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K. William Easter

Recurring Cost of Irrigation in Asia: Operation and Maintenance

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PREFACE

This study was commissioned by the Technical Resources Office of the Asia Bureau of USAID and contracted under Water Management Synthesis II (CID/AID-DAN-4127-C-00-2086-00). The report includes a synthesis of four studies done by local consultants in four Asian countries. Each study was done through the country USAID mission. The studies in Sri Lanka, Nepal and the Philippines were country wide studies focussing primarily on government irrigation systems. The study in India was restricted to government projects in the State of Maharashtra. A previously prepared study for Pakistan was also utilized. Summaries of the four case studies are included as Appendix A.

The author would like to thank Leslie Small, Norman Uphoff, Mark Svendsen, Douglas Merrey, L.S. Cabanilla, Tek Bahadur Shrestha, A.T.M. Silva, Jagannathrao R. Pawar, John Dixon and Maynard Hufschmidt for their helpful comments on earlier drafts. Special thanks goes to Robert Westgate who took the lead in putting together the two appendices which provide a summary of the four country studies as well as a review of literature. The final content of the report is my responsiblity and does not represent the views of USAID or Water Management Synthesis II.

FOREWARD

This working paper prepared by K. William Easter is being circulated with the hopes that we can obtain suggestions to improve the content. It focuses on a subject of growing importance and concern that has received relatively little attention in the past.

The conventional wisdom is that we need to devote more resources to O & M and that we need to find ways to encourage farmers to pay for systems maintenance. Beyond this, very little can be found in the literature even to clarify precisely what we mean by improved O & M.

This paper synthesizes the report of the O & M experience in four Asian countries and attempts to clarify some of the issues involved. Your comments are invited.

Randolph Barker
Cornell University

RECURRING COSTS OF IRRIGATION IN ASIA: OPERATION AND MAINTENANCE (O & M)

This report reviews the recurring costs situation for irrigation in Asia. These are the costs associated with project operation and maintenance (O & M).1/ As is well documented in the literature many developing countries have neglected project O & M which has resulted in a rapid depreciation of past irrigation investments (Carruthers, 1981). Irrigation systems fail to irrigate their total command areas and after a few years parts of the systems no longer function (Wade, 1975). The problem seems to be that no one is willing to invest the necessary funds and human resources in O & M to assure that irrigation projects operate at a hign level of performance over a long period of time.

> "Concern with O & M is not a new issue, and indeed there are precedents in provision of resources to sustain O & M. The new dimension is the apparent scale of the problem and the likely trend. Unease with the scale of deficit operating performance of irrigation schemes stems from a variety of sources. With the World Bank experience, some indications of the problem come from observations and reports of field investigators at appraisal, supervision and completion phases. Tangible evidence of general need comes from the increasing number of rehabilitation projects being implemented in countries as diverse as Mexico, Nepal and Indonesia" (Carruthers, 1981, p. 53).

1/Operation and maintenance includes the management of water supplies and the upkeep of system facilities from the water source to the farmers' fields. Recurrent costs mean the cost of operation and maintenance of the irrigation system. Operation means the allocation and delivery of water supplies, including the management of any storage facilities, and handling of drainage runoff. Maintenance is the upkeep of irrigation and drainage structures, embankments, dams, outlets, and channels and the removal of silt and vegetation from canals and storage facilities.

The funding of this study is further evidence of the growing concern among knowledgeable people in donor agencies concerning the scale and trend of this problem.

To provide a good overview of the problem of recurrent costs, the report is divided into six major sections and an appendix reviewing the literature. First is a discussion of the conceptual water management model which is used in the study. Second is a discussion of how the water management model is applied to specific operation and maintenance problems. The third section summarizes the water fee collection policies of the four study areas: Nepal, Sri Lanka, India and the Philippines. The fourth section discusses the performance of the four countries in dealing with problems associated with the recurring costs of irrigation. The individual consulting reports, on which sections three and four are based, are of uneven quality but do provide a basis for comparing the four countries. However, in terms of fee collections the record in Nepal and Sri Lanka is quite limited due to the lack of experience. For example, Sri Lanka has just recently launched a major effort to improve O & M collections but it is too early to draw any solid conclusion concerning this effort. Finally, the India study was limited by the fact that time and funding restricted it to the large central state of Maharashtra.

The fifth section discusses the alternatives available for increasing the investment in O & M and relates them to the four country studies. The final section considers the criteria for setting water fees and discusses the problems associated with charging a uniform fee across all projects.

Water Management Model

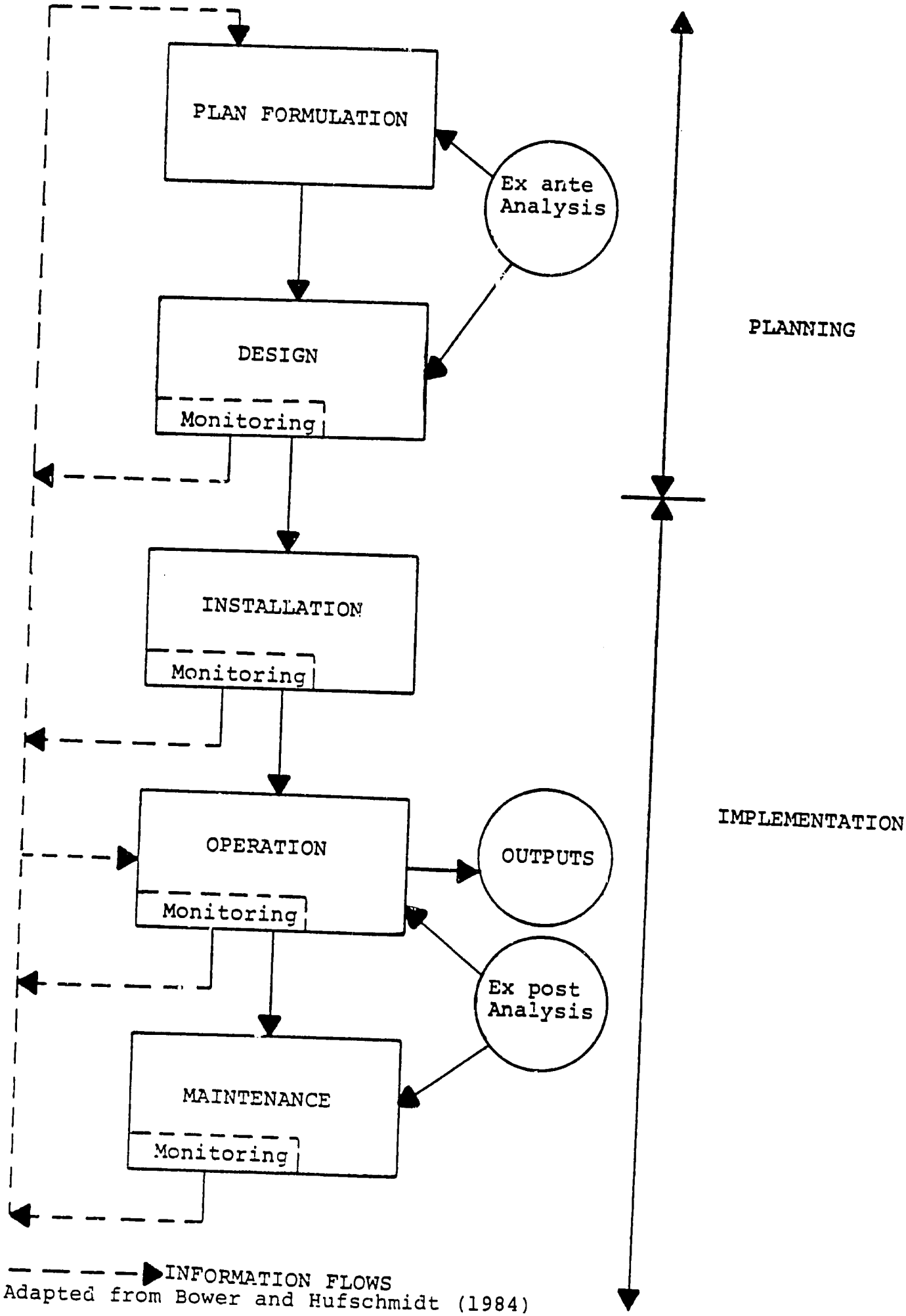
One of the problems associated with providing adequate O & M is the absence of a whole system perception. There is a failure to perceive the vital nature of O & M in the success of a project. Consequently, a conceptual model was adopted for this study which takes a whole system approach. It is based on a water management model developed by Bower and Hufschmidt (1984) which includes three major components: (1) a management process involving five stages, (2) a water management system with three elements and (3) a set of linked activities and tasks. Each component provides different insights into water management problems. For the problem of recurring costs certain parts of the model will be of particular importance.

Management Process

The first component considers water management as a process involving various stages starting with planning and ending with operation and maintenance (see Figure 1). For this report the primary concern is with the last stages of operation and maintenance (O & M). It is in these last stages that recurring costs are important. Yet the difficulty involved in providing adequate O & M is dependent on the project design and how well the project is constructed. A well designed and constructed project will require much less effort in O & M to achieve the same level of irrigation efficiency than one which is poorly designed or constructed.

As Carruthers (1981) points out, O & M problems may even start at the planning stage:

FIGURE 1. The Five Stages of Integrated Watershed Managment



Adapted from Bower and Hufschmidt (1984)

> "Many problems with O & M might be traced back to the project planning stage. In principle project appraisal examines the technical, economic, financial, organizational, managerial and operational aspects of the plan. Each of these aspects is not treated equally in relation to O & M and sufficient disaggregated detail of working procedures is seldom provided. The emphasis of appraisal reports is at present mainly upon technical, economic and financial aspects of projects. Indeed, it is also the technical, economic and financial aspects of the initial works which receive most consideration" (p. 56).

Another important characteristic of this management process is that the planning and design work is more easily done at the central offices located in the major cities, such as, New Delhi, Bangkok, and Dhaka. In contrast, the operation and maintenance of irrigation systems takes place in rural areas. This means that the better educated and trained people who prefer to locate in the major cities are involved in planning and design. Yet they do not get the local input so necessary to make the plans and designs fit local conditions. For operation and maintenance work, particularly maintenance, the younger and less experienced people get the job. They have to live in the remote areas and spend a good bit of their time trying to get back to the major urban areas. Thus in general the plans and designs are technically very well done but do not necessarily fit local conditions, while operation and maintenance are done in the local areas but do not receive the same attention and resources.

The same problem shows up in the budget. The planning, design and construction stages are well funded, often by donors, while inadequate funds are allocated for O & M. When the construction budget is cut to reduce project costs the impacts these cuts will have on increasing future O & M costs are usually ignored.

This situation is complicated by the fact that in many Asian countries O & M is done

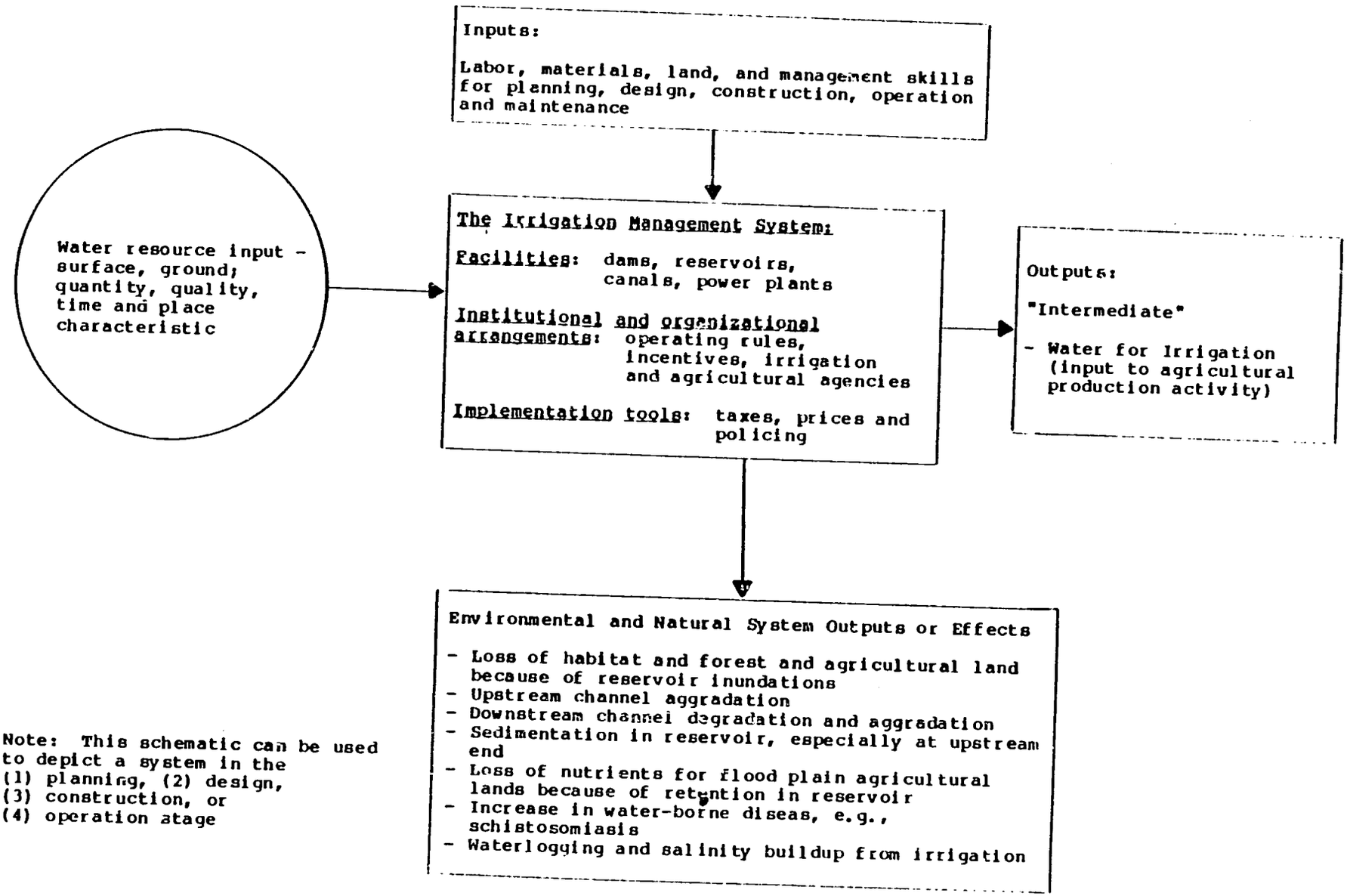
> "by an organization whose primary function has been construction. That is why few of the professional staff on a particular canal will have had much prior experience of O & M. It is also why they are not especially interested in O & M: because (a) the O & M budget will be a tiny part of the overall Irrigation Department budget, so its allocation and scrutiny will be given little attention; (b) professional reputation will be anchored firmly in construction; and because (c) they will tend to behave, while doing O & M work, in the top-down hierarchical control mode appropriate for construction but inappropriate for O & M" (Wade 1985a, p. 7).

Finally, once feasibility studies are completed, project planners tend to lose interest in evaluation. This means that project managers generally lack a reporting or monitoring system which could be used to suggest needed changes in O & M. This lack of data, including who gets water and what crops are produced, also makes it very difficult to set up a system for collecting water fees or charges. If a government wants to collect water fees from farmers who receive irrigation water from a project, then one basic requirement is an accurate information system which identifies those who actually receive adequate irrigation water.

Water Management System

The second facet of the model involves water management as a system which includes a set of facilities, implementation tools and institutional and organizational arrangements which are used to capture and deliver water to farmers (see Figure 2). The system requires inputs of labor, materials, land and management skills which

FIGURE 2. Irrigation Management System with Inputs and Outputs



Note: This schematic can be used to depict a system in the (1) planning, (2) design, (3) construction, or (4) operation stage

Adapted from Bower and Hufschmidt (1984)

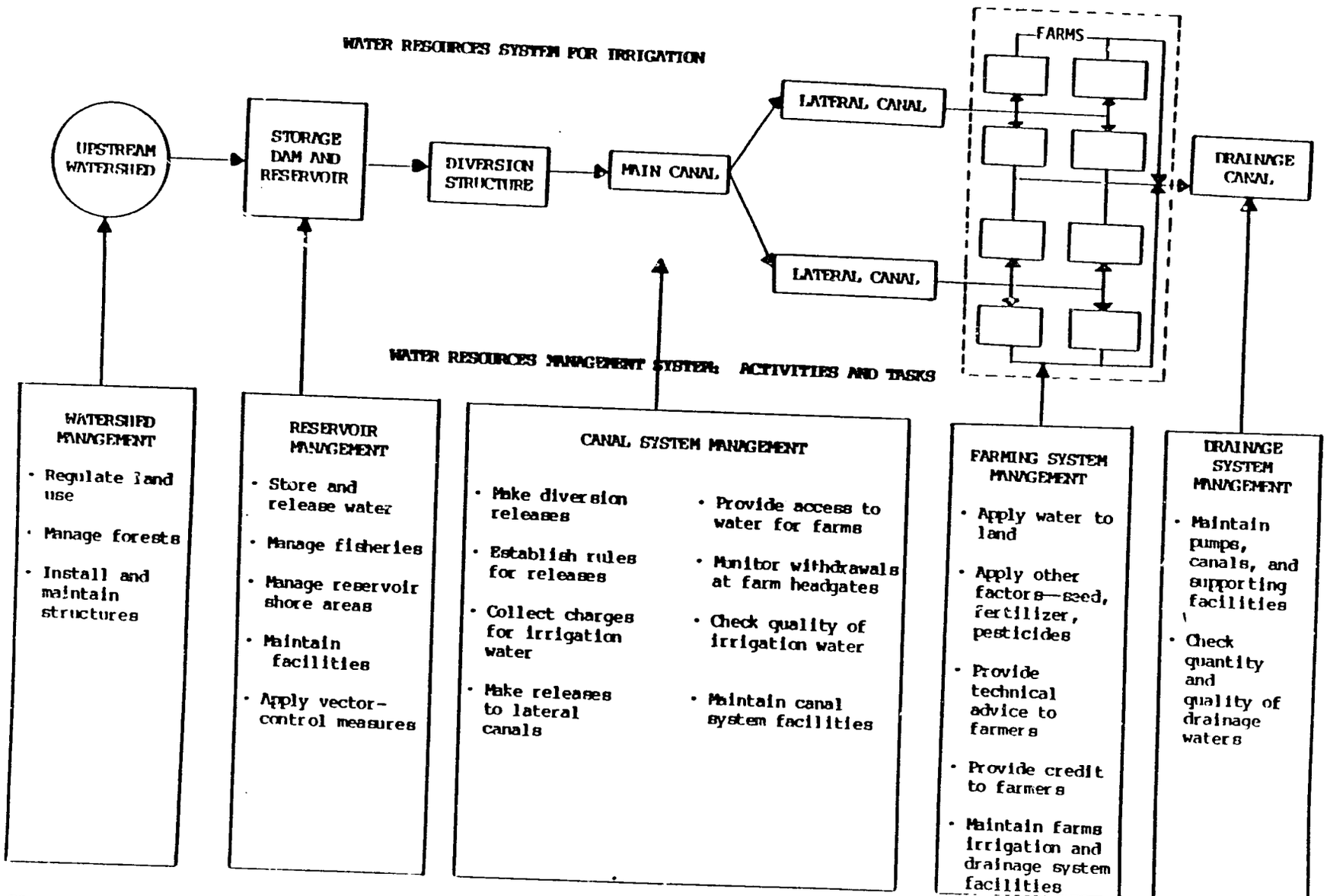
along with the irrigation facilities, institutions, organizations and implementation tools are used to provide the desired output of water. If the system is managed efficiently water is delivered at the time and in the quantity which produces optimum agricultural production with minimum adverse environmental effects.

In terms of the water management system the institutional and organizational arrangements and implementation tools are just as important as the physical parts of the irrigation. For example, the rules and incentives which govern the collection of irrigation water charges and/or the provision of farmer labor for system maintenance are of central concern for O & M. An additional concern is the government agency and/or farmer groups which are involved or should be involved in activities related to operating and maintaining the system and/or in collecting fees.

Activities and Tasks

The third component of the water management model involves a set of linked activities and tasks which are necessary for water delivery. Water management is subdivided into specific steps which government agencies, farmer organizations or individual farmers must perform if the desired outputs are to be obtained. One can visualize a surface water irrigation system as beginning with a watershed from which water is collected in a storage reservoir (see Figure 3). The water is then taken through canals and delivered to farmers' fields. Finally, there is a system of drainage canals which drains off excess water. With each of the components of this simplified system, activities and tasks are required to assure effective deliver of water. For example, to

Figure 3. Water Resources Management Activities and Tasks for a Surface Water Irrigation System



SOURCE: Bower and Hufschmidt (1994)

operate the canal system effectively rules must be established to allocate water among different parts of the system and dates must be set for water release and shut-off.

In groundwater or river pumping the system would be somewhat simplified. The watershed would be less important for groundwater unless it is the area where the groundwater is recharged. Instead of a reservoir there would be an aquifer or river from which pumps are used to withdraw water. No diversion structures would be present and the system of canals would probably not be as large since the area commanded by a given pump is usually smaller than most surface irrigation systems. However, the area served by a large pump would be the same as many of the small tanks (reservoirs) of Sri Lanka, South India and Northeastern Thailand. The system of farm ditches and drainage canals would also be smaller. In fact, because of the better water control which is generally possible with pump irrigation systems, the drainage problems are likely to be much less than those in large surface irrigation systems.

Operation and Maintenance

This study focuses on the last part of the water management process: operation and maintenance (O & M) (see Figure 1). In addition, watershed management is left out so that the emphasis is on the last four major management activities; reservoir, river or aquifer management, canal management, farming system management and drainage system management. The watershed is also excluded because to include it would require a more complex analysis (see Easter and Hufschmidt,

1985). However, the importance of the watershed in irrigation is becoming painfully evident as reservoirs silt up at alarming rates.

The model has also been simplified by leaving out any specific reference to markets or transportation. This is another key part of the "total" irrigation systems. Without adequate transportation for products and inputs and markets in which to sell products, prices will not match expectations. The increased output will greatly depress prices and the net project benefits will be low. This means that the ability of farmers to pay for water will be low and collections will be low. Thus provisions must be made to assure adequate markets and transportation if the irrigation project farmers are to sell their increased production at reasonable prices and inputs are to reach farmers at the appropriate times.

For analysis of irrigation problems it is important to be able to link the analytical framework to the specific problems (see Figure 4). Here the irrigation problem is shown as being due to deficiencies in operation and/or maintenance. These deficiencies are identified by examining the specific activities and tasks involved with operating and maintaining the system. These various activities and tasks are examined to determine which element of the management system is inadequate (facilities, institutional and organizational arrangements, or implementation tools). Should the emphasis be on building new or improved institutions or should it be on altering the implementation tools or both? The first job is to make a list of irrigation problems or issues which are related to project O & M (see Table 1).

FIGURE 4. Linkages of Irrigation Problems to Operation and Maintenance and the Irrigation Management System

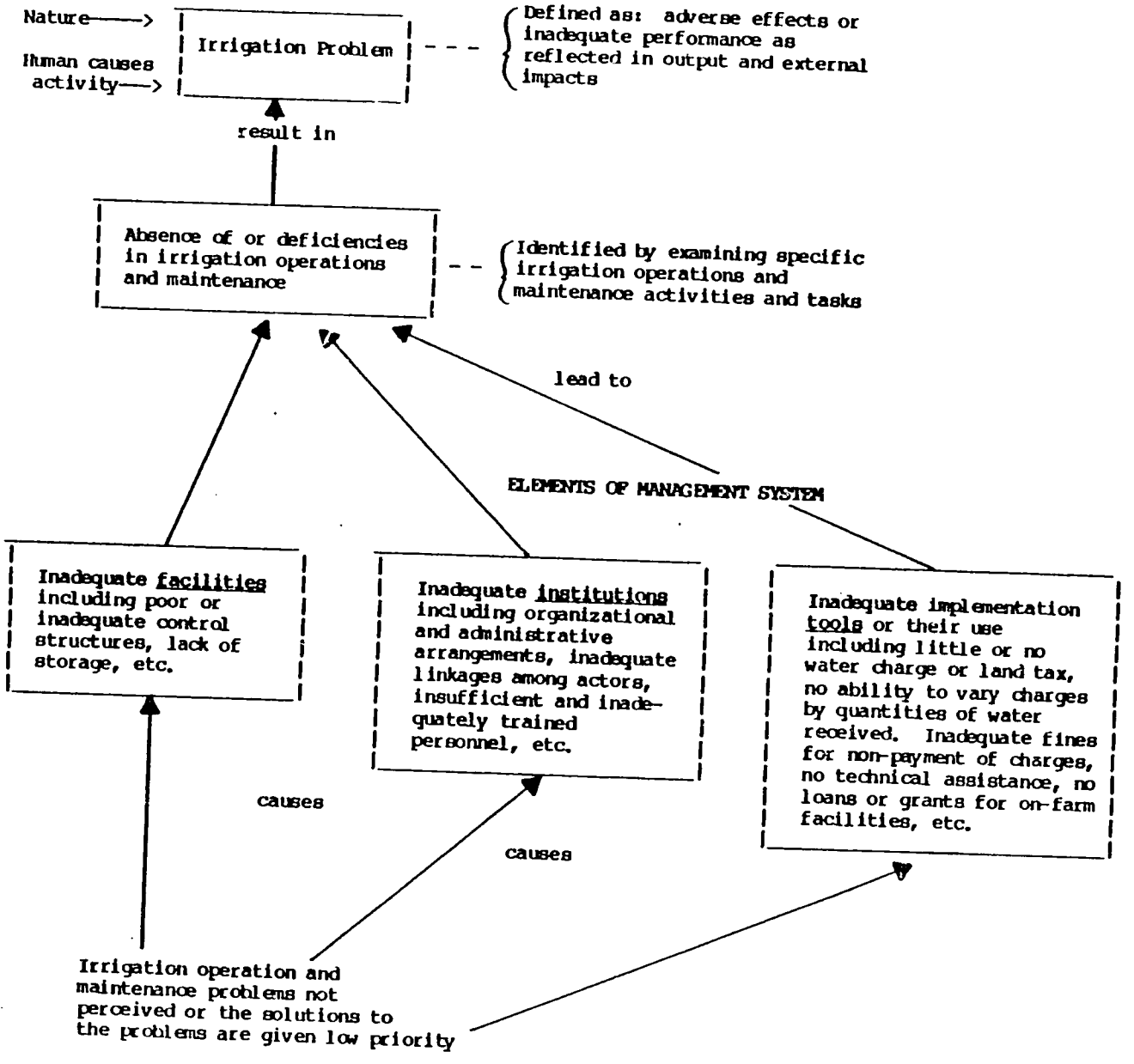


TABLE 1. Issues Associated with the Reoccurring Costs and O & M of Irrigation Projects by Country, 1984

ISSUE	Country			
	Nepal	Sri Lanka	Philippines	Maharashtra (India)
A. Institutional and Organizational Arrangements				
1. Link between fees and funds allocated for O & M	No	After 1984	In communal projects	No
2. High priority for efficient water use	No	Starting 1978-79	Yes	Yes
2. High priority given to maintenance	No	changing	improving	improving
2. High priority given to fee collection	No	Starting 1983-84	Yes	Yes
3. Encourage high farmer participation	No	Yes	Starting 1976	No
3. Good communication among farmers and irrigation officials	No	No	With active WUO	N.C.
4. Uncertain water and land rights	N.C.	N.C.	No	No
5. Adequate organization for fee collection and O & M	No	No	Yes	Yes
5. Clear responsibility for O & M	No	No	No	Yes 2/
B. Facilities and Inputs				
1. New projects take resources away from O & M	Yes	N.C.	1/	N.C.
1. Adequate funds and trained staff for O & M	No	No	No	N.C.
2. Adequate project design and/or construction	No	No	No	No
C. Implementation Tools				
1. Adequate data on area irrigated and crops grown by farm	No	No	Most cases	N.C.
2. Penalties for non-payment of fees	not enforced	starting 1984	Yes	Yes
2. Incentive for high rates of collection	No	No	Yes	No
3. Penalties on those not maintaining the project	No	No	In communal projects	Some

N.C. = Not clear from country reports.

1/NIA is considering a shift in its program to emphasize O & M and de-emphasize new construction.

2/Management wing of the Irrigation Department has O & M responsibility for medium and large scale systems above the outlet.

For each problem, the activities or tasks involved and the implications for facilities, institutions, organizations and implementation tools must be specified. This, however, is not an easy task since problems involved with the recurring costs of irrigation tend to be interrelated. For example, inadequate maintenance and the lack of farmer participation, in many cases, causes inefficient water deliveries. In turn the inefficient deliveries discourage payment of fees which will reduce the funds available for maintenance (Philippine Report, p. 38). Thus one must try to deal with a whole set of problems. For example, obtaining farmer participation in project maintenance is going to be difficult unless there is some assurance that all farmers will contribute. In addition, rules may have to be developed so that the water can be delivered effectively among farmers before farmers are going to be willing to pay fees which can be used for maintenance. They may also have to see that these funds are used to improve and maintain the system (accountability) before they are willing to pay water charges. Finally, if farmers are expected to take over a government irrigation system and do the O & M themselves, they may require it to be in good condition (Philippine Report, p. 40). Therefore, a system may have to be rehabilitated or plans made for rehabilitation before farmers are willing to take over the O & M.

These interrelated problems are just part of the syndrome of anarchy which grows out of and is reinforced by a lack of confidence on both sides.

> "The farmers lack the confidence that if they refrain from taking water out of turn (from stealing it, breaking the structures, bribing the officials) they will nonetheless get water on time. The officials for their part lack the confidence

> that if they do work conscientiously to get the water on time, farmers will refrain from rule-breaking. It is a 'syndrome' in that the behavior of each party to the relationship now tends to confirm the negative expectations held by the other. Each is the other's headache.
>
> "Breaking this syndrome has to be done primarily from the government side, by means of a sustained demonstration of the ability to deliver reliable and expected amounts of water if the farmers do not interfere. Our question then is: how can public officials assure farmers that if they restrain their taking of irrigation water, they will get the expected amounts?
>
> "Part of the answer is to be found in the physical design of the system, to make the independence of farmers on irrigation officials less critical. ....Another part of the answer is to be found in the design of the irrigation management organization" (Wade 1985, p. 5-6).

Wade goes on to argue that the irrigation Associations of Japan, Taiwan and South Korea are an effective way to organize irrigation management. This form of organization which is a watershed-based parastatal, (1) emphasizes O & M as opposed to construction, (2) relates water fee collections to O & M expenditures and staff performance, (3) encourages coordination among different agencies involved in irrigation and (4) fosters communication among irrigation officials and farmers. On the physical design side smaller operating units, possibly established by installing break-point reservoirs, would make the farmers less dependent on the performance of irrigation officials.

Water Fee Collections in the Four Countries

All four areas included in this study have had a different experience with establishing and collecting water fees. Nepal and Sri

Lanka have had considerable difficulty in collecting enough in water fees to just cover the cost of collection. As pointed out by Bowen and Young the transaction costs involved in collecting irrigation fee can be substantial. For Egypt they estimated the costs would range from a little less then $1 to over $7 per acre depending on the type of water fee.

Maharashtra and the Philippines have been relatively successful in collecting fees. Water charges collected in Maharashtra range from 70 to 116 percent of the operation and maintenance expenses during 1979-1984 while in the Philippines irrigation fees and equipment rental fees covered from 37 to 53 percent of the National Irrigation Agency's (NIA) budget during 1978-83 (Maharashtra Report, p. 33 and Philippines Report, p. 18).2/ For Maharashtra the percentage of O & M covered has declined while in the Philippines there is no particular trend. Differences in collection are due to the priority given to fee collections, the organization of the agency collecting the fees, the incentives involved, the level of communication with farmers, the information available on who gets irrigation water, the level of irrigation service and the penalties or sanction imposed for non-payment.

Philippines

Because of financial constraints the Philippines has had an active program to improve water fee collections. The basic government policy is that "NIA should charge fees that are just sufficient to

2/For Maharashtra it is not clear whether or not the water charges are those actually collected or just those which are due.

defray cost of operating and maintaining the systems plus repaying the construction costs within 50 years without interest. Thus pump systems which entails higher O & M costs, charge higher fees" (The Philippine Report, p. 21 and 24). However, the policy in national systems appears to have been aimed at covering only local O & M costs (Correspondence with Mark Svendsen).

To help meet this objective and to account for inflation over time, NIA tied water fees to a given quantity of rice starting in 1975. Thus as the support price of rice is increased the water fee is also raised. However, as the Philippine Report points out, the price of rice has not kept up with inflation and the water fee has declined in real terms since 1976. For example, the real value of irrigation fees for wet season gravity systems dropped from 120 pesos per hectare in 1976 to only 80 pesos per hectare in 1984.[3/] Given the national policy the problem facing NIA is how to cover increasing O & M costs by raising water fees over time without causing serious farmer complaints and collection problems. The current water fees emphasize farmers capacity to pay rather then repayment of O & M costs.

The Philippine has four general fee levels for government projects providing water for rice irrigation. There are rates for wet and dry season irrigation and for pump and surface irrigation. For gravity systems water fees are 2 cavans per hectare in the wet season and 3 cavans per hectare in the dry season.[4/] The one exception is the Upper Pampanga River Improvement Irrigation System where 2.5 and

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[3/]The banknote rate, November, 1984, was 19.5 pesos per U.S. dollar.

[4/]Cavan is 50 kg.

3.5 cavans per hectare are charged for the wet dry season. The higher fee could be due to the cost related to the reservoir or to a greater management input.

The pumping rates are more variable and appear to vary by O & M cost. For example, the farmers served by the Salana and Banga pumps are charged 8 cavans per hectare during the wet season and 12 cavans in the dry season. In the Libmanon-Cabusao Pump Irrigation Systems the charge is 6 cavans per ha. for both seasons.

In systems serving other crops the rates are also different. For crop such as sugarcane, except in hacienda Luisita Tarlac where 29,000 pesos per year is charged for 2,000 ha. (14.5 pesos per ha.), banana and other annual crops 5 cavans per hectare per year is charged in gravity systems and 8 cavans in pump systems. Almost all of these payments are made in cash equivalent based on the National Foods Authority support price and are collected twice a year once after each season (Philippine Report, p. 20 and 35).

In general there is suppose to be some consultation with farmers concerning proposed rate changes. This is, in part, because of the general guidelines which NIA considers in setting fees. The fees should:

(1) be within the farmer's capacity to pay

(2) not impair the incentive to use water

(3) not include charges for the repayment costs of power, reforestation, roads and flood control in multi-purpose projects.

The communal systems, which are entirely under farmer control, charge an average of one caven per ha. per season which is used to pay

for the amortization of the construction and rehabilitation cost of NIA. Farmer-members of communal systems can elect to pay their irrigation fees in labor used for cleaning canals.

The Philippine study considered a number of factors which might influence collection efficiency in their sample of irrigation systems. In general they found that the small and medium sized systems had higher collection efficiency then those with service areas of 5,000 ha. and above, and new systems or newly rehabilitated systems had higher collection efficiency than old unrehabilitated systems. Small scale farmers and upstream farmers had lower rates of payment then large farmers and mid-stream or tail-reach farmers. The collection efficiency for the sample systems ranged from 27 percent in one pump system to 100 percent in a communal gravity system.

Sri Lanka

The Goverrments' policy on water charges has changed over time. Before 1970 the water charge was Rs 5 per acre in most schemes but in some schemes the rate was as low as half a rupee.[5/] Even with these low rates collections were less than 2%. From 1970 to 1977 the collection of water fees of any form was virtually abandoned. During the early 1980's a new fee, of Rs 30 per acre for cropping intensity over 150% and Rs 20 per acre for intensity less then 150%, was introduced for irrigated rice land. Again collections were insignificant and they were replaced by the current O & M recovery rate.

5/ The banknote rate, November, 1984, was 26.5 rupees per U.S. dollar.

The new water charge policy is that farmers in all the major irrigation systems should pay Rs 100 per acre of paddy land per year. In the first year of implementation, 1984, the farmers will pay only 50% of the estimated O & M cost of Rs 200 per acre. The O & M recoveries will be credited to a special O & M fund and the collections made in each scheme will be available for the annual O & M work. The work is to be planned in consultation with farmers in each scheme. In the first year of operation the government will provide a matching contribution of Rs 100 per acre. The contribution by farmers for O & M will be progressively increased by 20 percent each year so that at the end of the 5th year the entire sum of Rs 200 per acre will be paid by the farmers. The amount of the Governments contribution to the special O & M fund not spent in the year received will return to the general revenue fund at the end of the year. There can be no carry over of this contribution from year to year (Sri Lanka Report, p. 63-64).

The amounts collected up to October 15th 1984 are only above 2 percent in seven of the seventeen districts. Only Polonnoruwa District with 22 percent and Manner district with 53 percent have rates over fifteen percent. The Mahaweli project has collection rates ranging from 15 percent to 57%. Although these collections are higher than the less then 2 percent collections found before 1984, it is too early to tell how effective the new program will be. However, these increases in water fee collections will be difficult to continue if there is a general farmer attitude that water is a gift from the Government (Sri Lanka Report, p. 57).

Maharashtra

The primary Government objective for collecting water charges is to obtain revenue to cover the cost of O & M and to provide a one percent return to the Government to cover project depreciation costs. Although Maharashtra has been doing better in this regard then the other the areas studied, it has not yet reached this objective. Part of the reason for this short fall is that the Government fixes water fees for 10 years. Thus the present fees have been constant since 1975 for all flow or gravity irrigation. With the real value of fees dropping, total collections cannot keep up with O & M.

The water charges are levied on the basis of the area of different crops irrigated in any year. The water charges for flow irrigation range from Rs 50 per ha. for kharif (wet) season crops to Rs 750 per ha. for sugarcane and plantation crops.[6/] In between rates include Rs 75 per ha. for rabi (dry) season crops and Rs 150 per ha. for many hot weather season crops. Cotton and groundnut, in the hot season, have rates ranging from Rs 200 to 400 per ha. while pre-season watering is only Rs 20 to 75 per ha. (see Maharashtra Report, table 4.3, p. 18). Thus charges are varied by crop and season mainly based on duration of irrigation required for the crops and the amount of rainfall likely to occur during the season.

The Maharashtra State Irrigation Commission has prescribed four principles for determining water fees or changes.

(1) The total recoveries through water charges should be equal to or greater than the annual cost incurred by the State in providing the water.

[6/] The banknote rate, November, 1984, was 15 rupees per U.S. dollar.

(2) The water charge for a crop should be related to the ability to pay from crop returns.

(3) The water charge should not be set at a level which would leave any of the irrigation potential unutilized.

The water fees for flow irrigation on food and non-cash crops are set roughly equal to 6 percent of the average years income from these crops. In the case of cash crops the charge is set at about 12 percent of the average gross income (Maharashtra Report, p. 17).

In addition to the water rates, farmers are required to pay extra charges for the Employment Gurantee Scheme and for Education. These fees are imposed by the State Government and are in the proportion of 1 percent and 10 percent of the water rates respectively. The payments for these charges are made to the Revenue Department when they collect the land revenue taxes on the land owned by the farmers. This is in contrast to the water fees which are collected by the Irrigation Department.

In the sample of farmers from the Maharashtra study 58 percent of the farmers in minor irrigation systems paid their water fees while 64 and 67 percent paid in meduim and major systems. The water fees collected were 66, 62 and 89 percent of the O & M costs in the minor, medium and major irrigation system respectively.

The study found the following factors important in successful efforts to collect water fees:

1. Government sanction on farmers not paying water charges, when they apply for irrigation water each year.
2. Fines for non-payment of water charges by a fixed date.
3. Good irrigation service.
4. Good communication among irrigation officials and farmers (Maharashtra Report, p. 55).

Nepal

The general responsibility for collecting water charges has been shifted from the District Land Revenue Office to the individual project offices. The Department of Agriculture is also involved in collecting water charges particularly in tubewell projects.

A general rule is used to identify those to be assessed water charges. All farmers who have land under the water delivery command below the full supply level are liable to be charged.

For medium and large scale irrigation projects there are no criteria for setting the level of water charges. Generally the water charges are fixed on a flat basis by the Board or the Department of Irrigation, Hydrology and Meteorology with approval by the Ministry of Finance. Thus the water charge for the Narayani, Kankai and Morang-Sunsari projects is Rs 100 per ha. per crop while it is Rs 60 in the Jhanj, Manusmara, Chitwan and Patharaiya projects.1/ Higher water charges are assessed in the large projects as compared to medium sized projects. Chitwan is the one exception as it is a large project with the lower rate. The pumping projects tend to have charges based on hours and cost of pumping. The Narayani groundwater project with a 80 cu sec discharge, has charges of Rs 100 per ha. per season for all crops except sugarcane. The Farm Irrigacion and Water Irrigation Division (FIWUD) managed groundwater projects have charges of Rs 16 per hour. In artesian wells operated by FIWUD the charges are based on discharge levels. These charges range from Rs 1 to 4 per hour.

1/The banknote rate, November, 1984, was 18 rupees per U.S. dollar.

In Bara district the communal irrigation systems are charging an annual fee of Rs 46 per ha. for irrigation. In times of emergency, a fund is also raised for use in the repair work.

The percent of O & M costs covered by water fees collected in the sample projects ranges from less then 1 percent in the Kankai and Manusmara projects to almost 19 percent in the Jhanjh project. Among these projects the medium sized projects covered more of the O & M costs then did the large projects (Nepal Report, p. 53). The low recovery rate is mainly the result of low levels of collection. Many farmers seem willing to pay for water in the dry season but not in the wet season. They argue that in the wet season they have traditionally grown a rice crop without the projects.

O & M Problems in the Four Countries

The problems or issues associated with recurring costs of irrigation projects can be grouped into three general categories taken from Figure 2. These three categories include (1) institutional and organizational arrangements, (2) facilities and inputs and (3) implementation tools. They correspond to the elements of the management system plus the resource inputs needed for system O & M. The largest number of issues are in the institutional and organizational arrangements category while the smallest number is under facilities and inputs. This supports the proposition that institutional and organizational arrangements have not been adequately considered and in some cases have been ignored in planning irrigation projects.

For example, the Nepal study reports that the Energy Commission Chairman criticized those developing water projects for having "the erroneous view that a project is completed once contruction has ended." The report goes on to say "that there has been a failure in public sector projects to ensure that mechanisms...requiring legal and institutional reform...are created for the farm management of water distribution and for the collection of necessary project operational resources from the beneficiaries" (p. 35).

Howe and Dixon (1983) found that "Maintenance is often done poorly because the difficulty of organizing effective maintenance programs is likely to be underestimated by both donor and recipient countries" (p.22). It is the institutional and organizational aspects which are the most underestimated.

Institutional and Organizational Arrangements

In the four countries studied the emphasis is on government operated systems particularly the larger systems. Only in the Philippines study was there a good mix of small scale irrigation and communal irrigation systems included in the sample of projects. Because of this emphasis on government projects a good starting point for the evaluating O & M is to consider institutional and organizational questions.

(1) Link between water fees collected and the amount spent on O & M.

To make this link funds collected from farmers for O & M need to be used on their irrigation project. In 1984, Sri Lanka made some important institutional changes to do just that by setting up

O & M accounts for each major irrigation system in which O & M collections are deposited (Table 1). In addition farmers are supposed to actually help determine how these O & M funds are to be used in their projects. The farmer contributions to the funds can be carried over from one year to the next. It is too early to determine how this incentive will work but district level collections in the first six months of 1984 ranged from 0 to 53%.

> "The successful collection of O & M depends to a large extent on the interest taken by the collectors and the supervisory work done by the Project Coordinator appointed for that purpose to each irrigation project. The senior level officers in the districts of Manner and Kilinochchi have devoted considerable time to explaining the O & M programme to farmers and winning their cooperation to secure collections" (Sri Lanka Report, p. 67-69).

Their 1984 collections rates where 53 and 15 percent respectively which ranked them one and three among the seventeen districts (Sri Lanka Report, p. 68).

In the Philippine case, more responsibility has been given to Water User Organizations (WUO) for both O & M and fee collection which may be providing an important feedback link. The WUO want to maintain higher collection rates so that they can obtain their bonus (Philippine Report, p. 37). Therefore, they have an incentive to provide adequate O & M. If adequate O & M is not provided, fees will be difficult to collect.

Nepal and India do not have any direct link between fees collected and funds spent on O & M. Yet in 1976 the Irrigation Department in Maharashtra, India, was given responsibility for collecting water fees. This means that the management wing of the

Irrigation Department is responsible for both collecting fees and providing O & M. Thus the irrigation Department would have some incentive to provide adequate O & M so that the collection of fees would not be too difficult.

As Bottrall, 1984, points out in his review of a paper on the irrigation schemes in the Mediterranean region; it "is not the fact that key decisions are taken by water users' representatives or by others nor is it some independently fostered 'cooperative spirit'; it is the need for the managers (whoever they may be) to provide a satisfactory service to their clients in order to ensure a sufficient financial return to cover those service costs", p. 4.

(2) Priority given to efficient water use, maintenance and water fee collections.

These issues are all very closely related and arise from the lack of government recognition of the importance of water use efficiency and the O & M problem. Once water resources and O & M are given high priority the necessary organizational and administrative changes are more easily made so that an effective O & M program can be implemented. However, this is not an easy task.

The Philippines has been making progress by focusing on organizing and training farmers to do more O & M. Yet the Philippine study suggests that there could be some problems with the budget priorities within O & M. "The bulk of O & M expenditures of NIA have been on salaries and wages of personnel most of whom are not directly involved in O & M" (Philippine Report, p. 45-6).

In Sri Lanka the government has given irrigation water use efficiency and O & M higner priority and has recognized some of the

organizational problems (Sri Lanka Report, p. 33). The important question is whether or not the new policy thrust can be implemented and the organizational problems resolved. Nepal is still in the position of not giving efficient water use or O & M a high priority. This acts as a serious constraint to effort to improve the implementation of irrigation projects.

In Maharashtra, due to the relative scarcity of water, irrigation development has had a high priority since independence. Even improved water use was given high priority during the 1970's. This does not mean that operation and maintenance expenditures have matched requirements. The existing efforts to improve water use do not seem to be sufficient to bring about the desired changes. However, in the case of new projects separate provisions have been made for O & M (Maharashtra Report, p. 23).

The state has a well established centralized bureaucracy which does both the O & M and collects water charges. Collections were 70 percent in 1980-81 and 83 percent in 1981-82 which is good compared to Nepal and Sri Lanka (Maharashtra Report, p. 16). In addition, expenditures for O & M in the sample of major and medium irrigation systems were Rs 261 and 210 per hectare respectivel (Maharashtra Report, p. 56). On the average for irrigation projects almost 60 percent of the O & M expenditures were for staff salaries (Maharashtra Report, p. xvi).

(3) Farmer participation and communication between farmers and irrigation officials.

Obtaining farmer participation all the way from project planning to maintenance is now a key strategy being tried in a number of Asian

countries. This can be an effective way of building links among the farming system, canal system and reservoir management segments of an irrigation project, and in improving communications between farmers and irrigation officials (see Figure 3). Starting in 1976 the Philippines has made the most concerted effort to increase farmer participation of the four countries studied. Their program can be seen as one example which should be considered by other countries. However, in the large government operated systems without WUO communication is not very good. In the sample system having the lowest collection efficiency, farmers complained that they had not been visited by the irrigation officials during the past two crop seasons (Philippine Report, p. 40).

The most frequently cited reasons for the failure of WUO in communal systems in the Philippines is financial mismanagement (De los Reyes, 1981). Two successful lowland irrigation systems of central Java had a variety of sources which were used to finance irrigation. Membership fees, water charges, special levies on land owners, village funds and revenues from village lands were all used to improve, maintain and operate their irrigation systems. Both villages made major efforts to establish a sound financial footing for their irrigation (Duewel, 1981).

The Irrigation Department in Maharashtra has relied on a centralized operation of their irrigation systems. There are no formal WUO but a few informal WUO are active in maintaining field channels. The main communication between farmers and the Irrigation

Department seems to be through the Canal Advisory Committees.[8/] Canal Inspectors are the only irrigation officials which most farmers have any contact with.

The Nepal report discusses the need for farmer participation but the strategy has not been effectively implemented. In most government built irrigation systems there is no effective communication between the farmers and the irrigation officials particularly regarding maintenance of the tertiary networks (Nepal Report, p. 9).

Sri Lanka will need to improve communications and farmer involvement if the new strategy of improving O & M and collecting fees from farmers is to be effective. Without more farmer involvement it will be difficult to change farmer behavioral patterns of not paying for water, which exists in most government irrigation schemes.

> "Since the emphasis had been on the design and construction of the major irrigation schemes and the settling of as large a number of farm families as possible, very little attention was paid to the position of the farmer himself as the principal agent of agricultural production. His participation was not sought for and his perceptions were not solicited and given due recognition in managing schemes. The role of the officials, particularly the officials of the Irrigation Department, were all important. Very often the relationship between the farmers and the official hierarchy in an irrigation scheme was one of confrontation rather than collaboration. The officials invariably blamed the farmers for excesssive use of water, water piracy, failure to observe cultivation calendars and even wilful damage to irrigation structures during times of water scarcity. The farmers on the other hand blamed the officials for not supplying quantities of water on their farms at the times they

8/ The committee includes the Executive Engineer as chairman, one representative from each of the following: the Agricultural Department, the Revenue Department and the sugar factories, and two members from each of the following: local irrigators and local members of the Legislative Assembly or Legislative Council.

> most wanted it, due to inefficiency, lack of interest etc.
>
> "There was hardly an emphasis on the management of the irrigation system as a whole and on the need for continuous effort at operating and maintaining the scheme at optimum levels of efficiency. After some years, when an irrigation system was beginning to malfunction, the remedy was to ask for further investments in rehabilitating the scheme or parts of the scheme as may seem necessary. Once such rehabilitation was done, the maintenance of the system continued to be well below the required standards. The farmers were not encouraged to participate in any of the these matters" (Sri Lanka Report, p. 23-24).

They are now trying to change this situation. However, this will require a behavioral change for both the irrigation officials and the farmers. The formation of WUO is still in its infancy. The most progress has been made in the Gal Oya system. Uphoff finds "encouragement in the fact that a situation as unpromising as Gal Oya .... was changed rather remarkably in just a few years, including changes in the Irrigation Department that constitute a important degree of 'bureaucratic reorientation.' A 'learning process' approach is not guaranteed to succeed, but our experience with this approach suggests that it can lead to behavioral changes and improved performance not only as the part of 'the public' but also with 'the public' service" (1985, p. 46). The key to these productive change was the catalysts or institutional organizers who had appropriate training, philosophy and support (Uphoff, 1985). In contrast the Minipe Water Management Experiment appears to have lost some of its earlier momentum. There is a policy commitment to building WUO but its implementation will take continued support and resources (Sri Lanka Report, p. 162-3).

Achieving effective farmer participation is not easy and will likely vary from community to community. What works in one place may not work elsewhere. Thus one can only expect to establish some flexible guidelines for improving farmer participation and not one set plan.

For farmer participation to be effective the guidelines should probably involve actions at three levels:

a. the policy level making the participatory approach legitimate;

b. the agency level, organizing people to facilitate participation; and

c. the village level, organizing people to solve local problems and to become more involved in the choice and implementation of irrigation projects.

Obstacles to participation can be found at all three levels. At the national level, participation means recognizing the needs of people whose opinions are usually not sought. At the agency level, participation means decentralizing decisions - making and sharing control over resources. Agency people need to become enablers of local action. Finally at the village level, participation involves developing water user organizations (WUO) and leadership while preventing the economic interests of the more powerful groups from dominating the WUO. In the case of the Gal Oya the institutional organizers seem to have brought about changes in the second two levels once the decision to encourage participation was made at the first level.

(4) Uncertain water and land rights.

The institutional arrangements involving land and water rights play a key role in determining the irrigation incentives. For example, security of land tenure and water rights is important for farmers if they are to invest in improving the irrigation system. In some cases, private ownership will be necessary to obtain the desired incentives, but in others community ownership works best. In fact, some community ownership of irrigation facilities is being tried as a way to improve O & M. Whether these efforts will be successful depends on the community's experience in providing public goods as well as the general condition of the facilities. Technical assistance may be necessary to help farmers in maintaining the system. In addition, government investment may be needed to make major repairs and to deal with damage caused by major floods. However, when the system is in good condition and the farmers understand what needs to be done to maintain the system, then there is a good chance that they will maintain "their irrigation systems."

The individual country studies did not adequately address this question. However, water rights in government projects appear to be more uncertain in Nepal and Sri Lanka than they do in the Philippines and Maharashtra. For example, in many of the irrigation projects in Sri Lanka there is a significant amount of encroachment. Farmers illegally occupy land and use irrigation water. Since they are illegal their lands are not registered and, therefore, they are not charged for O & M or other fees. The farmers legally using the water feel that this is unfair and that the illegal users should have to pay the O & M fee since they use irrigation water. To determine the

impact of uncertain land or water rights on irrigation productivity requires more detailed studies based on individual projects with varying tenure arrangements.

(5) Organization and responsibility for fee collection and O & M.

In O & M, as well as fee collection, one is dealing with a problem of implementation (see Figure 1). Little or no time is usually spent in planning for the important implementation tasks of operation and maintenance. In addition, no one asks how should the government organize to collect water fees and what design changes might make it easier to collect fees?

In terms of organization, one needs to know if a sympathetic agency or agencies will be in charge of O & M and fee collections. Does this agency have good management and adequate resources to get the job done? Finally, will the agency be able to obtain cooperation from the various other sectors involved, such as the Department of Agriculture? A 'no' to any one of these questions suggests that recurrent costs will continue to be a problem and the cost of fee collections will be high. Thus both Nepal and Sri Lanka still face organizational problems while the Philippines is making progress in dealing with these problems by giving more responsibility to WUO. In Nepal organizational problems even allow maintenance work to be delayed by contracting procedures. Sri Lanka created the Irrigation Management division with a specific goal of efficient O & M. Yet collections and O & M depend on actions taken at the district and project level where changes have been very limited. Thus responsibility for O & M is still fragmented.

For Maharashtra the centralized approach to collecting fees and providing O & M seems to have worked relatively well. The Irrigation Department seems to be fairly well organized and commited to providing irrigation water and collecting fees. Because of the high priority given to irrigation within the State the Irrigation Department also has the resources to do the job. However, it is not clear whether these resources are being used efficiently and if actions are being effectively coordinated with other Departments such as Agriculture. The under utilization of irrigation potential would suggest there are some problems. "Almost 65 percent of the irrigation potential remained unused during the year 1982-83" (Maharashtra Report, p. 11).

Facilities and Inputs

Two of the three problems or issues which are included under this heading relate to adequate financial resources (see Table 1). Both are concerned with the basic question of providing more resources for O & M.

(1) New projects and the impact on resources for O & M, and adequate funding and training of staff.

It is quite clear from the case studies and the review of literature that the resources committed to O & M are not adequate. This has caused funding agencies and host governments such as Sri Lanka to try to get farmers to pay more of the costs of irrigation. Whether increased collections from farmers can help reduce the financial constraint on O & M will depend on the answers to the questions raised above. There is a significant gap between imposing water charges and collecting them. Of the four studies only in

Maharashtra are the fees collected close to the O & M costs.

Another alternative is to spend less on new projects and devote the funds to O & M. The National Irrigation Administration (NIA) in the Philippines is considering a shift in its programs to emphasize O & M and reduce new construction (Philippine Study, p. 16). The Nepal study suggests that new projects are putting a real strain on the country's ability to operate and maintain existing projects. The best staff are used on the new projects while inadequate and poorly trained staff are left to perform O & M on existing projects. "The targets for irrigation development have increased over the years resulting in a steady decrease in the budgetary allocation for regular and recurrent expenditures" (Nepal Report, p. 38).

In Pakistan over ten years ago, the Provincial Irrigation Departments (PID's) began to shift emphasis from construction of new irrigation facilities to rehabilitation and improving water management on lands already irrigated. However, this has involved an effort to increase cropping intensity which has required the PID's to increase water flows through the system. The impact has been higher than normal maintenance and repair costs due to the added strain on the system. Thus the shift has not necessarily improved O & M (Development Alternatives, 1984, p. 5).

(2) Project design and/or construction.

The primary facility question that is involved with O & M is the adequacy of project design and/or construction. Howe and Dixon, n.d., point out that design failures "commit the future to difficult or impossible programs of operation, maintenance and replacement" (p. 9).

They also suggest that "the most common failing during construction is poor quality of materials used and faulty procedures. These saddle the future with high maintenance and poor or unreliable output" (p. 9).

Ian Rule, 1984, finds that "from an operator's point of view a designer would be given three priorities - simplicity, ease of access and longevity....Most dams, particularly in Africa, are in remote areas and emphasis must be given to the maximum of maintenance being handled by on-site staff or possibly a modular approach whereby a faculty or damaged item may be removed and dispatch for repair, in both cases avoiding the use of scarce and expensive contractors on site. Ease of access would appear obvious but too often the end construction results in cramped conditions for inspection, maintenance and repair. It is understood that financial pressures dictate cost savings but this policy can result in overly expensive recurrent maintenance and is, therefore, short sighted" (p. 2). He goes on to suggest that when building a dam the resident engineers usually have at their disposal contractors and equipment for the construction. Yet they do not fully prepare for the normal maintenance problems which will arise after the equipment is gone. "Whenever maintenance aids are built into a site they are seldom used in the original installations" (p. 3). Thus he recommends that, despite possible delays, any maintenance aid should be tested under normal maintenance conditions before the contractors leave "i.e. without the use of any construction equipment, to ensure that it will do the work intended" (p. 3).

Carruthers, 1981, argues that

> Vital components of projects may be missing. For example, drains, or even field channels, may not be

> included in designs. Technically poor designs occur all too frequently...although in principle only the unforeseen defects should survive technical scrutiny in the appraisal process. Designs may follow traditional practice, even though key components of the system have radically shifted. For example, canal closure periods for maintenance may neglect new short-duration crops with quite different irrigation requirements to traditional long-duration crops. Local pressure to provide water during closure period may then result in reduced maintenance standards" (p. 58).

Thus inadequate facilities can act as a constraint to both adequate O & M and fee collections. A first step in correcting the recurring cost problems may have to be rehabilitation of poorly designed facilities so that water deliveries are improved. For example, in the Philippine study new systems and newly rehabilitated systems had an average collection efficiency of 77 percent as compared to 38 percent for old systems.

Inadequate project design and construction will be a more serious problem when little or no information from farmers concerning local conditions is used during project planning and implementation.

> "One example of the consequences of ignoring local technical input is the case of a major irrigation supply canal north of the town of Solo in Central Java. When the Ministry of Public Works and foreign consultants publicized the intended location of the canal, local leaders told them that the proposed route was unstable and that a canal would quickly rupture and wash out in that location. Nonetheless, the canal was built and within six months ruptured in several places due to expansion of the soil. It had to be relocated" (Howe and Dixon, n.d., p. 18).

Thus by involving WUO in more irrigation decisions the Philippines is taking an important step to reduce the opportunities for improper project construction and design. Still there are

examples in all four countries where improper design and construction have made O & M very difficult and rehabilitation necessary. To illustrate, in the large irrigation systems of Nepal, there are reports of inadequate provision of drainage, inlet and water control structures. There are cases where secondary canals were converted to tertiary canals and where pipe outlets are idle due to poor location (Nepal Report, p. 37).

Implementation Tools

The tools used to implement project O & M and collect fees have been very limited. The general approach has been to use direct government action for O & M on the main and lateral canal systems and assume that the farmers will take care of the smaller channels (see Figure 3). In collecting fees, penalties have been the major incentive used. But the problem should be approached by asking how might incentives be changed to achieve the desired results, i.e. high rates of collection. Penalties are only one way of changing incentives. Another might be to improve service. Still another might be to tie the salaries of the project personnel to the percentage of fees collected. If their service proved to be inadequate, they would have a hard time collecting fees and their salaries would be low (see Abel, 1976, for a discussion of how this worked in Taiwan).

It will be difficult to achieve improvements in O & M without doing something about incentives. This is particularly true of collecting water fees. There is nothing magic about collecting irrigation fees. Either one makes the necessary plans and investments to do it, or cost of collection will exceed collections as it appears

to have in both Sri Lanka and Nepal. As Hotes (1964) pointed out, "most feasibilities have paid little or no attention to development of realistic O & M plans and organization let alone plan for collecting water fees"* (p. 7).

(1) Information concerning area irrigated and crops grown.

One critical requirement is an information system which is up to date concerning the area and crops irrigated by farm. "The margin of error used to measure canal performance is commonly so large that one must be wary of any statements about actual performance, or capacity utilization...Since, even with a good capacity, large canal facilities...are amongst the most complex of public enterprises to manage, it may be presumed that the absence of reliable performance data is an important reason for poor performance" (Wade, 1985b, p. 2). The irrigation agency needs to know who gets irrigation water. Government cannot expect farmers to pay very much for a services they do not receive. Pakistan found this out in the Sind after they shifted to a flat rate system of water charges where the fee was assessed on the entire land holding of the farmer irrespective of whether or not the land was cultivated or irrigated. In 1980 they had to return to the old water charge system based on the acreage irrigated, matured, and harvested. A general land tax should be used to pay for irrigation only when one does not know who receives water. When such information is lacking the best that can be done is to charge some low level land, product or input tax. This could be justified on the basis that even those who do not receive water are

*Underline added.

better off because of the generally higher economic activity and employment created by irrigation in the area.

The British, running irrigation systems in India during the early 1900's, understood very well the need for good records concerning who irrigated how many acres of various crops (Development Alternatives, 1984, p. 15-17). They developed excellent information systems in India. However, many of these systems have not been kept up to date and are now a constraint to improving fee collections in parts of the Indian subcontinent. Maharashtra seems to be an exception as they have maintained centralized control and are trying to improve their information system (Maharashtra Report, p. 22). Pakistan has also maintained its centralized system of information and control which has allowed them to maintain high rates of collection in the Punjab and the Sind. However, one must view these figures with some caution. They may not include a sizeable unreported acreage of irrigated land for which farmers were not changed (Wade, 1985b).

Lack of information is a particular problem in Nepal and Sri Lanka (see Nepal Report, p. 28). Their inadequate information systems are a constraint to efforts to obtain high collection rates. For example, in Sri Lanka collection of O & M fees is based on a specification register for each irrigation system prepared under the supervision of the Government Agent of the district. The register is supposed to give the name of the legal allottee and tenant cultivators, the extent of their paddy holdings in the scheme and their location (Sri Lanka Report, p. 61). However, the register is out of date and fails to identify accurately those who receive water and as discussed above does not include any land on which encroachment has occurred (Sri Lanka Report, pp. 71-72).

If the responsibility for fee collections is turned over to water user organizations (WUO), then the farmers will probably be able to obtain adequate information on which to base collections. However, they may need some assistance in establishing such a local information system. (see Easter and Hufschmidt, 1985, p. 37-38). In the Philippines some of the WUO appear to have enough information to achieve high rates of collection. The NIA claim they have reliable data on both crops grown and irrigated area. Yet some of the surveyed farmers said they were billed for irrigation which they never received.

(2) Penalties for non-payment of water fees and incentives for higher collection rates.

These two issues relate to the need to have both negative and positive incentives to help with the collection of water fees. The Philippines is the only country of the four which has used direct incentives to obtain payments from a higher percentage of farmers. Where farmer associations are deputized to collect fees from members, they are usually offered a graduated bonus for achieving specific collection performance levels.

> "If collection efficiency (on current account) is 100%, the association is given 5% of the total collected fees; 4% if collection efficiency is 90%; 3% if collection efficiency is 80%, and 2% if 70% efficiency. The deputized associations are also given as much as 25% of all back accounts collected." (Philippine Report, p. 37).

The Philippines also has penalties for non-payment of water fees for tubewell irrigation. In fact, a number of wells in the Philippines have been shut down since the farmers were unable or

unwilling to pay operating costs, particularly electricity fees. In contrast, the cut-off rule is not enforced in gravity-fed surface systems. "A 1% per month interest is charged on overdue accounts (with 3 months grace period)." However, the water supply cut-off or legal sanctions are not imposed because they are difficult to enforce. For example, the water control is not adequate to allow the shut-off of water to only one farmer on a canal. Legal sanctions are also difficult to enforce because many of the delinquent farmers are the economically powerful ones (Philippines Report, p. 44).

In the Nepal case, it is also impossible to enforce the cut-off rule for surface irrigation. In the case of tubewell irrigation, it is not clear whether or not the cut-off rule is enforced. The Nepal report states that "the supply can be stopped for non-payment cases." (p. 29). However, in the farmer survey none of the farmers reported any penalty for non-payment of water charges nor were they ever approached by project officials for their help in the repair and maintenance of the project (Nepal Report, p. 58).

Penalties and sanction have been a regular part of the system of collecting water fees in Maharashtra. If water charges are not paid by the due date, an extra penalty of 10 percent of the amount due is added to the charges. Sanction can also be imposed such as the rejection of a farmer's application for irrigation water. As a final resort the government can use coercive measures provided for under the Maharashtra Land Revenue Code (Maharashtra Report, pp. 26-27).

Finally, penalties for non-payment have been introduced in Sri Lanka's new program to increase water collections. The law has been amended to allow action to be taken against non-paying farmers. If

farmers do not pay they can be prosecuted and fined. Prior to 1984, no penalties or sanctions were imposed on defaulting farmers. As one might expect, the water charges were rarely paid. Hopefully, the new program can be studied over the next few years to determine its performance and its strengths and weaknesses particular the role of penalties and sanctions.

(3) Penalties on those who do not maintain the project.

In general, the individuals adversely affected by the lack of maintenance are the farmers in the tail-reaches and possibly in the middle of the irrigation systems. The farmers at the head-reaches usually get adequate water with or without maintenance. In addition, the irrigation officials who fail to do the maintenance work are not penalized. This is true for government operated projects in all four case studies. "The officials were not accountable to the farmers for the manner in which they operated and managed the irrigation system" (Sri Lanka Report, p. 158). Thus there is a lack of incentive to perform the maintenance task. Only farmers in the tail-reaches have a real incentive to see that maintenance gets done.

"One frequently finds there are no penalties for those who allow O & M to deteriorate. Systems are large and it may be difficult to fix the blame for inefficiency" (Howe and Dixon, n.d., p. 23). The fact that many projects do not depend on user payments to cover wages and salaries breaks an important feedback link. In contrast, "The communally operated subak irrigation systems in Bali are well known for their efficient allocation of water. In this case, the communal organization does not preclude accountability and fines and other

measures are used to ensure that operation and maintenance duties are performed by the subak members" (Howe & Dixon, n.d., p. 9).

Choices for O & M

What can be done to reduce the rapid rate of deterioration in irrigation investments? As the list of problems or issues above indicates, we already know many of the problems and what their links are with O & M (see Figure 4). However, alternative solutions need to be tried under different conditions. For example, the Philippines seems to be making headway in its policy of improving fee collections and O & M by giving WUO more responsibility for O & M and fee collection. Compared to Sri Lanka and Nepal, its record is good.

In contrast, Maharashtra appears to have done a comparable job of O & M and fee collection using a centralized approach with a separate cadre of staff for O & M. "The responsibility of Irrigation Department does not cease at the outlet but continues till water is supplied to the variety of crops grown in the command at required irrigation intervals and in required quantities" (Maharashtra Report, p. 15). Farmers appear to have a very limited involvement in decisions concerning water management. Yet collection rates are reported as being relatively high. But the under utilization of the irrigation potential and the possibility of unreported irrigated acres raises some questions concerning the effectiveness of the O & M program and fee collections.

There are four general approaches or some combination of these approaches which can be used to provide additional resources to meet recurrent costs. All of the following approaches have been tried at different times in the past:

(a) Increased investment by government;

(b) Collect more fees from users to invest in O & M;

(c) Turn systems or parts of the systems over to groups of farmers and let them do the O & M; and

(d) Have farmers contribute the labor part of O & M.

First, increasing government investment will be difficult for many countries such as Nepal since they have a serious budget constraint. In many cases it involves the hard choice between maintaining old projects or building new ones. In the future, governments need to decide more frequently in favor of the old projects.

Second, to collect higher fees or just increase fee collection efficiency requires a major effort. In some countries, such as Sri Lanka, with a history of providing many free goods and services, fee collecting will require a significant behavioral change. As pointed out above, a well planned collection program with current records on who receives water is a necessary condition.

The third strategy is being used in the Philippines, that of turning more responsibility for collections and O & M to the farmers through WUO. This has worked fairly well in some projects, since NIA has made a major effort to organize farmers into WUO. In one system collections went up 15 percentage points after the formation of the WUO (Philippine Report, p. 14). For the smaller systems and the larger ones which can be divided into smaller units, this approach seems to be working. However, for certain groups and larger indivisible systems, farmer organizations will not be the complete answer. In addition, organizing farmers is not an easy task. Farmers

usually need some incentive to organize, such as better service, training, technical assistance and/or rehabilitation of the irrigation system.

The strategy of giving farmers more responsibility for "their" irrigation systems is partly based on the success of communal systems. These systems are generally small in size and are operated and maintained by the water users served by the system. In both the Nepal and Philippines studies, the communal systems generally had better success in collecting fees for O & M than did the government systems. For example, the Nepal study reports that the community managed schemes had no difficulty in levying water charges to meet O & M expenses.

Farmers may also be more likely to pay specific fees for specific purposes rather than general water fees which suggests a strategy of local collection and utilization of fees.

> "In some communal irrigation systems, several different fees for specific purposes have been established. Although this adds complexity to the process of collecting and accounting for the funds for irrigation, the farmers involved apparently feel that the benefits associated with the greater incentives for payment outweigh these problems" (Small, 1982, p. 7).

Fourth, many of the early irrigation projects, particularly in India, used labor provided by the irrigated farmers to maintain the system. In Nepal 42 to 95% of the farmers sampled in three projects indicated a willingness to contribute free labor to repair and maintain the tertiary canals if they received a timely water supply (Nepal Report, p. 46). Since labor is a major part of the maintenance cost, it could be provided by farmers. To increase farmer labor input

into systems maintenance will require organizing farmers. If farmers are not well organized, the free-rider problem is likely to cause this approach to fail. Only the tail-end farmer will contribute labor since they receive the most benefits. This approach is not too different from having farmers take over more responsibiliy for O & M. Yet a well-organized irrigation department with good connections and communications with the farmers, could use more farmer labor in O & M. In fact, mobilizing farmers to provide labor in an irrigation project can reduce government costs across the board and could be looked upon as an augmentation to the farmer's repayment capacity (United Nations, 1968).

A fifth alternative would be to have O & M provided by a third party which could be either a private or state assisted company. Fees could be paid directly to the company by farmers or could be paid by the government. The important institutional arrangement would be to establish a financial relationship between the company and the farmers which obliges the company to be responsive to their clients needs. The third party approach is quite different from the usually alternatives of a state irrigation bureaucracy or a WUO. Bottrall, 1984, suggests that "one might hypothesize that where irrigation schemes are large, require specialized management skills and/or have good communications with urban areas...a third party approach may be the most cost-effective: if farmers have the option of transferring scheme management responsibilities to a competent third party, why would one assume that they would see many attractions in a more 'participative' approach?" (p. 5)

A sixth alternative would be for donor agencies to set aside funds just for O & M. All new projects could have an O & M budget provided for by the agency or agencies funding the project. The O & M commitment might be limited to ten years with the possibility of renewal for another ten years. Along with the O & M commitment, a training program will also be necessary, in countries such as Nepal, to provide the trained staff to do the O & M.

This will work against the donor agency bias towards construction. "Donors generally have short budget periods that call for getting the money spent and seeing the results quickly. Construction is visible while non-construction programs may not be" (Howe and Dixon, n.d., p. 12). A shift away from new construction is what is needed. It does not make much sense to build a new project to increase crop production while losing more production in other projects because of poor O & M. In addition the donors desire for quick solutions and results may be at variance with long-run environmental costs. This may mean that the negative effects of the irrigation project will be greater then necessary (see Figure 2 for examples of the possible negative environmental outputs).

Many donor agencies have particular reservations about external recurrent financial support.

> "Their unease stems from concern about accountability, fungibility and the risk that O & M support will only defer the time when financial responsibilities and financial maturity, through self-discipline will be reached. Furthermore, there are fairly obvious political problems associated with external assistance to operation of schemes. Most of these political difficulties are absent or of a much lower order in the case of capital aid" (Carruthers, 1981, p. 61).

Because of these reservation an alternative approach might be used where new irrigation projects go through a commissioning period. The transition from construction to O & M is probably one of the most critical periods in project development (United Nations, 1968, p. 81). As Howe and Lixon, n.d., point out most new systems go through a shake-down period during which time construction and design mistakes are discovered and hopefully corrected. Having a commissioning or shake down phase

> "would require those accountable for design and construction to retain responsibility for a much longer period, possibly as long as five years after operation is initiated. Perhaps financial support for the commissioning phase could be provided by the aid agency at the time of main capital outlay. This might be held in an earmarked reserve and disbursed to assist O & M expenditures over a five year or even ten year period. For example, suppose a surface irrigation project costing $100 million, had a further $15 million provided to be disbursed for O & M with 100 percent of O & M in the first year coming from aid, gradually reducing to zero percent in the sixth year. In such a case the aid agency would have a legitimate and direct interest in the operation efficiency and the recipient Government would gradually assume full financial responsibility for operation as the irrigation project built up toward its potential technical efficiency. A transfer of funds for O & M as a grant or loan to a locally held reserve at the period of main disbursement might help overcome the donor's political objections to "continuing" O & M obligations" (Carruthers, 1981, p. 64).

The transition period points out the importance of monitoring during project implementation (see Figure 1). Without the appropriate monitoring systems accountability for lower then planned output cannot be maintained. Thus donor agency could do more to fund project monitoring and ex-post analysis.

Providing adequate funding for O & M may not be enough to raise the level of operation of irrigation projects above the general level

of efficiency in the rest of the economy. Furthermore, irrigation "by its nature spread over a large area, serving a biological based industry to some extent depending on weather effects, serving large numbers of independent small-scale producers, has particular difficulties in maintaining efficient production, even if financial resources are readily available" (Carruthers, 1981, p. 63). He goes on to point out that people seldom fully appreciated the difficulties involved in mobilizing resources in a low-income economy. These countries are faced with the disadvantages of pervasive external diseconomies which are associated with wide spread poverty.

Finally, governments could consider a package approach for extracting benefits from various beneficiaries. Direct taxes could be assessed against direct beneficiaries and production-related indirect beneficiaries, and indirect taxes against the general public who enjoy low cost irrigated agricultural commodities. The pricing system should also be fitted to the conditions facing a particular country and project and should change with development. Indirect water charges coupled with close administrative control over water distribution may be best in the initial phase of a project when farmers are inexperienced in irrigation. As farmers gain more experience, the systems could be converted to a system of fixed and variable water charges (Doppler, 1977).

Although there is much support for the use of some form of water charge to ensure the efficient and equitable distribution of water, such a charge is impractical without the necessary infrastructure to accompany it. Rules have to be made and the prices for water and irrigation services estimated. An organization is required to

determine and enforce these regulations and collect the charges. The inability to collect water charges from higher income farmers has led many to argue against water charges of any kind in a number of developing countries. Some type of volumetric measure of water delivered is also necessary if water pricing is to help improve water allocation, which requires devices that are often expensive and prohibitive in many schemes. Thus all three elements of the irrigation management system are involved (see Figure 2).

A possible solution to this dilemma is to locate measuring devices at the head of each branch canal and to charge a "branch canal water users association" an aggregate fee for water delivered to that point. This would necessitate strong leadership and effective organization in the form of a formal or informal WUO. They would be responsible for delivering the water in the branch canal and for collecting the fees from each user.

India is experimenting with this approach in Gujarat. Bulk amounts of water are being sold at a tertiarty distributary to all farmers served by that distributary as a unit. The farmers organize the distribution of water and the collection of fees (Wade, 1985a).

Fee collections by farmers might also be combined with Wade's idea of break-point reservoirs. He argues that "some kind of break-point reservoir is a fundamental feature of good design in large-scale systems....The break-point reservoir permits a basic distinction to be made between the task and organization of <u>water conveyance</u>, which is properly the concern of experts in hydraulics and that of <u>irrigation</u> which should be the concern primarily of agriculturalists. Above the break-point reservoir, the water supply

agency delivers plugs of water according to simple transparent rules" (1985a, p. 16-17). Plugs of water could then be sold to farmers, as a group, served by the break-point reservoir just as it is at the tertiarty distributaries in Gujarat. Again, farmers would organize to collect fees. This requires that the area served by the break-point reservoirs is not so large that it is difficult to organize farmers.

The Level of Water Charge

The level and type of charge to be collected from farmers will depend on the government's objectives which usually include economic efficiency, income distribution and increased funds for future investments (Ray et al, 1976). The latter involves capturing the economic surplus generated by the irrigation project so that it can be reinvested in development projects. For many irrigation projects it may mean reinvestment in O & M to keep the old investment viable. Capturing the economic surplus also involves the income distribution objective (irrigated farmers have higher incomes than rain-fed farmers) and can involve economic efficiency if the fees charged are related to quantity of water received.

Fees that are related to the quantity of water used can also help reduce some important environmental impacts. As shown in Figure 2 irrigations projects can cause significant negative environment effects such as schistosomiasis, waterlogging and salinity buildup. High fees which are related to the quantity of water use can help reduce the latter two effects.

In setting water fees, two criteria usually must be considered, if the level is to be acceptable to farmers and the government's

interest in covering costs: (1) the net benefits to farmers generated by the irrigation, and (2) the actual O & M costs.9/

Both the O & M costs and net benefits will vary among projects because of differences in farm resources and project investments. The service provided by most irrigation systems, particularly large ones, will vary from place to place, thus the total value of the irrigation service to the farmer will vary. The head-end farmers usually receive much better service than tail-end farmers. The total value of water will also vary from place to place since the other resources combined with the water are not the same, i.e. better land or management on certain farms. The more varied the farm resource conditions and irrigation services provided, the more difficult it is to charge a uniform rate which approaches the O & M costs.

It would, therefore, appear that a pricing policy based on one uniform fee for all projects, such as Sri Lanka has initiated, would run into some difficulties. This fee is based on the amount required to recover O & M. Yet this is going to vary from project to project and some of the farmers may feel they are being overcharged. Consequently one would expect quite a variation in collection efficiency among projects as seems to be the case in Sri Lanka during the first six months of 1984.

As many authors have pointed out, one cannot expect farmers to pay fees which exceed their net benefits from irrigation. In contrast

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9/This assumes that farmers actually receive irrigation water. Provisions are usually made for cases of crop failure due to the lack of water or other natural disasters. For example, in the Philippines farmers who get yields below 40 cavans per hectare are exempt from the irrigation fee but no such cases were reported by farmers in the survey (Philippines Report, p. 37).

donors and government officials feel that farmers should, at least, pay the O & M costs. These two positions may be inconsistent if the cost of collections are quite high, the project benefits do not match expectations (bad investment) or there is a great variation in benefits among farmers. The best economic guidance which can be given decision makers is to determine net farm benefits (NB) and the O & M costs and then see if they are consistent.10/ When they are consistent, (NB > O & M), a good start is to charge the full cost of O & M. If NB < O & M, then the decision makers have to determine how much of the NB they feel they should and can collect.

In fact, even if NB > O & M the difference will have to be large enough so that the farmers have a good incentive to use the irrigation water (See Carruthers and Clark, 1981, Chapter 7 for more details). Finally, decision makers should keep in mind what Howe and Dixon conclude concerning water fees:

> "Too little dependence of project financing on direct user payments results in a loss of valuable feedback and user leverage. When users pay directly for a service, they can withhold payment when service is inadequate. If salaries of the O & M personnel are directly dependent on those payments, a direct motivation for good performance is provided. If salaries and perquisites of office are paid from the central treasury independent of system performance motivation is lost."
>
> "The attitude of project users or beneficiaries is strongly affected by the mode of payment. When paying directly, they know they have leverage on the project management and that leverage is likely to be used. If the service is provided free (e.g. irrigation water) the beneficiaries seem to accept supply failure much more readily, as if to say: 'what can you expect from a zero price?' or 'if

10/The net farm benefits are only net of farm production costs. Irrigation water charges are not subtracted out.

> they first brought us the water, they will eventually bring us adequate maintenance of the system.' This attitude is often called the 'cargo-cult belief and it seems strikingly prevalent in irrigation systems and village water supply systems" (Howe & Dixon, n.d., p. 27).

Conclusions

The basic constraint is the lack of resource commited to O & M. Irrigation agencies tend not to take a whole system approach to irrigation and do not plan for or design programs for O & M until after projects are built. Thus water pricing policy and/or ability to collect fees is not adequate to meet these costs in many Asian countries. The lack of resources can also be attributed to a number of other factors including: national budget constraints, emphasis on new projects, the unwillingness of donor agencies to provide O & M support and the low status of O & M in irrigation departments. Only one of the possibilities for dealing with the resource constraint involves government collecting more from farmers. However, in all but two of the strategies, farmers must be involved more effectively in O & M. Even for the first strategy, increased government investment, to be effective, more farmer input will be necessary.

However, if the strategy selected involves increased fee collections from farmers, one needs to understand what will be required. There are at least four conditions which appear to be necessary if collections are to be significantly increased. They will also be, in some cases, sufficient conditions and include the following:

(1) an up-to-date information system on those who receive water;

(2) a reasonably dependable delivery system;

(3) a willing and able agency with enough resources (human & financial) to collect the fees (could be a WUO); and

(4) use of the funds collected to improve or maintain the irrigation system.

Another condition which may be necessary in some countries is that collections start either when the project is new or has just been rehabilitated. There are really two reasons for this condition. One is need to start collecting some of the economic surplus before it is capitalized into land values. The second is that farmers are more willing to pay for a new service or improved service than they are for one which has been free. The latter requires a major change in behavior and one which Sri Lanka is trying to make.

A sixth condition which will also be necessary in many communities is a penalty for non-payment. Pakistan is a good example of irrigation with high penalties which have been used as an effective incentive to maintain high collection rates. In areas where there are strong community pressures to pay water fees a penalty may not be necessary. However, in many cases a penalty along with a means of collecting it will be necessary to assure high collection rates.

Penalties might also be imposed on those responsible for managing the irrigation system who do not provide adequate O & M. This might be done by making salaries dependent on system performance. Another possibility would be for farmers to have more of a say about who manages the system and what they are paid.

When any of the above four necessary conditions do not hold, the best that can be done is to collect some general land tax, input tax or product tax. We tend to have unrealistic expectations concerning

the collection of water fees. Even when these conditions hold and collections are fairly good, the government may have to cover some of the O & M costs. This is true in projects where the irrigation system generates low returns due to poor soils, farmers inexperienced with irrigation, government pricing policies and pest or disease problems. Finally, farmers should not be expected to pay for past government mistakes in building non-economic projects. Thus it will be unreasonable to expect that a government should collect the same level of fees from all projects or that the fee should cover O & M in all projects.

Alternatives other then improving collections from farmers will have to be considered. The Philippines approach of turning more responsibility over to the farmers is one good alternative. Farmers will first have to be organized so that they are capable of doing more of the O & M. Otherwise giving them the responsibility without the necessary means will not get the O & M done. Once WUO are effectively operating they provide important links between the different parts of the irrigation system (see Figure 3).

Increased government or donor agency investment in rehabilitation or maintenance may be necessary before more input can be expected from the farmers. The irrigation system may have to be improved and operated effectively for a period of several years before collections can be increased and/or more farmer involvement in O & M can be expected. A direct tie between the resource collections and improve service needs to be made where possible. To provide the necessary resources government should consider diverting funds from potential new projects to rehabilitation of existing projects. This would be

followed by the reallocation of funds from both new projects and rehabilitation of projects to O & M.

Finally, donor agencies should consider different ways of establishing a good system of O & M before a project's funding is completely turned over to the government. One example is funding a five year shake-down period of operation. They might also try innovative ways for encouraging governments to take O & M more seriously at the planning and design stage such as tying new funding to the performance of existing projects. This would probably involve more donor funding for project monitoring and ex post analysis. Another possibility might be a special O & M fund to be used during periods of temporary cash flow crises or during adjustment periods of structural change (Carruthers, 1981). During such periods O & M seems to be one of the first things to be cut.

One additional conclusion, which can be drawn from the study, is the lack of non-government sponsored country case studies of water charges and levels of collections. There is very limited information concerning the impact of different types of water charges on water use and collection efficiency. For example, what is the relative cost of collecting X dollars of water fees in the large scale systems of Maharashtra as compared to those of Orissa?

This study clearly shows that there is a wide range in the levels of collections ranging from almost zero in a number of systems in Sri Lanka to 90 percent in some Philippine systems. Also there is little information concerning the cost and efficiency of collecting water charges. How much does it cost to raise the rates of collection by 10 percent? At what point is it uneconomic to try to raise the level of

collections by another 5 percent. During a period when developing countries are struggling to find ways to increase fee collections from irrigation, it is time that researchers began to ask these questions.

REFERENCES

Abel, Martin E. (1976). "Irrigation Systems in Taiwan: Management of a Decentralized Public Enterprise", Water Resources Research, 12, pp. 341-348.

Bottrall, Anthony. "Comments on Management Structure for Irrigation", Irrigation Management Network, Agricultural Administrative Unit, Overseas Development Institute, Network paper 10f, p. 4-7.

Bowen, Richard L. and Robert A. Young (forthcoming). "Allocative Impacts of Alternative Methods of Charging for Irrigation Water in Egypt" in Irrigation Investment and Management Policies for Developing Countries, ed. by K. William Easter and Delane E. Welsch, forthcoming from Westview Press.

Bower, Blair T. and Maynard M. Hufschmidt (1984). "A Conceptual Framework for Analysis of Water Resource Management in Asia", Natural Resources Forum, Vol. 8, No. 4, pp. 343-355.

Cabanilla, L.S. (1985). Study of Operation and Maintenance Problems in Irrigation: the Philippine Case, Report for USAID, Philippines.

Carruthers, Ian and C. Clark (1981). The Economics of Irrigation, Liverpool: Liverpool University Press, 300 p.

Carruthers, Ian (1981). "Neglect of O & M in Irrigation. The Need for New Sources and Forms of Support". Water Supply and Management, Vol. 5, pp. 53-65, Pergamon Press, Ltd.

De los Reyes, Ramond P. (1981). "Managing Communal Gravity Systems: Farmer's Approaches and Implications for Program Planning". A/D/C/ Workshop, Bangkok.

Development Alternatives Inc. (1984). Funding Requirements for Adequate Irrigation System Operation and Maintenance Pakistan, Report for USAID, Pakistan.

Doppler, W. (1977). "Towards a General Guidelines of Irrigation Water Charging Policy", Agricultural Administration 4:121-129.

Duewel, John (1981). "Promoting Participatory Approaches to Cultivating Water Users Organizations: Two Case Studies from Java. A/D/C/ Workshop, Bangkok.

Easter, K. William and Maynard M. Hufschmidt (1985). "Research for Integrated Watershed Management in Developing Countries," East-West Center Report on Workshop for Integrated Watershed Management, Honolulu, Hawaii, 54 p. (Draft).

Easter, K. William (1980). "Capturing the Economic Surplus Created by Irrigation", Staff Papers, pp. 80-14, Department of Agricultural and Applied Economics, University of Minnesota.

Engineering Consultants Limited (1985). Study of Recurrent Cost Problems in Irrigation Systems, Report for USAID, Sri Lanka.

Hotes, F.L. (1984). "World Bank Irrigation Experience", Irrigation Management Network Paper 9D (April) 14p.

Howe, Charles W. and John A. Dixon (n.d.). "Distortions in the Development Project Process: An Economic Perspective". Unpublished paper, East-West Center, EAPI, Honolulu, Hawaii, 37 p.

Howe, Charles W. and John A. Dixon (1983). "What Happened to the "M" in O, M and R? Essay in the Lack of Maintenance in LDC's". Unpublished paper. East-West Center, Honolulu, Hawaii, 37 p.

Pawar, Jagannathrao R. (1985). Recurrent Cost Study of Operation and Maintenance of Irrigation Systems in Maharashtra, Report for USAID India, Mahatma Phule Agricultural University, Maharashtra.

Ray, A., C. Bruce and F. Hotes (1976). "Cost Recovery Policies for Irrigation Projects: Informal Guidelines". Unpublished papers, Washington, D.C., World Bank, 11 p.

Rule, Ian (1984). "Design for Easy Maintenance." Irrigation Management Network, Agricultural Administrative Unit, Overseas Development Institute, London, Network paper 10d, 4 p.

Shrestha, Tek Bahadur, et. al. (1985). Study of Operation and Maintenance Problems in Nepalese Irrigation Projects, Report for USAID, Nepal.

Sison, J. and R. Guino (1983). "An Assessment of Costs and Performance of Various Types of Irrigation in the Philippines". Paper prepared for the International Food Policy Research Institute.

Small, Leslie E. (1982). "Investment Decisions for the Development and Utilization of Irrigation Resources in Southeast Asia", Teaching and Research Form Workshop Report #26. A/D/C/, New York.

United Nations (1968). "Policies and Methods Pertaining to the Financing of Water Resources Projects and the Repayment of Project Costs". Water Resources Journal, December, p. 75-86.

Uphoff, Norman (1985). "Developing Water Management Institutions in Sri Lanka: Understanding Collective Action and Managing Common Resources". Unpublished paper for ASPA Panel on Developing Institutions for National Development: A Comparative Analysis of Analytic Frameworks and Contemporary Practice in National Resource Management Institutions, 52 p.

Wade, Robert (1975). "Water to the Fields: India's Changing Strategy", South Asian Review, Vol. 8(4), pp. 301-321.

Wade, Robert (1985a). "Managing Water Managers: Deterring Expropriation, or Equity as a Control Mechanism," Discussion paper, Research Unit, Agricultural and Rural Development Department, World Bank, Report No. ARV 35, 24 p.

Wade, Robert (1985b). "On the Sociology of Irrigation: How Do We know the Truth about Canal Performance", Discussion paper, Research Unit, Agricultural and Rural Development Department, World Bank, Report No. ARV 37, 13 p.

Westgate, Robert A. (1984). "Suggested Readings: Meeting Recurrent Costs of Irrigation Systems in Asia". Unpublished paper, Department of Agricultural and Applied Economics, University of Minnesota, 11p.

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Appendix A

EXECUTIVE SUMMARIES OF FOUR CASE STUDIES ON THE RECURRING COST OF IRRIGATION: OPERATION AND MAINTENANCE (O&M)

by

Robert A. Westgate
Research Assistant
Department of Agricultural and Applied Economics
University of Minnesota

Summary of the Study of Operation and Maintenance Problems in Irrigation: the Philippine Case

by

Liborio S. Cabanilla
Department of Economics
University of the Philippines at Los Baños

INTRODUCTION

Because of the desire to attain self-sufficiency in rice, irrigation development has been a significant component of the Philippine Government's agricultural expenditure.

In the past, the Govrnment's irrigation program has been concerned mainly with the construction of new systems and the rehabilitation of old systems. There was little emphasis on improved operations and maintenance (O&M); as a result, systems deteriorated quickly. Costly rehabilitation had to be undertaken every seven years.

The need to improve O & M in irrigation is only now slowly being realized by officials of the National Irrigation Administration (NIA)[1/], due in part to a now serious scarcity of financial resources in the economy. The shortage of funds has slowed the development of new projects and, just as importantly, dimmed the prospects of rehabilitating existing systems which have deteriorated rapidly due to poor O & M.

1/Established in 1964, the NIA is the government agency which has the main responsibility of developing and managing water resources in the country.

IRRIGATION SYSTEMS IN THE PHILIPPINES

There are three types of irrigation systems found in the Philippines: National Irrigation Systems (NIS), Communal Irrigation Systems (CIS) and private irrigation systems (PIS). In 1983, the total service area of all systems was 1,385,940 hectares. Forty percent of this area in 1983 was covered by NIS, 49 percent by CIS, and 11 percent by PIS.

The NIA has the sole responsibility for constructing, operating, and maintaining the NIS[2/]. CIS[3/] are operated and maintained by farmer groups, but in general, are constructed by NIA.

OPERATING AND MAINTAINING NATIONAL SYSTEMS

The planning and coordination of O & M activities at the national level is done by the Systems Management Department of the NIS (SMD-NIS). The O & M Division of SMD-NIA is responsible for reviewing plans and programs of work for O & M.

The twelve regional offices of the NIA provide the link between the central office in Manila and the irrigation systems within the region. At the regional level, the operations division is responsible for monitoring and evaluating O & M of each NIS within the region.

The O & M activities of all NIS are conducted by system personnel headed by an irrigation superintendent at the system level. The office of the irrigation superintendent is ultimately responsible for the equitable and timely distribution of water to farms and also the

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2/ Most national systems are gravity type with a service area ranging from less than one thousand to over one hundred thousand hectares.

3/ Communal systems usually encompass a service area of less than one thousand hectares.

maintenance of canals, structures and measuring devices. The office of the irrigation superintendent also collects irrigation fees during peak collection periods to back-up bill collectors.

The only exception to the above outlined organizational structure occurs in the few large systems. In addition to O & M sections, these large systems have a separate collection section and a separate repair and improvement section.

With the exception of pump system, O & M costs among NIS consist mainly (90%) of salaries and wages for employees—including administrative and field personnel. This indicates that very little is spent on equipment operation which is essential in maintaining the operating efficiency of canal structures at peak levels.

OPERATING AND MAINTAINING COMMUNAL-TYPE SYSTEMS

The heavy wage bill for O & M and the financial difficulties which NIA has been experiencing, primarily due to poor collection of irrigation fees, has prompted NIA to adopt a policy of turning the O & M of marginal systems over to farmers' associations.4/ NIA has also started turning the O & M (including collection activities) of certain sections of the main canal and laterals over to viable Farmers' Irrigation Association (FIAs).

Generally, NIA's programs related to FIAs involve training farmers to enable them to eventually operate and maintain the system facilities when they are turned over to the Association.

The general approach is to organize farmers within hydrologic boundaries starting at the rotational level. The Farmer-Irrigators'

4/ Marginal systems are ones with less than one thousand hectares service area.

Groups (FIGs) are organized at the rotational level[5/]. Through the FIG and its set of elected officers, it is hoped that a more equitable distribution of water within the rotational level will be attained.

Viable FIGs are then formally organized into an FIA. They consist of at least two or three FIGs with an elected Board of Directors which directs the management, maintenance, dispute resolution and fee collection. Specialized committees are also set up as necessary.

As of late 1983, NIA had organized 1,014 FIAs involving 133,571 farmers and covering an area of 223,704 hectares. With NIA's program of turning over to viable organizations the O & M of all marginal systems and specific areas covered by certain NIS laterals[6/], the number of FIAs is likely to increase in the future.

NIA pays the IFA a fixed amount paybale at the end of every month. An FIA also receives a collection bonus based on its attained collection efficiency.

IRRIGATION FEES AND COLLECTIONS

The NIA Board of Directors approved a major change in fees in 1975. Additionally, instead of fees being expressed in pesos, fees were expressed in cavans (50 kgs) of palay per hectare.

The advantage of this scheme is that there is an automatic adjustment on the cash equivalent of the fee: everytime the support

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5/ Covering approximately 50 hectares served by one turnout.

6/ The NIA realized two important benefits from turning O & M over to FIAs: NIA saves on the salaries of displaced ditchtenders, and NIA can attain higher collection performance.

price for palay increases, the cash equivalent of the fee also increases. Despite this mechanism, however, the irrigation fee has been declining in real terms. Additionally, fee collections have been less than O & M fund releases by approximately 25 percent (1982 data)7/.

FIELD STUDIES

Information at the system level was generated from a non-random survey of 27 sample systems taken from seven regions of the country. Ten of those systems were CIS, the balance were NIS.

Communal systems charge an average of one cavan per hectare per season which is used to pay for the amortization of the constitution/rehabilitation cost of NIA. Fees are paid to the treasurer of the organization.

For the NIS, bulls based on the list of planted area prepared by field personnel are delivered to the farmers by bill collectors or other field personnel. Payments are either collected in the field or in the office8/.

Average collection efficiency among the sample systems is low, particularly among the NIS samples. It is below 60 percent with a range from 27 to 100 percent. A vicious circle results with the NIA

7/Based on NIA estimates, NIS must collect at least 80 percent of the collectible service fees for the system to be able to recover O & M costs. On the average, the latest available data (1982) shows that only 60 percent of the total fees collectible in the NIA are collected.

8/From 1975 onwards, for most systems, the rates are as follows: for gravity systems, 2 cavans during the wet season and 3 during the dry; for pump systems, 3 cavans during the wet season and 5 during the dry.

officials arguing that O & M is poor because they lack funds to efficiently operate the systems and farmers arguing that they do not pay because they do not get the right amount of water at the right time.

A number of factors can possibly explain the low collections including the following: faulty design, illegal diversion, unsettled conflicts, poor communication, system size, state of system facilities and a farmer's position in the system. Significantly, the majority of these factors occur in NIS while there appears to be better cooperation among farmers who are Association members in communal systems. This is reflected in higher collection efficiences in systems covered by FIAs.

CONCLUSION

Given the present water rate structure and the prices of other inputs, it is highly unlikely that farmers can afford to pay higher fees. The only equitable solution to minimize NIA O & M deficits is to increase collection efficiency. The success of this effort, however, is directly related to the state of O & M. When there is timely and equitable distribution of water and when there is less conflict among water users, collection efficiency is higher. There is, thus, a need to upgrade NIA's facilities, strengthen irrigators' associations, and resolve other problems which impact O & M.

Summary of the Study of Operation and Maintenance Problems in Nepalese Irrigation Projects

by

Tek Bahadur Shrestha,
Shyam Kajee Shkya,
and
Mahesh Man Shrestha
No-Frills Development Consultants
Nepal

INTRODUCTION

There is very little agricultural land under irrigaiton in Nepal. Agriculture has relied on rainfall and, as a result, the vast irrigation potential has remained undeveloped.

Despite the increased emphasis placed on irrigation development in the latest plan, the plan target of increasing agricultural production by 3.2 percent annually was not met. Agricultural production increased instead at an annual average of 2.1 percent, lower even than the population growth rate.

An increase in the operational efficiency of the irrigated sector could help decrease the growing food deficit. Indeed, it has been shown that an assured irrigation supply made possible by timely, equitable and efficient operation and maintenance (O & M) will positively change the level of production. With the presence of irrigation, a number of farmers have produced two rice crops (early and late) and a wheat crop where only one crop was possible before.

IRRIGATION SYSTEMS IN NEPAL

Nepal is endowed with abundant water resources. However, the acreage brought under irrigation by the government after two decades

is only 6.4 percent of the total cultivated area, whereas irrigation systems owned by farmers provide irrigation to nearly 400,000 hectares—four times more than the public systems irrigate. Farmer owned and operated irrigaion systems are less durable than the capital intensive government built projects, because of a high degree of reliance on the use of inexpensive local materials which the farmers can afford.

The principal organization involved in planning and implementing public irrigation projects is the Department of Irrigation, Hydrology and Meteorology (DIHM) of the Ministry of Water Resources.

OPERATION AND MAINTENANCE OF NATIONAL SYSTEMS

Besides being involved in planning, design, construction and implementation, DIHM is responsible for rehabilitation, operation and maintenance of irrigation systems.

At the regional level and on the project level, the functions and responsibilities of DIHM are operated through five regional directorates and through semi-autonomous organizations or project boards. The command areas of irrigation projects under DIHM are larger than 600 hectares in the Terai and larger than 50 hectares in the hills.

The Farm Irrigation and Water Utilization Division (FIWUD) of the Department of Agriculture (DOA) is involved in farm-level irrigation.[1/] At the zonal level, FIWUD is assisted by four zonal offices which are mainly responsible for hill irrigaton projects. For

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1/ The Department of Agriculture under the Ministry of Agriculture is responsible for agriculture, extension and technology dissemination.

implementing small-scale irrigation systems in the Terai, FIWUD has separate project offices which are responsible for O & M of a number of projects.

The Ministry of Panchayat and Local Development (MPLD) is also engaged in small-scale irrigaiton schemes with areas of less than 50 hectares. The involvement of the MPLD through its district technical office in small irrigation development schemes is generally limited. It is active only in cases of externally financed rural irrigation development under MPLD responsibility.

Hence, a host of organizations are providing technical and financial assistance to irrigation development projects with the responsibility of developing and improving the irrigation system.

WATER USER ORGANIZATIONS

Although farmer involvement was expected in irrigation projects, it has not been achieved in most projects. As a result, in most government built irrigation systems, there is no effective way to communicate field-level problems with respect to O & M.

Regular maintenance work along the main and secondary canals is said to be occuring on those projects where funds are sufficient. But, at the terriary levels, where water user organizations (WUO) are organized and made responsible for safeguarding the proper functioning of the water delivery systems, maintenance is not adequate. Although WUO could have played a significant role in mobilizing farmers for system maintenance and repair, payment of water charges, dispute settlement, and aiding in effective operation of the irrigation system, none of these functions have materialized.

In those projects where farmers' organizations do not exist, beneficiaries were interested in establishing WUO to deal with a spectrum of issues. A greater level of community participation should be incorporated into the public irrigation projects during the planning and execution phases.

IRRIGATION FEES AND COLLECTIONS

Water charges in Nepal are based on a per hectare per crop assessment. The actual level of charges is determined by the board or the DIHM upon approval by the Ministry of Finance.

Water charges, in general, are considered to be one of the government's regular sources of income. From the government treasury, the overall budget provisions are made under twelve different budget headings; cost items which allow for O & M are spread over headings in the entire budget.

Although the responsibility for water charge collections had rested with the District Land Revenue Office, it is now the responsibility of individual project offices. The former system, however, was reportedly more effective because water taxes were collected together with land revenue.

The current level of water charges collected from individual projects are negligible and are far below the level of funds required to conduct effective O & M. There is not one government irrigation project in the country where funds collected meet the recurrent costs involved.

Difficulties relating to poor collection are explained by a number of factors including a lack of correct water use assessment, a

limited number of staff in the collection unit, and a lack of staff mobility. Additionally, penalty rules have not been effective or enforced.

If the system management is to depend on water charges, the rate needs to be based on micro-data in order to ensure that the benefits derived by farmers through water use are properly charged.

CONCLUSION

Once an irrigation project is completed in Nepal, serious difficulties are experienced in implementing effecitve O & M. This is because the amount of water charges collected from farmers is significantly less than what is needed to pay for O & M. The problem is compounded by the government which does not allocate sufficient funds to make up for shortfalls in collections. Systems deteriorate rapidly as a result.

The study concludes by recommending that farmer participation be incorporated into the planning phase of projects so that their needs and problems are well identified:

> "Water user associations in the command area need to be given clear rules in systems operation and maintenance as well as in the collection of water charges from system users. The O & M cell in the project office will need to be strengthened with proper budgetary support vis-a-vis training support to the O & M staff for timely and regular services to keep the systems functioning effectively."

Summary of the Recurrent Cost Study of Operation and Maintenance of Irrigation Systems in Maharashtra

by

Jagannathrao R. Pawar
and
Mahatma Phula
Agricultural University, Maharashtra, India

INTRODUCTION

The performance of agriculture in the State of Maharashtra, India, is dependent largely on the vagaries of the monsoon. Recognizing this fact and in response to other natural resource endowments or lack thereof, the State Government has developed irrigation by completing a large number of projects. The efforts to develop irrigation represent approximately 20 percent of the Government's budget[1/].

Despite the Government's focus on irrigation development, the State is plagued with a low water use efficiency. The inefficiency in irrigation water use is partly attributable to poor operations and maintenance (O & M). Thus, it is necessary to determine methods for effecting improvements in O & M to realize maximum returns from irrigation.

IRRIGATION SYSTEMS IN MAHARASHTRA

There are three identifiable types of irrigation systems in Maharashtra: lift irrigation systems, small irrigation systems, and flow irrigation systems with service areas above 100 hectares.

1/ The budget provided for irrigation works also includes the expenses on account of operation and maintenance of existing (both old and new) irrigation systems in the State.

After an irrigation project is completed by the Irrigation Department and commissioned by the Government, the management wing of the Irrigation Department is responsible for O & M, with the exception of small system[2/].

OPERATING AND MAINTAINING STATE SYSTEMS

The State of Maharashtra has been divided into six regions. A Chief Engineer is in charge of each region. He coordinates activities relating to construction of irrigation projects, operation and maintenance of irrigation systems, and monitoring and evaluation. Separate wings under the Chief Engineer are responsible for these activities.

Each region is, in turn, divided into 3 to 5 circles depending upon the river basins and sub-basins and the number of irrigation projects (both under construction and in operation) in each region. The Superintendent Engineer directs construction, operation and maintenance, and monitoring and evaluation at the circle level.

The separation of activities commences at the circle level. Each circle is divided into 2 to 4 divisions headed by an Executive Engineer with O & M as one of these divisions.

Finally, each division is divided into 4 to 6 subdivisions and each subdivision is composed of 4 to 6 sections. A subdivision is headed by a Deputy Engineer, and a section is headed by a Junior Engineer. There exists a separate cadre of staff at the division, subdivision and section levels for system O & M.

2/ Small irrigation systems, having irrigation potential up to 100 hectares, are operated by the irrigation staff workers under zilla parishads.

The actual O & M activities of each irrigation system are done by the section staff at the field level.3/ Besides being responsible for O & M, the section staff are in charge of the equitable and timely distribution of water, preventing unauthorized use of irrigation water, and assessment and recovery of water charges.

The provision for O & M is made in the non-plan sector of the annual budget. The total budget provision for O & M is dependent on the total irrigation potential created for use in a particular year and not as a fixed proportion of the total irrigation budget.

WATER USER ORGANIZATIONS

The state government has tried to establish Canal Advisory Committees (CACs) and Water User Organizations (Pani Panchayats: WUO). To date, CACs exist on almost all of the canals. WUO, however, have not become popular despite provisions made by the government to supply irrigation water to such organizations at a concessional rate.4/

IRRIGATION FEES AND COLLECTIONS

Water rates are usually assessed on an area basis for different crops as it is a convenient measure. Water supplied for non-irrigation use (domestic and industrial use) is charged on a volumetric basis.

Irrigation water charges are uniform throughout the State and do not differ among systems. However, there are seasonal differences in

3/Field-level staff are represented by canal inspectors.

4/WUO are expected to charge rates to members not exceeding rates charged to non-members.

water charges, based mainly on the duration of the crop over which irrigation is required and the quantum of precipitation likely to be received during the season.

Because the Government has adopted a policy of changing water rates only after a period of ten years, changes in water rates have not matched changes in the general level of prices.

However, when irrigation charges are considered along with other irrigation-related receipts (the employment guarantee scheme cess on irrigated areas and the education cess on irrigated areas), total revenues exceed the actual working expenses of irrigation projects in the State on an aggregated basis. Expenses would not be met if charges for irrigation water are considered in isolation.

In the sample of projects studied, the irrigation water fee collection percentages range from 58 to 68 percent, depending on the size of the system.

FIELD STUDIES

Information at the system level was generated from a random survey. The existing arrangements under which O & M is implemented was detailed earlier and a similar pattern was observed in the field studies.

Farmers contacted during the field studies reported a need for having water user organizations for allocating water and maintaining field channels. Yet, a number of farmers expressed doubts concerning the effectiveness of such organizations due to the probable interference of political forces.

Farmers' water bills are paid directly to the Irrigation Department. Charges for the employment guarantee scheme and the education cess, imposed by the government, are paid directly to the Revenue Department at the time of paying annual land revenue taxes on the land owned by the farmers. Rules, penalties, good service and close contact with the farmer are listed as factors helpful to the Irrigation Department in collecting water charges.

CONCLUSION

The State Government has set out definite procedures for conducting O & M, fixing water rates and collecting water charges. Government policy has also encouraged the establishment of Canal Advisory Committees and Water User Organizations. Despite these efforts, a sizeable proportion of irrigation water resources appears to be underutilized, partly as a result of inefficiencies inherent in the O & M mechanisms. The inefficiencies are manifest in the facts that:

1. Costs of O & M are not considered when deciding water rates, and
2. Water rates are infrequently revised.

Farmers expect an efficient and equitable water supply. They respond positively to paying rates under an assured water supply.

Summary of the Study of Recurrent Cost Problems in Irrigation Systems: Sri Lanka

by

Engineering Consultants Ltd. in association with
Development Planning Consultants Ltd.
Sri Lanka

INTRODUCTION

Irrigation systems in Sri Lanka function within the vagaries of the monsoon. The success of irrigation efforts rests ultimately on the skill and efficiency with which farmers and the supporting technical and managerial cadres can make the system function.

The provision of irrigation facilities for agriculture and the establishment of large irrigated settlements, especially in the dry zone, has been a major thrust of the government since independence. In spite of a number of criticisms, the major irrigation systems have generated substantial employment and income in the rural areas and are making a significant contribution to agricultural production.

From about the late 1960s, there has been an increasing level of attention paid to the subject of water management in these schemes. This interest was fostered and heightened by local and foreign water management specialists through their research and writings and a number of seminars which were organized with support from the Government. The recent concern of Government over the performance of major irrigation systems is shown by the launching of the Mahaweli Development Project. The Accelerated Mahaweli Development Program has focused intensive attention on the problems of water management, levels of productivity, and settler motivation, in a way that had not

occurred previously. The reasons for ths concern in the Mahaweli and other irrigation projects have been the gradual realization by policymakers that serious mistakes have been made in the design, construction and management of major irrigation schemes and that water and not land is the major constraint to increased production.

As a result of a number of studies, experience gained in implementing numerous development schemes in major irrigation systems and the Government's recent concerns, it is now possible to identify a number of problem areas which require remedial action on a priority basis. One of the most important problem areas which will impact solutions in other problem areas is the willingness and ability of farmers to pay operation and maintenance (O & M) costs.

OPERATING AND MAINTAINING NATIONAL SYSTEMS[1/]

Because there are virtually no private irrigation systems in Sri Lanka, the Govrnment has taken the responsibility for major and minor irrigation. There are five Government agencies associated with irrigation O & M efforts: The Irrigation Department (under the Ministry of Lands and Land Development, MLLD), the Mahaweli Economic Agency, the Department of Agrarian Services (under the Ministry of Agricultural Development and Research), and the Water Resources

1/This study is not directly concerned with minor irrigation schemes (command areas less than 200 acres) or Government sponsored lift-irrigation schemes because the Government has so far not made a decision to recover O & M charges with respect to minor or lift-irrigation schemes. In the latter schemes, since the escalation of fuel prices, the farmers have to supply the fuel to the Irrigation Department or make a payment for fuel if the pumps are to operate. This is purely a fuel charge and not an irrigation rate or an O & M recovery.

Development and Irrigation Management Divisions of the Ministry of Lands and Land Development (MLLD).

The Irrigation Department which operates at the national, regional, district and project levels has three main irrigation objectives.

1) Development of land and water resources.
2) Provision of facilities, and
3) O & M of systems

However, the overall responsibility for O & M now rests with the recently created irrigation management Division which functions in accordance with policy guidelines provided by MLLD through the Standing Committee set up for the O & M Program. The Irrigation Management Division has the responsibility for the collection of O & M rates, organizing publicity and providing farmer education to ensure acceptance of the program by farmers. Work is done through committees established in each major irrigation project under a project manager. The committees consisting of all the project level officers in a settlement scheme together with farmer representatives. With the introduction of the O & M Cost Recoveries Program in 1984, funds for O & M work are allocated to the Irrigation Department by the Irrigation Management Division.

The Mahaweli Economic Agency conducts an integrated package of programs for the all-round development of irrigation settlements under the Mahaweli Scheme. The Department of Agrarian Services' responsibility is minor irrigation. Finally, the principal function of the Water Resources Development Division is to develop policy

and an orientation toward the management of water resources principally in the major irrigation systems.

WATER USER ORGANIZATIONS

Since the emphasis had been on the design and construction of the major irrigation schemes and the settling of as large a number of farm families as possible, very little attention was paid to the position of farmers as the principal agent of agricultural production. Their participation was not sought and their perceptions were not solicited or given due recognition in managing schemes. The role of the officials, particularly the officials of the Irrigation Department, were all important. Very often the relationship between the farmers and the official hierarchy in an irrigation scheme was one of confrontation rather than collaboration. The officials invariably blamed the farmers for excessive use of water, water piracy, failure to observe cultivation calendars and even willful damage to irrigation structures during times of water scarcity. The farmer, in contrast, blamed the officials for not supplying sufficient quantities of water at the times they most wanted it, for inefficiency and for lack of interest. In other words, the divergent viewpoints of the officials and the farmers indicate basically a situation of mutual distrust sometimes leading to confrontation.

It is now the declared policy of the Government that this "traditional" situation should be changed if the full potential of major irrigation systems are to be developed. The key factor in such development is basically the management of water for optimum productivity. It is in this context that the Government has made a

commitment to develop farmer organizations in the major irrigation systems. The Government realizes that farmer management of water at the tertiary level of the irrigation system offers two important advantages over management by Government agencies. First, farmer management makes the system more responsive to farmer needs and thus increases productivity. Second, farmer management takes some of the responsibilities from Government agencies, thus reducing direct Government expenditure on irrigation management.

To sum up, the formation of farmer organizations in the major irrigation schemes in Sri Lanka is still in its infancy. The basic position, however, is that there is a policy commitment towards building these organizations. But the realization of this objective will likely take a significant period of time given its evolution.

IRRIGATION FEES AND COLLECTIONS

Historically irrigation fees in Sri Lanka have been insignificant. Irrigation water was not recognized as a scarce and expensive resource. The farmers considered it as a gift from the Government (the great benefactor).

From 1970 to 1977, the collection of any form of water charges in the agricultural sector was virtually abandoned. The enforcement of the rates is a politically sensitive issue. The political elites would rather refrain from advocating water charges which are unpopular with farmers.

However, the Government's policy on irrigation rates has undergone a recent change. These efforts are particularly important because the funds the Government is able to release for O & M have

been insufficient to implement a proper program of O & M. The position of the Government is that the O & M charge introduced at the beginning of 1984 is not an irrigation rate or a water charge or a levy to recover the cost of constructing or rehabilitating the irrigation system. The Government has sought to explain the O & M charge to the farmers as an annual contribution which the farmers are called upon to pay for the proper operation and maintenance of the system. The Government points out that the farmers themselves stand to benefit by systematic attention to O & M work, especially where the irrigation system is old.

After 6 months of implementation, the 1985 district collections remain far from satisfactory with a range in collection rates of from 0 to 53 percent. However, it is important to realize that the O & M recovery program has been in operation only a short time. It is too early to say how the Government will enforce the fee payment rules and what sanctions will be imposed on defaulting farmers.

FIELD STUDIES

Out of the four irrigation schemes (Minipe, Mahaweli H Area, Gal Oya Left Bank and Parakrama Samudraya) that were selected for site analysis, 3 were stipulated by the USAID mission in Sri Lanka. At each site, farmer interviews were conducted to ascertain irrigation system strengths and weaknesses. They found that the 1985 collections in the Mahaweli H Area were a relatively high 57.3% while they were lower elsewhere. Efforts to establish WUC in the Gal Oya project seem to have paid off in increased farmer participation.

Water problems emerged in almost all schemes studies. The type of water problems range from total absence of water to inadequate and unreliable supplies. The most common problems are lack of water in the reservoir, waste of water by head-end farmers, poor channel maintenance and defects in the conveyance system.

CONCLUSION

In the past, there was hardly any emphasis on the management of the irrigation system as a whole and on the need for a continuous effort at operating and maintaining the scheme. After the irrigation systems begin to malfunction, the remedy has been to ask for further investments to rehabilitate the scheme or parts of the scheme. Once such rehabilitation was completed, maintenance continue to be well below the required standards. Additionally, farmers were not encouraged to participate in any of these matters.

Through a slow and hesitant path, policy perspectives have now arrived at the recognition that there are acute technical, managerial and socio-economic problems in nearly all of the major irrigation systems in Sri Lanka and that unless they are resolved or contained within certain limits, these schemes will not contribute to national growth as originally envisaged.

The policy thinking of the Government has also posed the question of rehabilitation vs. operation and maintenance. There is one school of thought which emphasizes rehabilitation of an irrigation system from time to time in order to maintain its efficiency. The other view emphasizes the importance of regular maintenance in order to sustain the efficiency of an irrigation system over a long period of time. In

the context of Sri Lanka, overdependence on rehabilitation does not appear to be a desirable objective. While some amount of major rehabilitation work is being done now in different major irrigation schemes and will even have to be conducted in the future, the policy option of rehabilitation is too expensive for a country such as Sri Lanka. In such a context, the policy perspectives of the Government have turned towards emphasizong regular operation and maintenance as the viable answer to maintaining the efficiency of irrigation systems. It is for this reason that the Government has introduced a program for O & M recoveries.