profitable. For these cases a combination of on-farm plots, technical assistance and education may be necessary. However, the necessary trained people must be available before the project is implemented. This is part of providing the necessary financial and technical resources. Thus the first phase of the project implementation might be a pilot project along with staff training. Farmers could also receive training at the pilot project.

Finally in planning and implementing watershed management practices it is important to remember that practices and funds need to be targeted to the problem locations. As pointed out by Ziemer,

> Most steepland erosion occurs in a few areas, and most of the remaining area produces only a small amount of erosion. To effectively minimize erosion in steeplands, it is more important to specify where land is to be treated than to be concerned with how much land is to be treated. A small amount of activity conducted in the wrong place can result in a great deal more erosion than a large amount of activity conducted in locations which are erosion resistant (Ziemar 1984, p. 14-15).

The same conclusions can also be made about erosion from agricultural lands. Thus part of our implementation task will be to identify these critical areas.

## INSTITUTIONS AND ORGANIZATIONS

Recognition of the role of institutions in problems of implementation in development is not new.

> "However good agricultural policies might be, there is widespread failure in implementation;—a major part of this failure can be ascribed to a failure to learn the lessons of experience in the choice of organizational methods and of institutional forms" (Hunter, 1976).

Understanding institutions and organizations for development is as important as understanding the socioeconomic, technical and ecological characteristics of the target communities.

Institutional analysis helps us to understand three important questions in natural resource use: What are the management rules that determine the direction, rate and timing of use of natural resources and who controls them? Who receives the benefits? and, Who bears the costs? (Bromley, 1982 (a)) Those questions differ from those most frequently posed by economists by emphasizing the distribution of benefits and costs rather than the efficiency of resource use. However, these are the questions at the heart of much of natural resources policy. For this reason institutional analysis must become part of the watershed management research agenda if our aim is to affect the policy process.

Institutional analysis provides two lessons for analyzing watershed management. These lessons relate to: (i) the role of institutions in determining technology; and (ii) the treatment of institutional arrangements as variables in the analysis of watershed management as a planned system.

Institutions and Technology

Technology is defined by technique and institutions. Technique corresponds to management measures described in the conceptual framework for watershed management (Hufschmidt. 1985) and represents the physical and human capital of an economy: institutions define how these factors are considered. Consequently, 'rice technology' means not only the combination of factors of production to produce a crop but also the operating rules that define land-use patterns, water control practices, marketing opportunities, labor obligations and other related institutional considerations. (Bromley, 1982(c)).

The distinction between technique and institutions is important for two reasons. First, it is not sufficient to define new watershed management techniques that are superior to current techniques and assume that they will be adopted. New or modified institutional arrangements must complement these techniques if the techniques are to succeed. Second, the world of the small farmer in Asia, in upper watershed areas especially, is characterized by institutional uncertainty. Small farmers' claims to resources of land and water are typically insecure. Major changes in watershed management technology therefore will require both improved management measures and more dependable institutional arrangements. For this reason, many purely technical innovations in agroforestry for upland watersheds will fail because of uncertain land tenure. The essence of institutional economic analysis is based on the question of the distribution of property rights and participation in the control of resources by individuals and the public (Schmid, 1972). The production of new knowledge leading to technical change is the result of a purposeful

process of institutional development (Ruttan, 1977). However, our knowledge of the processes by which new techniques are developed is still substantially greater than our knowledge of the process of institutional innovation.

## Institutional Arrangements as Variables

Decision-making about natural resource use takes place at three general levels. At the lowest level, decision-making relates to the control of inputs and outputs by the operating components of the economy - families, firms, industries or public organizations. This has been called the operating level. At the second (middle) level, the institutional level, decisions are made which affect the operating level. At the third (top) level, the policy level, top level policy decisions are made which affect institutions on the second level. (Ciriacy-Wantrup, 1971). At the operating level decision-makers usually take the institutional arrangements as 'given.'

For watershed management planning we must be concerned with all three levels. At the operating level, whenever management measures and implementation tools are employed they are affected by the prevailing institutional arrangements. However, institutional arrangements are variables, not necessarily fixed, and subject to modification through political processes (Ciriacy-Wantrup, 1967(b)). The policy level is also critical because in many countries the policies regarding use of different resources (minerals, timber, water, and livestock) in the same watershed are in conflict.

## ASIAN WATER MANAGEMENT EXPERIENCE

Institutions in their non-organizational form, as 'rules of the game,' are embodied in property rights which define opportunities and create incentives. The purpose of institutional analysis is to understand the impact of alternative institutional arrangements and the incentives and disincentives they create for decision-makers at the operating level and to influence policy. Institutions in their organizational form are especially important for understanding implementation and the study of their performance is the subject of organizational behavior and management.

While institutional and organizational analysis of watershed management is needed, a considerable body of research has been built up during the 1970's and 1980's with respect to irrigation water management in Asia (Cruz, Briones and Hufschmidt, 1984). In this section, a sample of this literature is reviewed in order to identify lessons of potential value in guiding research on institutional aspects of watershed management.

### Institutional Lessons

For this purpose, institutional lessons from irrigation water management in Asia can be grouped under three headings: (i) incentives for individual action; (ii) incentives for collective action; and (iii) incentives for resource conservation.

#### (i) Incentives for Individual Action.

Understanding property rights is at the heart of irrigation water

management. The central problem of irrigation is who gets what water, where and when (Chambers, 1980). Different arrangements of property rights produce different patterns of allocation and distribution (Randall, 1974). Property rights define who owns the water resource, who has the right to use it, and whether the right can be exchanged or traded (Bromley, 1983). As an economic activity irrigation is not equity-neutral, and property rights in water and related land will help to determine the pattern of benefits (Steinberg, 1983).

The role of property rights is especially clear with respect to groundwater development since the choice between public and private ownership, and who has effective control, directly influence how the resource is used (Bottrall, 1981). Groundwater utilization can be enormously profitable but, in the absence of an adequate legal framework, can result in either monopolization by the few or over-exploitation by the many (Carruthers and Stoner, 1981). Experience suggests that development controls tend to preserve the influence of the established interests.

Small farmers in less developed countries are cautious optimizers and farming is an adaptive process, based upon feedback from experience. In irrigation systems, where institutional uncertainty exists, caution shows up as an unwillingness to adopt more productive cultural practices quickly (Bromley, 1982(b)). An adaptive man makes short-term plans not because he is irrational but because he is cautious and has several goals to satisfy. These goals can be arranged in an ordered hierarchy (Day and Singh, 1977) as follows:

subsistence goal - assure survival
safety goal - cautious optimizing
surplus goal - acquire cash for consumption and saving
speculative goal - maximize profits

The safety goal is not considered until the subsistence goal has been attained; the surplus goal is not considered until the safety goal has been attained; and the speculative goal is not considered until the surplus goal has been attained. Where property rights in water are unclear or insecure they combine with the cautious optimizing behavior of farmers to create an environment where innovation is discouraged.

(ii) Incentives for Collective Action.

Irrigated agriculture can become an important new source of income for rural development if farmers can accumulate a surplus. But irrigation implies interdependence among farmers as water users, and independent action can lead to both inefficiency and inequity (Bromley, 1982(b)). Independent action can be seen as the individual's response to the uncertainty of collective action, where opportunities for the farmer are affected by the actions of others. Where uncertainty dominates and the farmer cannot depend on the timely delivery of the appropriate amount of water, interdependence breaks down and the expected surplus fails to accumulate. Irrigation frequently provides examples of faulty institutions at the intensive margin of agriculture, where irrigators have the incentive to capture as much water as they can before their neighbor does.

Organization for group action in irrigation must recognize both individual and group interests and provide sufficient leadership and incentives to overcome individual resistance to collective action (Popkin, 1979). Individual farmers weigh up their costs, their expected rewards and the effectiveness of group leadership before

deciding to join with others in a group activity. Individuals may decide that they are better off not participating and as long as they cannot be excluded from the benefit they may become 'free riders.' Maintenance of irrigation canals and ditches provides an example of an activity where all member farmers benefit if the maintenance is done, whether or not they contribute as individuals. In the upper watershed group action to police village woodlots to protect them from fire or grazing by livestock provides another example. "Indeed, unless the number of individuals in a group is quite small or unless there is coercion or some special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interest" (Olson, 1965 p. 2). What these sanctions and incentives are needs to be more fully understood.

Agriculture in developing countries is distinguished by being conducted in an uncertain environment (Bromley, 1982) and the ultimate producers are a very large number of small farmers (Bottrall, 1981). For the small farmer, irrigation replaces one form of uncertainty - climatic uncertainty, with another - institutional uncertainty (Bottrall, 1981; Steinberg, 1983). However, institutional uncertainty can be as limiting to agricultural productivity as climatic uncertainty because it creates an environment in which farmers are unwilling to invest in new practices because of insecurity over possible gains. In irrigation, institutional uncertainty adds to the technical uncertainty of sensitive high-yielding varieties that demand high levels of inputs, including management (Bromley, 1982(b)).

Institutional uncertainty flourishes in a society where formal institutional arrangements are merely suggestive, and when these rules

are subject to frequent change. Small farmers find themselves in an environment that is not conducive to the kinds of action development planners typically advocate. 'Modernized' agriculture requires farmer involvement in markets for inputs and outputs and external sources of information, while subsistence agricultural minimizes these contacts. Where there is institutional uncertainty, the subsistence farmer has little incentive to break out of his secure but impoverished existence. In practice, where institutional uncertainty exists in irrigation, larger more powerful individuals may use their resources to strengthen their positions of advantage and to heighten inequalities.

If 'modernization' means the opening up of an economy to external linkages, many 'unmodernized' societies exhibit dependence on indigenous institutional rules for natural resources management (Netting, 1977; Bromley, 1983). This is true for the management of water (Carruthers and Stoner, 1981) as well as for upland and forest (Runge, 1983, Ramm, 1982). Water and forests are both emotive subjects in traditional societies, frequently bound up with custom and religion.

While Western analysts generally invoke the superiority of one kind of property institution over another, experience is teaching us that there is a continuum of property institutions, from pure private property to common property, that are appropriate to different local environments. In less developed economies where few individuals are spared the risk of failure, common property management institutions may be the rational response to spreading risks and reducing uncertainty (Runge, 1983(a),(b)). The expectation that aid will be

forthcoming from others in times of need may be a more powerful stimulus than 'going it alone.'

Customary common property institutions provide a form of insurance when rainfall is scarce, are relatively inexpensive, provide a degree of fairness and a group hedge against individual failure. Traditional common property institutions are also tenacious since the cost of frequent rule changes is high and because they embody beliefs, ideas and practices important to the community (Malinowski, 1961; Runge, 1983(a)).

(iii) Incentives for Resource Conservation.

Resource conservation has been defined as the direction of natural resource use away from the present and toward the future (Ciriacy-Wantrup, 1968). However, property rights may establish a pattern of incentives that is not conducive to conservation. Resources may be depleted because the institutional rules in effect do not encourage the use of management measures which are conserving. If irrigation is seen simply as 'getting the water flowing' and insufficient attention is paid to the rules governing water allocation and system maintenance, system-wide benefits of irrigation will not be achieved (Bromley, 1983).

Most so-called 'technical' decisions in water management are both 'technical' and 'institutional', and matching rules, roles and organizations to tasks is essential (Coward, 1980). This agreement applies to upper watersheds also where users have the incentive to capture grazing or forest products before their neighbor (Bromley, 1983). Institutional uncertainty creates incentives to use water

'now', when if is available, for it may not be available next time (Steinberg, 1983). Similarly where rights in water are insecure and organizations are weak, the incentive exists to take water illegally, either covertly or in open defiance of the rules (Barker, Coward, Levine and Small, 1984).

## Organizational Lessons

The organization and management literature relating to irrigation water management in Asia is extensive and growing. There is great potential for improved productivity of water through improved water management. Lessons that could prove helpful to watershed management are summarized under the following headings: (i) farmer participation; (ii) incentives; (iii) organizational factors; and (iv) management processes.

### (i) Farmer Participation.

Considerable variation exists both between and within countries in Asia with respect to roles and responsibilities in irrigation but better water management is achieved most often from effective participation between the farmer and the irrigation agency (Chambers, 1980; Coward, 1980; Bottrall, 1981; Korten, 1981; Murray-Rust, 1983). The closer water management decisions are taken to the farm level, the greater are the benefits to the farmer (Steinberg, 1983).

Examples of farmer participation in water management in Asia occur in planning, design, operation, maintenance, and project evaluation. However, despite the successes, effective farmer participation in water management is still the exception rather than

the rule, as obstacles to effective participation exist within implementing agencies, within the rural community, and within the larger society (F. Korten, 1981).

Obstacles to farmer participation within water management agencies include: centralized decision-making; inappropriate attitudes, values and skills of personnel; inappropriate evaluation systems; and frequent transfers of personnel in rural areas. Obstacles within the community include: lack of appropriate local organizations; lack of leadership and organizational skills; poor community facilities; factionalism; and corruption. Obstacles within society include: fear of political conflict between the organized poor and the status quo; lack of an appropriate legal foundation; and the inertia of national bureaucracies (F. Korten, 1981).

As pointed out above, there are a number of benefits from participation. Farmers provide local information for planning, design, management and evaluation which agency staff do not normally possess. Better water management results from joint decision-making by engineers, agriculturalists, administrators, and farmers (Chambers, 1980). Failure to include farmers in planning and management results in errors in design and subsequent poor system performance (Bottrall, 1981(b)). Farmer participation in water management projects is essential if project services are to meet beneficiary needs, and if beneficiaries are to articulate their needs to the assisting agency (D. Korten, 1981).

Farmer involvement in water management is normally through organizations (Steinberg, 1983) and the more complete the membership the better the resulting management. Effective communication breaks

down as the scale of projects increases, and time must be allowed for communication and consultation to develop (Bottrall, 1981(a)). In small organizations it is easier to hold member accountable and make sure they are doing their fair share. Farmer organizations are most effective when the expected benefits accrue locally in proportion to the local effort expended (Chambers, 1980), and when farmer organizations develop the capacity to solve problems at the local level and articulate local concerns clearly to the water management agency (Chambers, 1980; Barker, Coward, Levine & Small, 1984). Such capacity does not simply appear but must be built progressively (Bottrall, 1977; D. Korten, 1981).

Problems of articulation exist not only between farmer and agency professionals but also among professionals both within and between agencies. Poor communication and conflicts between engineers and agriculturists are a chronic problem of water management (Hotes, 1984). Each profession seeks it own objectives and exhibits a degree of disciplinary self-containment and professional esprit that are obstacles to communication and cooperation with one another (Steinberg, 1983).

(ii) Incentives

At the local level, poor water management frequently results from lack of incentive to perform well. Farmers will pay for water when management is good (Bottrall, 1977). If farmers pay for irrigation it is usually through a fixed charge per acre and not a charge for the volume of water used even when water is scarce (Barker, Coward, Levine & Small, 1984). Farmer payments for water are generally not linked to

the service they receive, and payments are rarely linked to system operation and management with the result that operations and maintenance are invariably underfinanced (Bottrall 1981(a) & (b)). Where farmers are involved in setting and using irrigation charges to improve the system, water management tends to be more efficient (Steinberg, 1983 and Bottrall, 1977).

At the agency level, bureaucracies have their own incentive systems that are unrelated to on-farm water use (Steinberg, 1983) and water rationing is a non-market exercise (Reidinger, 1974). Water management agency objectives and structure are frequently unrelated (Bottrall, 1981(a) & (b)). Most commonly cited operations and maintenance failures in water management include: lack of clear objectives; inappropriate organizational structure; poor management procedures; poor policies on staff recruitment; promotion and salaries; and inadequate recurrent finance (Chambers, 1974; Bottrall, 1981(b)). The reason for this catalog of neglect is a chronic failure to plan for implementation. Project implementation is too often seen as a residual decision made after the technological and economic innovations have been made (Jiggins and Hunter, 1977). However, arrangements for operations and maintenance are mistakenly seen as components which existing local organizations cannot provide, as extensions of engineering and economic concepts to be 'added on' to the project.

Incentives failures also exist between agencies responsible for different outputs within water management projects. For example, conflicts can arise in management between water use for hydroelectric power generation, which is determined daily, and irrigation use, which

is determined seasonally (Reidinger, 1974). Managers of multipurpose dams may have the incentive to favor power production, which generates revenue for the agency over irrigation which may raise no revenue for the agency at all.

Donor organizations also have incentive and reward systems which are not conducive to effective water management. Donors each have a 'style' and function that influences the outcome of their actions strongly. However, most donors are competing for projects which provided relatively quick solutions to intractible problems (Steinberg, 1983). There is pressure to obligate funds and complete work quickly to meet bureaucratic ends. Concern for short-run benefits may be at variance with long-run environmental or other costs.

International donor organizations also appear to make many of the same mistakes that the water management agencies of developing countries make (Bromley, 1982). Donors know too little about local social systems and power structures, and there are few rewards in donor agencies for institution-building and social analysis (Steinberg, 1983). Rewards are for obligation rates and physical construction.

(iii) Organizational Factors.

Emphasis in irrigation water management has been on the construction and development of large scale systems (Levine, 1980; Barker, Coward, Levine & Small, 1984). This has been the result of a virtual romance with engineering and agronomy that has put management of projects and processes into the background (Steinberg, 1983).

Experience shows consistently that we prefer to invest in structures than to manage systems (Bromley, 1983). Investment in structures is safer politically for donors and recipients, and there is often political pressure to expand the geographic scale of projects, even when this means overtaxing the capabilities of the water supply (Murray-Rust, 1980; Bottrall, 1981; Bromley, 1983). Much recent water management literature focuses on the problems of large scale, state owned projects, the need to recognize management explicitly, and to shift control from the bureaucracy to the local community.

Governments still persist in their efforts to build large projects, rather than medium or small projects (Lowdermilk and Svendsen, 1983) and we are doing little to improve existing systems with farmer investment. Governments continue to act as if engineering solves irrigation problems but the water management experience suggests that the changes required are in farmers' behavior, motivation, and expectations. Such changes are the product of institutional reforms which improve production possibilities and the incentives for farmers (Wiener, 1976).

The performance of water management organizations is affected by two sets of factors: those which appear to be universally true and those which are contingent on local cultural or technological factors (Bottrall, 1981(a)). Case studies reveal that there is great variation in local conditions among projects, and management must begin with a clear and detailed understanding of the local environment and a willingness to be adaptive (Bottrall, 1981(b)). Accordingly, successful water management seems to function at two levels: the central government agency level where responsibility rests for storage

and main system management, and the village level where farmer organizations are responsible for water management within the water course (Bottrall, 1981(a) & (b); Barker, Coward, Levine & Small, 1984).

Obviously, these two levels of management are not entirely separate. Performance at the local level can be affected by decisions taken at the level above. in much the same way that overauthoritarian management within an organization may adversely affect the performance of junior staff (Bottrall, 1981(b)).

Management deficiencies attributed to the farmer level can frequently be shown to have their origins higher up in the system. One of the most important roles of farmer organizations is to articulate understanding between national agencies and farmers, to permit effective decentralization of management, and to raise the status and credibility of local organizations. Intelligent planning in water management facilitates decentralization (Bottrall, 1981(a)). Even in the case of Taiwan, where decentralized water management has possibly gone furthest, the shift from authoritarian management has been relatively recent (Bottrall, 1977). The shift was in response to water scarcity and was an effort to combine the integrity of the local communal system with greater basin-wide efficiency in water use (Bottrall, 1981(a)).

Water and management are substitutes at the farm and system levels i.e. with better water management farmers can produce higher yields from the same volume of water, or the same yield from less water. Consequently, there have been shifts in the focus of analysis of water management from 'hardware' to 'software' and from 'farmer

failure' to 'system' failure which reflect this understanding (Carruthers and Clark, 1981; Barker, Coward, Levine & Small, 1984). However, these shifts have required professionals in water management to examine their own roles and performance, to acknowledge failure, and to respect the farmer as a professional (D. Korten, 1981). Recognizing that irrigation systems are both biophysical and behavioral implies a need for new approaches to management within bureaucracies and for new management tools. If water allocation at the local level is best performed by farmers, then the water management agency must reorient its role to become an enabling body, supporting and complementing farmer organizations. Changes in management style are necessary to accomplish this but a shift from an authoritarian style of management to a participatory style represents a major challenge to a bureaucracy (Korten and Uphoff, 1981).

Bureaucratic reorientation requires changes in how agency professionals communicate with farmers and among themselves. Changes are also required in personnel policies and incentives in order to provide stability in relations, and rewards for working well with farmers (Chambers, 1983). Power and incentive must be shifted downwards and outwards in agencies in order that they become enablers of action by others.

Reorientation of this kind requires a high level of political encouragement and support (Chambers, 1980; Levine, 1980) focussed on reforming existing organizations rather than creating new ones (Steinberg, 1983). Improved water management is increasingly dependent on reversals: reversals in location of action from the center to the periphery; in professional values that recognize farmer

performance; in specialization from single disciplines to multidisciplines; and, from 'hard' science to 'soft' (Chambers, 1983).

(iv) Management Tasks.

Important management tasks discussed in the irrigation water management literature include evaluation, enforcement, arbitration and conflict resolution. Criteria for evaluating irrigation water management have also begun to shift from an overriding preoccupation with efficiency measured by 'crop water requirements' to multiple objectives (including productivity, equity, environmental stability reliability. flexibility and cost recovery) emphasizing 'farmer water requirements' (Coward, 1980; Bottrall, 1981(a) & (b); Barker, Coward, Levine & Small, 1984). This change is a result of the recognition of irrigation as both a biophysical and a behavioral system, and the adoption of an ecological perspective. System performance is not under the direct control of the engineer (Levine, 1980) and engineers and farmers have different legitimate system performance criteria. Improved management can bring farmers and engineers closer together.

Inequity between the heads and tails of systems is a chronic characteristic of water management performance in Asia (Bottrall, 1981(a)). At the same time, equity and productivity are linked, and redistribution of water from head-enders to tail-enders can improve both equity and productivity (Chambers, 1980). Improved equity in water distribution brings significant benefits to the poor, who are typically tail-enders (Bottrall, 1981(b)). At the same time, a preoccupation with short-run productivity gains has resulted in the

neglect of long-run environmental costs, including drainage, salinization, system maintenance and rehabilitation (Steinberg, 1983).

Some poor water management performance can be attributed to a failure to enforce the rules of the game. Such failure can be attributed to unenforceable legislation or an ineffective legal framework for enforcement (Bottrall, 1981(a)). At the local level, water rights and allocations must be clearly understood by all members of the community, and cultivators want to see quick and clear enforcement when required (Chambers, 1980). While policing remains necessary, allocation of water and arbitration of disputes is best performed at the local level by the community of farmers. In rural communities in Asia, arbitration is preferred to litigation, and local organizations and institutions permit this (Steinberg, 1983). Western sytems of justice force funds out of the local community and corruption in conflict resolution increases with the distance of the settlement from the location of the dispute. Arbitration and conflict resolution can be efficiently and effectively performed by community water management organizations. (F. Korten, 1982).

Irrigation management in Asia provides numerous examples of institutional and organizational lessons that have been learned and resulted in improved implementation in irrigation systems. The institutional arrangements that create the incentives to use water collectively, equitably and conservatively are becoming better understood. Also the organizational arrangements which are conducive to delivering water effectively to farmer's fields under different circumstances are becoming clearer. However, while the management of watersheds is vitally important to the future of all major irrigation

systems, comparable understanding of the institutional and organizational arrangements for watershed management remains undeveloped.

## Conclusion

There are three key points we would like to leave with you concerning project implementation and institutions. First is that implementation must be planned with as much care as the technical and physical aspects of the project. One cannot assume that the project will be operated, maintained and used effectively. Development projects and irrigation projects, in particular, are clear cases where implementation has not been planned for in advance.

Second, one should not take institutions as given. Institutional arrangements are one of the management elements and should be used to achieve the desired project outputs. This means that the effects of different institutional arrangements must be estimated and plans made to obtain the desired institutional changes. Alternatively the implementation tools and management measures will have to be selected so that they fit the expected conditions. In either case, institutional arrangements will be important considerations in implementation planning.

Finally, user participation and flexibility must be built into project planning and implementation. This will require extra resources and a new way of approaching problems. However past experience indicates that these extra costs pay off in the long run through better program implementation and greater project returns.

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